Abstracts

of the Psychonomic Society

Volume 19 • November 2014

55TH ANNUAL MEETING

Hyatt Regency Hotel
Long Beach, California
Thursday, November 20-Sunday, November 23, 2014

REGISTRATION

Hyatt Regency Hotel Lobby,
Hyatt Regency Long Beach Hotel
Thursday, November 20 .... 10:00 a.m.-8:00 p.m.
Friday, November 21............................. 7:30 a.m.-6:00 p.m.
Saturday, November 22 .... 7:30 a.m.-1:30 p.m.

KEYNOTE ADDRESS/
WELCOME RECEPTION

Regency A-C, Hyatt Regency Hotel
Thursday, November 20 .... 8:00 p.m.-9:00 p.m.
- **Psychonomic Society Early Career Awards**
- **Looking Back: Noticing and Recollecting Change**
  Larry Jacoby, Washington University in St. Louis
- **Welcome Reception**

SYMPOSIA

Regency A-C, Hyatt Regency Hotel
Friday, November 21.........................10:00 a.m.-12:00 noon
Multi-Voxel Pattern Analyses of Source Memory

Friday, November 21.............................. 1:30 p.m.-3:40 p.m.
Cognitive Science in the Attention Economy

Saturday, November 22 ....9:50 a.m.-12:00 noon
Memory, Sleep, and Dreams

Saturday, November 22 .... 1:30 p.m.-3:40 p.m.
New Ideas About Memory Development

POSTER SESSIONS

Grand Ballroom, Long Beach Convention Center
Session I
Thursday, November 20 .... 6:00 p.m.-7:30 p.m.
Session II
Friday, November 21...........................12:00 noon-1:30 p.m.
Session III
Friday, November 21............................. 6:00 p.m.-7:30 p.m.
Session IV
Saturday, November 22 ....12:00 noon-1:30 p.m.
Session V
Saturday, November 22 .... 6:00 p.m.-7:30 p.m.

BUSINESS MEETING

Regency A-C, Hyatt Regency Hotel
Saturday, November 22 .... 5:10 p.m.-6:00 p.m.
- Presentation of the Psychonomic Society
  2014 Clifford T. Morgan Best Article Awards
- Business of the Psychonomic Society

FUTURE MEETINGS

2015 – Chicago, IL – November 19-22
2016 – Boston, MA – November 17-20
2017 – Vancouver, BC – November 9-12
2018 – New Orleans, LA – November 15-18

OPENING SESSION/KEYNOTE ADDRESS

Looking Back: Noticing and Recollecting Change
Larry Jacoby, *Washington University in St. Louis*
Thursday, November 20, 8:00 p.m., Regency Ballroom

2014 EARLY CAREER AWARDS
Michael N. Jones, *Indiana University*
Tania Lombrozo, *University of California, Berkeley*
Katherine Rawson, *Kent State University*
Jessica K. Witt, *Colorado State University*

WELCOME RECEPTION
Thursday, November 20, immediately following the Keynote Address, Regency Ballroom Foyer
Hosted by: Psychonomic Society Governing Board

NOTICES
- *Designation of Psychonomic Society Early Career Award Winners:* An asterisk (*) preceding an author's name indicates that he/she is a recipient of the Psychonomic Society's Early Career Award for 2014.

HOTELS

The Hyatt Regency Long Beach will serve as our headquarters hotel. All sessions for the 2014 Psychonomic Society Annual Meeting will be held at the Hyatt, with the exception of poster sessions. All poster sessions will be held just a short distance from the hotel at the Long Beach Convention Center. With the exception of SJDM, which will be meeting at the Westin Long Beach, all affiliate meetings will be held at the Hyatt.

There are a limited number of rooms available at the Hyatt, so please book early to secure your sleeping room. The Psychonomic Society also has negotiated conference rates at the nearby Renaissance Long Beach Hotel and the Westin Long Beach Hotel. *To maintain our practice of no registration fee, it is essential that all rooms reserved for the Annual Meeting be identified as such at the time of booking.* To assure you receive the specially negotiated room rate of $179 + tax per night at each hotel, please make your reservations no later than **October 29, 2014**. Visit www.psychonomic.org/hotels to make reservations.

REGISTRATION

Registration is free for attendees and will be located at the Hyatt Regency in the lobby, near the registration desk at the following times:

Thursday, November 20 ....10:00 a.m. – 8:00 p.m.
Friday, November 21.........................7:30 a.m. – 6:00 p.m.
Saturday, November 22 ....7:30 a.m. – 1:30 p.m.

To avoid lines on site, you are strongly encouraged to preregister through the Psychonomic Society Web site, www.psychonomic.org. Click on the "Annual Meeting" link, then "Registration" to access the online registration form. If you choose not to preregister, please visit the PS Registration Desk on the Hyatt Regency lobby level when you arrive in Long Beach and complete a registration form so the Society can obtain an accurate count of attendees.

MEETING ROOMS

All meeting rooms for spoken papers are located in the Hyatt Regency Long Beach:

- Regency Ballroom A-C, D-F, H (Fourth Floor)
- Beacon Ballroom A, B (Fourth Floor)
- Seaview Ballroom A & B (First Floor)
- Shoreline (First Floor)

Session Chairs are encouraged to solicit papers from individuals in their sessions prior to the meeting and load presentations onto the laptop computer in the meeting room. This will save time.

TRAVEL TO LONG BEACH

Airports:
- **Long Beach Airport** (LGB) and the Hyatt Regency Long Beach (approximately 6 miles)
- **Los Angeles International Airport** (LAX) and the Hyatt Regency Long Beach (approximately 22 miles)
- **John Wayne Airport** (SNA) and the Hyatt Regency Long Beach (approximately 24 miles)

Parking:
- **Hyatt Regency Hotel:** $24 per night for both self-parking and valet parking
- **Westin Hotel:** $18 per night for self-parking/$21 per night for valet parking
- **Renaissance Hotel:** $18 per night for self-parking/$23 per night for valet parking

Shuttle Service:
We have negotiated special discounts with Prime Time Shuttle for attendees to and from the airports. Here are three ways to book a reservation:

1. Call 800-733-8267 and press 1 for reservations; provide the discount code 612000.
2. Visit www.primetimeshuttle. On the left navigation bar, enter the discount code 612000 where it says Frequent Rider ID.
3. Use the personalized portal link: http://primetimeshuttle.hudsonltd.net/res?USERIDENTRY=612000&LOGON=GO

TAXIS

Taxis are available at all three airports. They cost approximately $63 from LAX and SNA, but could be higher based on rush hour/traffic. Taxis from LGB will run around $30. Please allow 2-3 hours travel time from LAX during rush hour.

PROGRAMS

Programs will be available in print, a pdf on psychonomic.org, and a mobile app (free download at the Apple App Store and Google Play Store). All versions include the full program as well as a list of posters.

POSTER SESSIONS

All poster sessions will take place at the Long Beach Convention Center in the Grand Ballroom on Level 2. Use of the space at the convention center must be paid for by the Society. To help pay this cost, an $8 per night rebate from each room night paid by attendees will be applied toward the rental of the convention center. The three evening sessions will be held in conjunction with the general reception. Authors of posters are asked to make their posters available for viewing on the following schedule:

Session	Viewing Time	Author Present
Thursday Evening	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.
Friday Noon	10:00 a.m.–1:30 p.m.	12:00 noon–1:30 p.m.
Friday Evening	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.
Saturday Noon	10:00 a.m.–1:30 p.m.	12:00 noon–1:30 p.m.
Saturday Evening	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.

NOTE: The size of the posters is 4 ft. x 4 ft. to accommodate all of the submissions. This means that you will be sharing an 8 ft. x 4 ft. board with another presenter. Please plan accordingly. Visit www.psychonomic.org/posters for suggestions on preparing your poster.

We have extended viewing times so all interested attendees can see the posters of their choice and reduce the crowded conditions that at times occur during the poster sessions. As usual, the author(s) are required to be present only during the official times shown in the program. Posters should be taken down at the end of the actual session. Please do NOT leave your poster behind at the end of the session. The Psychonomic Society cannot be responsible for poster presentations that are left on the poster boards after the session is over.

The numbering of posters this year uses the same system as last year. Abstract numbers assigned to posters are not in sequence with the numbers assigned to talks. Rather, each poster is assigned a four-digit abstract number. The first digit codes the session to which the poster has been assigned; the last three digits code the location of the poster within its session (i.e., 001-200).

EXHIBITORS

Attendees are encouraged to visit our exhibitors located at the Hyatt Regency in the Regency Ballroom Foyer, on the fourth floor. Exhibit hours are:

Thursday, November 20 .... 7:00 p.m. – 10:00 p.m.
Friday, November 21 .... 9:30 a.m. – 5:30 p.m.
Saturday, November 22 .... 9:30 a.m. – 5:00 p.m.

RECEPTIONS

On Thursday, November 20, there will be a general reception with a cash bar between 5:30 p.m. and 7:30 p.m. in the Regency Ballroom Foyer at the Hyatt Regency. A cash bar will be held at the Long Beach Convention Center with the poster session from 5:30 p.m. to 7:30 p.m. on Friday, and from 5:30 p.m. to 7:30 p.m. on Saturday in the Grand Ballroom, Level 2. Note that the reception is combined with the poster session on Friday and Saturday evening.

COFFEE BREAKS

Complimentary coffee and tea will be available from 7:30 a.m. to 9:00 a.m. each morning near the registration area.

PSYCHONOMIC TIME

Persons chairing sessions this year will be asked to keep the spoken papers schedule on times standardized against a clock at the Psychonomic registration desk. All attendees are asked to synchronize their watches with Psychonomic time.

AUDIOVISUAL EQUIPMENT FOR TALKS

LCD projectors (e.g., for PowerPoint presentations) will be provided in all rooms where spoken sessions are scheduled. Laptop computers will be provided in each meeting room. Please bring your presentation on a USB drive and load it onto the laptop computer in your session room prior to the beginning of that session. Please bring two copies of your presentation in case of media failure. (Slide projector and overhead projectors will not be provided unless the speaker has specifically requested such equipment.)

THE 2014 PROGRAM

There were 1,300 submissions. Of the 1,299 papers that were placed on the program, 299 are spoken papers and 1,000 are posters. In addition, there are 4 Invited Symposia.

PROGRAM HISTORY

Year – Site	Submissions	Accepted
2013 – Toronto	1, 279	1,264
2012 – Minneapolis	1,066	1,054
2011 – Seattle	1,046	1,037
2010 – St. Louis	928	928
2009 – Boston	1,230	1,220
2008 – Chicago	1,040	950
2007 – Long Beach	936	928
2006 – Houston	905	883
2005 – Toronto	966	940

2014 AFFILIATE MEETINGS

- **Auditory Perception, Cognition, and Action (APCAM)**
  13th Annual Meeting
  Thursday, November 20, 2014
  8:30 a.m. – 5:30 p.m.
  Regency Ballroom H, Hyatt Regency Long Beach
  www.apcam.us

- **Comparative Cognition Society (CCS)**
  Keynote Speaker: John Wixted, University of California-San Diego
  Thursday, November 20, 2014
  8:00 a.m. – 5:00 p.m.
  Regency Ballroom B, Hyatt Regency Long Beach
  www.comparativecognition.org

- **Configural Processing Consortium (CPC)**
  Wednesday, November 19, 2014
  8:30 a.m – 5:00 p.m.
  Seaview Ballroom, Hyatt Regency Long Beach
  www.configural.org

- **International Association for Metacognition (IAM)**
  Thursday, November 20, 2014
  12:00 p.m. – 4:00 p.m.
  Beacon Ballroom A, Hyatt Regency Long Beach

- **Object Perception, Attention and Memory (OPAM)**
  22nd Annual Workshop
  Keynote Speaker: Dr. Aude Oliva, Massachusetts Institute of Technology
  Thursday, November 20, 2014
  7:00 a.m. – 5:00 p.m.
  Regency Ballroom A, Hyatt Regency Long Beach
  www.opam.net

- **Society for Computers in Psychology (SCiP)**
  Thursday, November 20, 2014
  8:00 a.m. – 5:00 p.m.
  Seaview Ballroom, Hyatt Regency Long Beach
  www.scip.ws

- **Society for Judgment and Decision Making Annual Meeting (SJDM)**
  Friday, Saturday, Sunday, & Monday, November 21-24, 2014
  Centennial Ballroom, Westin Long Beach
  www.sjdm.org

- **Tactile Research Group (TRG)**
  Speakers: Farley Norman, Soledad Ballesteros, and Warren Grundfest
  Thursday, November 20, 2014
  8:00 a.m. – 6:00 p.m.
  Beacon Ballroom B, Hyatt Regency Long Beach
  http://trg.objectis.net/

- **Women in Cognitive Science 12th Annual Meeting (WICS)**
  Thursday, November 20, 2014
  4:00 p.m. – 7:00 p.m.
  Seaview Ballroom A, Hyatt Regency Long Beach
  womenincogsci.org

PROGRAM AND CONFERENCE ORGANIZATION

The Secretary/Treasurer, Ruth Maki, has the responsibility for organizing the program, and the Convention Manager, Andrew Conway, has the responsibility for arranging facilities at the meeting. They do so with the indispensable help of Lou Shomette, Executive Director of the Society; Peggy O'Brien, our meeting planner; Linda Potchoiba, our registrar; Kathy Kuehn, our production director; Jess Goedken, our graphic artist; and John Hofmann, our IT and production guru.

OFFICERS OF THE SOCIETY

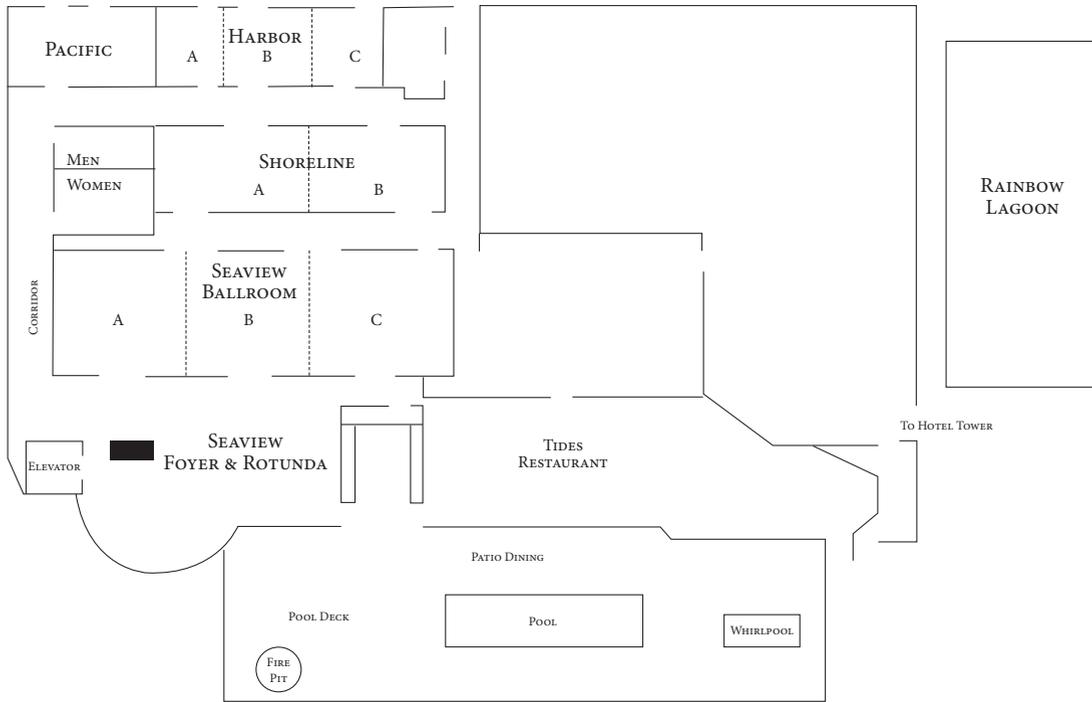|	
Chair	Jeremy M. Wolfe, Brigham and Women's Hospital & Harvard Medical School
Past Chair	Helene Intraub, University of Delaware
Chair-Elect	Robert Logie, University of Edinburgh
Secretary/Treasurer	Ruth Maki, University of Arizona (2011-2016)

2014 GOVERNING BOARD

- Jeremy M. Wolfe, Brigham and Women's Hospital & Harvard Medical School
- Helene Intraub, University of Delaware
- Robert Logie, University of Edinburgh
- Michael C. Anderson, University of Cambridge
- Teresa Bajo, University of Granada
- Aaron Benjamin, University of Illinois
- Colin M. MacLeod, University of Waterloo
- Janet Metcalfe, Columbia University
- Cathleen Moore, University of Iowa
- Lynne Reder, Carnegie Mellon University
- Patricia Reuter-Lorenz, University of Michigan
- Valerie Reyna, Cornell University
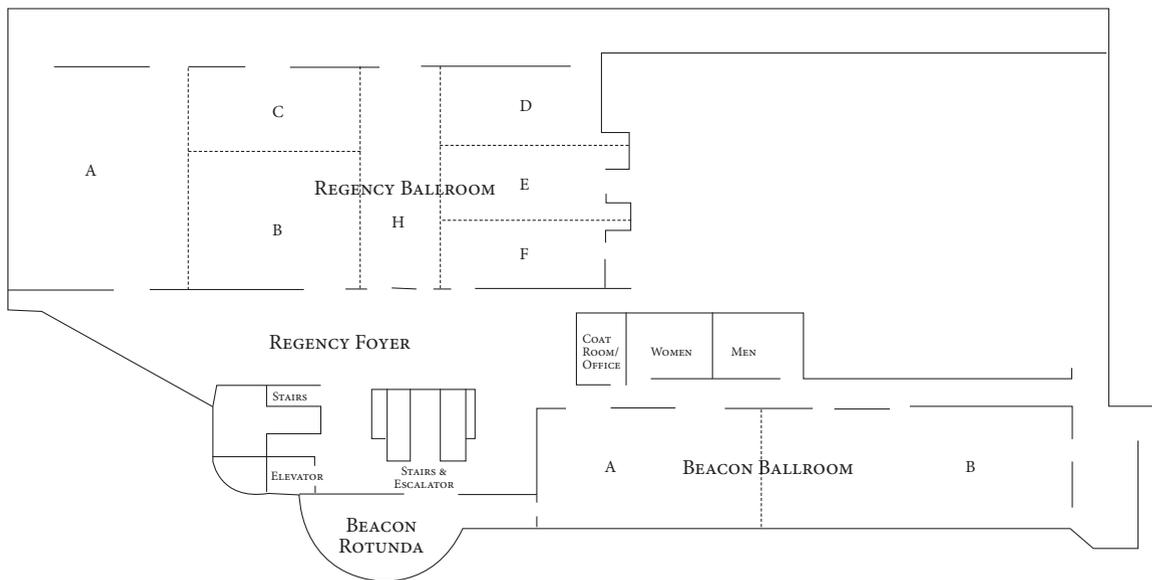- Ruth H. Maki, University of Arizona, ex officio

The names of two members elected to the Governing Board for 2015-2020 will be announced at the Business Meeting on Saturday, November 22.

Ruth Maki, Secretary/Treasurer
Adjunct Professor, University of Arizona
2785 E. Posse Court
Green Valley, AZ 85614
rmaki@email.arizona.edu

HYATT REGENCY LONG BEACH HOTEL - LOWER LEVEL (FIRST FLOOR)

PACIFIC

HARBOR
A   B   C

MEN
WOMEN

SHORELINE
A   B

CORRIDOR

SEAVIEW BALLROOM
A   B   C

ELEVATOR

SEAVIEW FOYER & ROTUNDA

TIDES RESTAURANT

TO HOTEL TOWER

RAINBOW LAGOON

PATIO DINING

POOL DECK

POOL

WHIRLPOOL

FIRE PIT

HYATT REGENCY LONG BEACH HOTEL - UPPER LEVEL (FOURTH FLOOR)

A

REGENCY BALLROOM
C   D
B   E
H   F

REGENCY FOYER

COAT ROOM/ OFFICE   WOMEN   MEN

STAIRS

ELEVATOR

STAIRS & ESCALATOR

A   BEACON BALLROOM   B

BEACON ROTUNDA

The Psychonomic Society Announces the Winners of the

2014
EARLY CAREER
AWARD

The Early Career Award recognizes exceptional research accomplishments among our members. Nominees must have completed their terminal degree (typically Ph.D.) within the last 10 years and must be a Fellow or Member of the Society. Nominations are made by members of the Society, and each candidate must be endorsed by two members. Up to four awards can be made each year. In 2014, one of these four awards was named in honor of the late Steve Yantis. Selection of the winners is made by a committee consisting of two members of the Governing Board and three other members of the Society. The 2014 committee consisted of Patricia Reuter-Lorenz and Lynne Reder (Governing Board) and Laura Novick, Lael Schooler, and Sian Beilock.

Michael N. Jones
Department of Psychological and Brain Science
Indiana University
Cognition and Computation
Nominators: Richard Shiffrin, Gary Dell

Dr. Jones' research program uniquely combines computational, experimental, and large-scale corpus methods to demonstrate how humans acquire and process semantic knowledge. His theoretical work models learning from sequential word order, statistical properties of the input, and perceptual information simultaneously. Jones' models also can be scaled to apply to real-world problems.

Tania Lombrozo
Department of Psychology
University of California, Berkeley
Life Span Language and Cognition
Nominators: William Prinzmetal, Barbara Spellman

Dr. Lombrozo's research illuminates the role of explanation in cognition. Her work is broad and interdisciplinary, building strong connections between psychology and philosophy. She studies causal reasoning and moral judgments, as well as preferences for teleological versus mechanistic explanations. Her research examines these preferences throughout the life span, from young children to older adults suffering from Alzheimer's Disease.

Katherine Rawson
Department of Psychology
Kent State University
Learning and Memory
Nominators: Henry L. Roediger III, Maria Zaragoza

Dr. Rawson's prolific research program has both practical significance and theoretical impact on several interrelated problems pertaining to education, strategies that promote effective learning, and the automatization of reading. Her work demonstrates the critical importance of the spacing, timing, and difficulty of retesting on the quality and durability of learning in educationally relevant domains.

The Steven Yantis Early Career Award
Jessica K. Witt
Department of Psychology
Colorado State University
Perception and Action
Nominators: Anne Cleary, Arthur Glenberg, James Nairne

Dr. Witt's innovative and influential research program investigates how action shapes perception. Her research shows that perception is action-specific by demonstrating that people's ability to perform particular actions influences how they perceive the size, speed, and distance of objects.

The Psychonomic Society Announces the Winners of the

2014
MEMBER SELECT-SPEAKER AWARD

The Member Select-Speaker Awards are designed to showcase exceptional research by 10 Members. Each award winner will be given the unique opportunity to present his or her research in a spoken session during the conference and will be provided travel funds.

The Program Committee was responsible for the extremely difficult task of selecting the top 10 abstracts submitted for a Member Select-Speaker Award. The main criteria for selection were overall quality of research, theoretical impact, and methodological rigor. This year's award winners more than satisfied these criteria and collectively represent an exciting and diverse range of research topics, including memory, learning, judgment and reasoning, and language processing.

The Member Select-Speaker Award is now an annual award program. All Members are encouraged to apply for the award next year!

Magdalena Abel
Regensburg University
Area: Human Learning and Instruction
Abstract #69: Sleep Benefits Memories After Restudy, but not After Retrieval Practice: Evidence for the Distribution-Based Bifurcation Model of the Testing Effect

Brian A. Anderson
Johns Hopkins University
Area: Recall
Abstract #43: Value-Driven Attentional Capture is Modulated by Spatial Context

Stephanie Borrie
Arizona State University
Area: Speech Perception
Abstract #48: Computational Modelling of Conversational Entrainment: A Novel Framework for Examining Spoken Interaction in Communication Disorders

Zhicheng Lin
University of Washington
Area: Consciousness
Abstract #44: When Weaker is Stronger: Robust Attentional Orienting and Alerting Evoked by Subliminal, but Not Supraliminal, Cues

Lynn K. Perry
University of Wisconsin-Madison
Area: Meaning/Semantics
Abstract #57: How Language Dynamically Structures our Concepts: Evidence From Transcranial Direct Current Stimulation

Elizabeth R. Schotter
University of California, San Diego
Area: Letter/Word Procession
Abstract #216: Toward a New Theory of Reading: Independent and Joint Effects of Context, Parafoveal Preview, and Foveal Information

Thomas Töllner
Ludwig-Maximilians-Universität München
Area: Neural Mechanisms of Cognition
Abstract #250: Distractor Templates: Predicting Stimulus Surround Biases Focal-Attentional Selection of High, but not Intermediate and Low, Salient Targets

Joseph Toscano
University of Illinois at Urbana-Champaign
Area: Speech Perception
Abstract #167: Speech Sound Encoding in the Brain Measured Using Fast Diffuse Optical Imaging

Jennifer Trueblood
University of California, Irvine
Area: Reasoning/Problem Solving
Abstract #92: A Quantum Probability Approach to Human Causal Reasoning

Evie Vergauwe
University of Missouri-Columbia
Area: Working Memory
Abstract #149: Tracing Thoughts Through the Probe-Span Task: Microanalytic Evidence That People Mentally Refresh Items in Working Memory

PSYCHONOMIC SOCIETY
2014 CLIFFORD T. MORGAN BEST ARTICLE AWARDS
Sponsored by Springer

The Psychonomic Society Clifford T. Morgan Best Article Award recognizes the best article published in each of the Psychonomic Society's journals in 2014. Selections are made by the Editor of each journal. Award recipients (the lead author) will receive a certificate and honorarium of $1,000 and will be recognized at the 55th Annual Meeting in Long Beach, California.
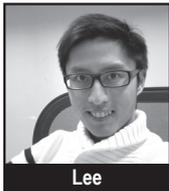
Lee

Attention, Perception, & Psychophysics (Editor Jeremy M. Wolfe)
Alan L. F. Lee, Hongjing Lu
"Global-motion aftereffect does not depend on awareness of the adapting motion direction"
DOI 10.3758/s13414-013-0609-8

Behavior Research Methods (Editors Gregory Francis and Michael Jones)
Clintin P. Davis-Stober, Jason Dana
"Comparing the accuracy of experimental estimates to guessing: A new perspective on replication and the 'crisis of confidence' in psychology"
DOI 10.3758/s13428-013-0342-1

Davis-Stober

Otto

Cognitive, Affective, & Behavioral Neuroscience (Editor Deanna Barch)
Benjamin Otto, Supriya Misra, Aditya Prasad, Kateri McRae
"Functional overlap of top-down emotion regulation and generation: An fMRI study identifying common neural substrates between cognitive reappraisal and cognitively generated emotions"
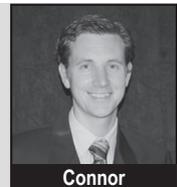DOI 10.3758/s13415-013-0240-0

Learning & Behavior (Editor Geoffrey Hall)
Patrick C. Connor, Vincent M. Lolordo, Thomas P. Trappenberg
"An elemental model of retrospective revaluation without within-compound associations"
DOI 10.3758/s13420-013-0112-z

Connor

Markant

Memory & Cognition (Editors James Nairne and Neil Mulligan)
Douglas Markant, Sarah DuBrow, Lila Davachi, Todd M. Gureckis
"Deconstructing the effect of self-directed study on episodic memory"
DOI 10.3758/s13421-014-0435-9

Psychonomic Bulletin & Review (Editors Cathleen Moore and Gregory Hickok)
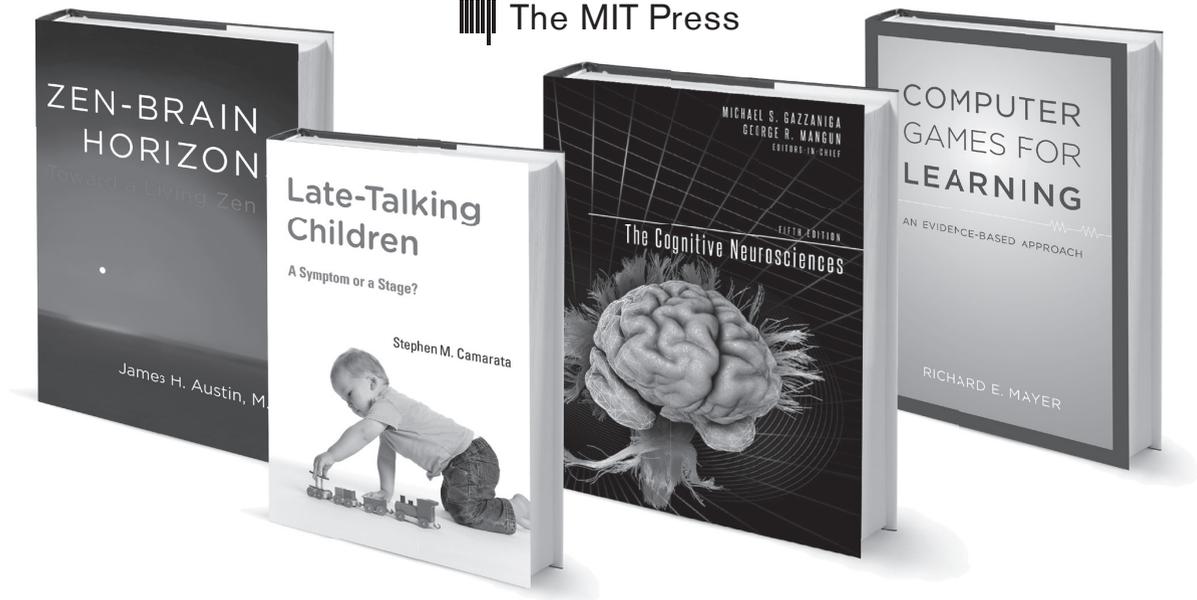**Sudeep Bhatia**
"Sequential sampling and paradoxes of risky choice"
DOI 10.3758/s13423-014-0650-1

Bhatia

Visit http://www.psychonomic.org/clifford-t-morgan-best-article-awards for more information and previous recipients.

The American Journal of Psychology

Coming in Summer 2015

"Learning, Memory, and Cognition in Basic and Applied Contexts"

This special issue features papers given at the Festschrift in honor of Alice F. Healy, held June 7-8, 2014, at the University of Colorado Boulder.

Special Issue Editor: Erica Wohldmann

Alice F. Healy

"Desirable Difficulties in Vocabulary Training"
Robert A. Bjork & Judith F. Kroll

"Can Multiple-Choice Testing Induce Desirable Difficulties? Evidence from the Laboratory and the Classroom"
Elizabeth Ligon Bjork, Nicholas C. Soderstrom, & Jeri L. Little

"The Three W's of Episodic Memory: What, Where, and Why"
James S. Nairne

"Simultaneous Versus Sequential Presentation in Testing Recognition Memory for Faces"
Jason R. Finley, Henry L. Roediger, III, Christopher N. Wahlheim, Andrea D. Hughes, & Larry L. Jacoby

"Morin and Grant (1955) Revisited: Influence of Response-Effect Feedback on Learning and Performance of a Complex Key-Pressing Task"
Jing Chen & Robert W. Proctor

"Salience, Perceptual Dimensions, and the Diversion of Attention"
Kiran N. Kumar, Suyog H. Chandramouli, & Richard M. Shiffrin

"What's the Problem? Familiarity, Working Memory and Transfer in a Problem Solving Task"
James A. Kole, Hannah R. Snyder, Chandra L. Brojde, & Angela Friend

"Meaning in Context"
Richard J. Gerrig

"From Generating in the Lab to Tutoring Systems in Classrooms"
Danielle S. McNamara, Matthew E. Jacovina, Erica L. Snow, & Laura K. Allen

"Planting a Seed: Applications of Cognitive Principles for Improving Food Choices"
Erica Wohldmann

"The Comprehensive LOFT: Translating Training Principles into Specifications"
Immanuel Barshi

[[ǀ]] UNIVERSITY OF ILLINOIS PRESS

The 14th Annual Meeting of Women in Cognitive Science

Thursday, November 20, 2014

Meeting: 4-6 pm; Social Hour: 6-7 pm

Hyatt Regency Long Beach, Seaview

Merging professional development and science: Constructing a successful grant proposal

Panelists:
Sian Beilock, The University of Chicago
Judith F. Kroll, The Pennsylvania State University
Tania Lombrozo, University of California, Berkeley
Betty Tuller, National Science Foundation

Organizers:
Laurie Feldman (lf503@albany.edu)
Judith Kroll (jfk7@psu.edu)
Suparna Rajaram (suparna.rajaram@sunysb.edu)
Debra Titone (dtitone@psych.mcgill.ca)
Natasha Tokowicz (tokowicz@pitt.edu)
Janet van Hell (jgv3@psu.edu)

For more information visit: <u>http://www.womenincogsci.org/</u>

Women in Cognitive Science is affiliated with the Psychonomic Society, and its activities are funded by the National Science Foundation's Perception Action and Cognition program

THURSDAY EVENING, NOVEMBER 20, 2014

Hospitality..5:30 p.m.-7:30 p.m., Grand Ballroom, Long Beach Convention Center
Poster Session I. .... 4:00 p.m.-7:30 p.m. (Author present between
.... 6:00 p.m.-7:30 p.m.) Grand Ballroom, Long Beach Convention Center

Vision I (1001-1015)	Metamemory/Metacognition I (1093-1105)
Perception (1016-1025)	Human Learning and Instruction I (1106-1119)
Action and Perception (1026-1041)	Cognitive Control (1120-1134)
Embodied Cognition I (1042-1051)	Attention I (1135-1151)
Emotion and Cognition I (1052-1065)	Letter and Word Processing I (1152-1164)
Cognitive Aging I (1066-1079)	Bilingualism I (1165-1182)
Working Memory I (1080-1092)	Decision Making I (1183-1200)

Psychonomic Society Early Career Awards .... 8:00 p.m., Regency Ballroom
Keynote Address .... 8:00 p.m., Regency Ballroom
Welcome Reception.. Regency Ballroom Foyer

FRIDAY MORNING, NOVEMBER 21, 2014

Reasoning/Problem Solving I (1-6) .... 8:00 a.m.-9:55 a.m. Beacon A
Psycholinguistics I (7-11) .... 8:00 a.m.-9:35 a.m. Regency A-C
Cognitive Control of Working Memory (12-17)...8:00 a.m.-9:55 a.m. Regency D-F, H
Emotion and Cognition (18-22)..8:00 a.m.-9:35 a.m. Beacon B
Music and Tone Perception (23-27)..8:00 a.m.-9:35 a.m. Shoreline
False Memory (28-32)...8:00 a.m.-9:35 a.m. Seaview A & B
SYMPOSIUM I: Multi-Voxel Pattern Analyses of Source Memory (33-38) .... 10:00 a.m.-12:00 noon Regency A-C
Attention: Capture (39-44)...10:00 a.m.-11:55 a.m. Beacon B
Embodied Cognition (45-49) .... 10:20 a.m.-11:55 a.m. Regency D-F, H
Scene Processing (50-54)... 10:20 a.m.-11:55 a.m. Beacon A
Meaning/Semantics (55-60)...10:00 a.m.-11:55 a.m. Shoreline
Decision Making (61-66) .... 10:00 a.m.-11:55 a.m. Seaview A & B
Poster Session II.. 10:00 a.m.-1:30 p.m. (Author present between
....12:00 noon-1:30 p.m.) Grand Ballroom, Long Beach Convention Center

Audition (2001-2010)	Attention II (2100-2110)
Spatial Cognition I (2011-2025)	Cognitive Control II (2111-2124)
Associative Learning (2026-2040)	Letter and Word Processing II (2125-2138)
Emotion and Cognition II (2041-2049)	Psycholinguistics I (2139-2150)
Eyewitness Identification (2050-2057)	Bilingualism II (2151-2162)
Human Learning and Instruction II (2058-2073)	Neural Mechanisms of Cognition (2163-2177)
Working Memory II (2074-2086)	Statistics and Methodology (2178-2187)
Recognition Memory II (2087-2099)	Concepts and Categories I (2188-2200)

FRIDAY AFTERNOON, NOVEMBER 21, 2014

Human Learning and Instruction I (67-72).. 1:30 p.m.-3:25 p.m. Regency D-F, H
Numerical Cognition (73-77) .... 1:30 p.m.-3:05 p.m. Shoreline
Word Recognition (78-82) ....1:30 p.m.-3:05 p.m. Beacon A
Vision I (83-87).. 1:30 p.m.-3:05 p.m. Beacon B
Judgment (88-92) .... 1:30 p.m.-3:05 p.m. Seaview A & B
SYMPOSIUM II: Cognitive Science in the Attention Economy (93-98)................................1:30 p.m.-3:40 p.m. Regency A-C
Statistics and Methodology (99-104)... 3:30 p.m.-5:25 p.m. Beacon B
Metamemory/Metacognition I (105-109)... 3:50 p.m.-5:25 p.m. Regency D-F, H
Priming (110-115).. 3:30 p.m.-5:25 p.m. Shoreline
Ad Hoc Cognition (116-119)...4:10 p.m.-5:25 p.m. Regency A-C
Visual Search (120-125)..3:30 p.m.-5:25 p.m. Beacon A
Judgment and Decision Making I (126-131) .... 3:30 p.m.-5:25 p.m. Seaview A & B

FRIDAY EVENING, NOVEMBER 21, 2014

Hospitality ....5:30 p.m.-7:30 p.m. Grand Ballroom, Long Beach Convention Center
Poster Session III .... 4:00 p.m.-7:30 p.m. (Author present between
.... 6:00 p.m.-7:30 p.m.) Grand Ballroom, Long Beach Convention Center

Vision II (3001-3017)	Prospective Memory (3111-3119)
Action and Perception II (3018-3030)	Visual Search I (3120-3131)
Spatial Cognition II (3031-3045)	Discourse Processes I (3132-3138)
Recall I (3046-3059)	Language Production/Writing (3139-3148)
Recognition Memory I (3060-3072)	Meaning/Semantics (3149-3160)
False Memory I (3073-3089)	Psycholinguistics II (3161-3177)
Metamemory/Metacognition II (3090-3101)	Reasoning and Judgment I (3178-3188)
Cognitive Aging II (3102-3110)	Decision Making II (3189-3200)

SATURDAY MORNING, NOVEMBER 22, 2014

Memory: Reward and Motivation (132-136)..8:00 a.m.-9:35 a.m. Regency D-F, H
Eyewitness Identification (137-140)...8:00 a.m.-9:15 a.m. Regency A-C
Psycholinguistics II (141-146) ....8:00 a.m.-9:55 a.m. Seaview A & B
Working Memory I (147-152) ....8:00 a.m.-9:55 a.m. Beacon A
Metamemory/Metacognition II (153-157) ....8:00 a.m.-9:35 a.m. Beacon B
Animal Learning and Cognition (158-163)...8:00 a.m.-9:55 a.m. Shoreline
Speech Perception (164-169) ....10:00 a.m.-11:55 a.m. Beacon B
Perception and Action (170-174) ....10:20 a.m.-11:55 a.m. Seaview A & B
Cognitive Skill Acquisition (175-179) ....10:20 a.m.-11:55 a.m. Shoreline
Event Cognition (180-185) ....10:00 a.m.-11:55 a.m. Regency D-F, H
Automatic Processing (186-190) ....10:20 a.m.-11:55 a.m. Beacon A
SYMPOSIUM III: Memory, Sleep, and Dreams (191-197)........................9:50 a.m.-12:00 p.m. Regency A-C
Poster Session IV .... 10:00 a.m.-1:30 p.m. (Author present between
....12:00 noon-1:30 p.m.) Grand Ballroom, Long Beach Convention Center

Multi-Sensory Integration (4001-4014)	Working Memory III (4110-4119)
Event Cognition (4015-4025)	Cognitive Control III (4120-4131)
Autobiographical Memory (4026-4038)	Visual Search II (4132-4142)
Recall II (4039-4056)	Bilingualism III (4143-4157)
Testing Effects (4057-4072)	Psycholinguistics III (4158-4174)
Cognition and Technology (4073-4080)	Letter and Word Processing III (4175-4188)
Implicit Memory (4081-4096)	Decision Making II (4189-4200)
Memory and Reward, Motivation and Emotion (4097-4109)	

SATURDAY AFTERNOON, NOVEMBER 22, 2014

Reward, Motivation, and Decision Making (198-202)..1:30 p.m.-3:05 p.m. Regency D-F, H
Recall I (203-208) .... 1:30 p.m.-3:25 p.m. Seaview A & B
Attention: Features and Objects I (209-213)..1:30 p.m.-3:05 p.m. Beacon A
Reading (214-219) .... 1:30 p.m.-3:25 p.m. Beacon B
Perceptual Processes (220-225) ....1:30 p.m.-3:25 p.m. Shoreline
SYMPOSIUM IV: New Ideas About Memory Development (226-231) ....1:30 p.m.-3:40 p.m. Regency A-C
Vision II (232-237)..3:30 pm-5:25 p.m. Beacon A
Working Memory (238-242).. 3:50 p.m.-5:25 p.m. Beacon B
Human Learning and Instruction II (243-248)...3:30 p.m.-5:25 p.m. Regency D-F, H
Neural Mechanisms of Cognition (249-253)..3:50 p.m.-5:25 p.m. Seaview A & B
Associative Learning (254-258)..3:50 p.m.-5:25 p.m. Shoreline
Presentation of the 2014 Clifford T. Morgan Best Article Awards and Business Meeting ....5:10 p.m.-6:00 p.m. Regency A-C

SATURDAY EVENING, NOVEMBER 22, 2014

Hospitality ....5:30 p.m.-7:30 p.m. Grand Ballroom, Long Beach Convention Center
Poster Session V... 4:30 p.m.-7:30 p.m. (Author present between
.... 6:00 p.m.-7:30 p.m.) Grand Ballroom, Long Beach Convention Center

Music Cognition (5001-5011)	Cognitive Control of Working Memory (5112-5122)
Numerical Cognition (5012-5028)	Discourse Processes II (5123-5131)
Embodied Cognition II (5029-5038)	Speech Perception (5132-5149)
Cognitive Skill Acquisition (5039-5046)	Psycholinguistics IV (5150-5167)
Emotion and Cognition III (5047-5058)	Concepts and Categories II (5168-5177)
False Memory II (5059-5075)	Consciousness and Automatic Processing (5178-5186)
Working Memory IV (5076-5086)	Animal Learning and Cognition (5187-5193)
Human Learning and Instruction III (5087-5104)	Reasoning and Judgment II (5194-5200)
Collaborative Memory (5105-5111)	

SUNDAY MORNING, NOVEMBER 23, 2014

Recognition (261-265)..8:00 a.m.-9:35 a.m. Regency D-F, H
Judgment and Decision Making II (266-271)..8:00 a.m.-9:55 a.m. Beacon B
Attention: Features and Objects II (272-277) ....8:00 a.m.-9:55 a.m. Seaview A & B
Bilingualism (278-282) ....8:00 a.m.-9:35 a.m. Regency A-C
Letter and Word Processing (283-288)..8:00 a.m.-9:55 a.m. Beacon A
Autobiographical Memory (289-293)...8:00 a.m.-9:35 a.m. Shoreline
Discourse Processes (294-298) ....10:20 a.m.-11:55 a.m. Seaview A & B
Recall II (299-304)..10:00 a.m.-11:55 a.m. Shoreline
Reasoning/Problem Solving II (305-309) ....10:20 a.m.-11:55 a.m. Beacon B
Spatial Cognition (310-314)..10:20 a.m.-11:55 a.m. Beacon A
Cognitive Aging (315-320)..10:00 a.m.-11:55 a.m. Regency A-C
Cognitive Control (321-326) ....10:00 a.m.-11:55 a.m. Regency D-F, H

Beacon A	Regency A-C	Regency D-F, H
Thursday Evening, November 20		
	Keynote Address: Looking Back: Noticing and Recollecting Change Larry Jacoby, Washington University in St. Louis *8:00 p.m.*	
Friday Morning, November 21		
Reasoning/Problem Solving I *8:00 a.m. – 10:00 a.m.*	Psycholinguistics I *8:00 a.m. – 9:40 a.m.*	Cognitive Control of Working Memory *8:00 a.m. – 10:00 a.m.*
Scene Processing *10:20 a.m. – 12:00 noon*	SYMPOSIUM I: Multi-Voxel Pattern Analyses of Source Memory *10:00 a.m. – 12:00 noon*	Embodied Cognition *10:20 a.m. – 12:00 noon*
Friday Noon, November 21		
Friday Afternoon, November 21		
Word Recognition *1:30 p.m. - 3:10 p.m.*	SYMPOSIUM II: Cognitive Science in the Attention Economy *1:30 p.m. - 3:40 p.m.*	Human Learning and Instruction I *1:30 p.m. - 3:30 p.m.*
Visual Search *3:30 p.m. - 5:30 p.m.*	Ad Hoc Cognition *4:10 p.m. - 5:30 p.m.*	Metamemory/Metacognition I *3:50 p.m. - 5:30 p.m.*
Friday Evening, November 21		
Saturday Morning, November 22		
Working Memory I *8:00 a.m. - 10:00 a.m.*	Eyewitness Identification *8:00 a.m. - 9:20 a.m.*	Memory: Reward and Motivation *8:00 a.m. - 9:40 a.m.*
Automatic Processing *10:20 a.m. - 12:00 noon*	SYMPOSIUM III: Memory, Sleep, and Dreams *9:50 a.m. - 12:00 noon*	Event Cognition *10:00 a.m. - 12:00 noon*
Saturday Noon November 22		
Saturday Afternoon, November 22		
Attention: Features and Objects I *1:30 p.m. - 3:10 p.m.*	SYMPOSIUM IV: New Ideas About Memory Development *1:30 p.m. - 3:40 p.m.*	Reward, Motivation and Decision Making *1:30 p.m. - 3:10 p.m.*
Vision II *3:30 p.m. - 5:30 p.m.*	Business Meeting *5:10 p.m. - 6:00 p.m.*	Human Learning and Instruction II *3:30 p.m. - 5:30 p.m.*
Saturday Evening, November 22		
Sunday Morning, November 23		
Letter and Word Processing *8:00 a.m. - 10:00 a.m.*	Bilingualism *8:00 a.m. - 9:40 a.m.*	Recognition *8:00 a.m. - 9:40 a.m.*
Spatial Cognition *10:20 a.m. - 12:00 noon*	Cognitive Aging *10:00 a.m. - 12:00 noon*	Cognitive Control *10:00 a.m. - 12:00 noon*

Beacon B	Shoreline	Seaview A&B	Grand Ballroom, Long Beach Convention Center
			Hospitality *5:30 p.m.-7:30 p.m.* Poster Session I *6:00 p.m. - 7:30 p.m.*
Emotion and Cognition *8:00 a.m. – 9:40 a.m.* Attention: Capture *10:00 a.m. – 12:00 noon*	Music and Tone Perception *8:00 a.m. – 9:40 a.m.* Meaning/Semantics *10:00 a.m. - 12:00 noon*	False Memory *8:00 a.m. - 9:40 a.m.* Decision Making *10:00 a.m. – 12:00 noon*	
			Poster Session II *12:00 noon - 1:30 p.m.*
Vision I *1:30 p.m. - 3:10 p.m.* Statistics and Methodology *3:30 p.m. - 5:30 p.m.*	Numerical Cognition *1:30 p.m. - 3:10 p.m.* Priming *3:30 p.m. - 5:30 p.m.*	Judgment *1:30 p.m. - 3:10 p.m.* Judgment and Decision Making I *3:30 p.m. - 5:30 p.m.*	
			Hospitality *5:30 p.m.-7:30 p.m.* Poster Session III *6:00 p.m. - 7:30 p.m.*
Metamemory/Metacognition II *8:00 a.m. - 9:40 a.m.* Speech Perception *10:00 a.m. - 12:00 noon*	Animal Learning and Cognition *8:00 a.m. - 10:00 a.m.* Cognitive Skill Acquisition *10:20 a.m. - 12:00 noon*	Psycholinguistics II *8:00 a.m. - 10:00 a.m.* Perception and Action *10:20 a.m. - 12:00 noon*	
			Poster Session IV *12:00 noon - 1:30 p.m.*
Reading *1:30 p.m. - 3:30 p.m.* Working Memory II *3:50 p.m. - 5:30 p.m.*	Perceptual Processes *1:30 p.m. - 3:30 p.m.* Associative Learning *3:50 p.m. - 5:30 p.m.*	Recall I *1:30 p.m. - 3:30 p.m.* Neural Mechanisms of Cognition *3:50 p.m. - 5:30 p.m.*	
			Hospitality *5:30 p.m.-7:30 p.m.* Poster Session V *6:00 p.m. - 7:30 p.m.*
Judgment and Decision Making II *8:00 a.m. - 10:00 a.m.* Reasoning/Problem Solving II *10:20 a.m. - 12:00 noon*	Autobiographical Memory *8:00 a.m. - 9:40 a.m.* Recall II *10:00 a.m. - 12:00 noon*	Attention: Features and Objects II *8:00 a.m. - 10:00 a.m.* Discourse Processes *10:20 a.m. - 12:00 noon*	

THURSDAY, NOVEMBER 20, 2014
6:00 P.M. -7:30 P.M.
POSTER SESSION I (1001-1200)
GRAND BALLROOM, LONG BEACH CONVENTION CENTER

Vision I (1001-1015)
(1001) Ericson, Beck
(1002) Arguin, Aubin, Gosselin, Jolicoeur
(1003) Birngruber, Schroeter, Ulrich
(1004) Grubaugh, Dodd, Mills, Bahle, Dalmaijer, Van der Stigchel
(1005) Tran, Hoffman
(1006) Fiedler, Moore
(1007) Üner, Mutlutürk, Boduroglu
(1008) Kaiser, Tomko
(1009) Ueda, Ishiguchi, Tokita
(1010) Favelle, Tobin, Palermo
(1011) Maxcey
(1012) Sheridan, Reingold
(1013) Harvey, Walker, Liversedge, Godwin
(1014) Peltier, Becker
(1015) Hutson, Smith, Magliano, Loschky

Perception (1016-1025)
(1016) Burnett, Henik
(1017) Labos, Neuhoff
(1018) Langston, Hubbard
(1019) Plotnick, Galotti
(1020) Hu, Heald, Malonis, Nusbaum
(1021) Sim, Wu, Klatzky
(1022) Mallick, Beauchamp, Magnotti
(1023) Mitchel A, Mitchel M, Wellington, Finucane
(1024) Nagai, Yokosawa, Asano
(1025) Gamiz, Bausenhart

Action and Perception I (1026-1041)
(1026) Huestegge, Pieczykolan, Koch
(1027) Chihak, West, Mahoney
(1028) Chen, Proctor
(1029) Slifkin, Eder, Byrne
(1030) Huhn, Potts, Rosenbaum
(1031) Abdolvahab, Gordon, Frank
(1032) Taddese, Anderson, La, Fournier
(1033) Barany, Gilbert, Grafton
(1034) Vuorre, Metcalfe
(1035) Quek, Finkbeiner
(1036) Cunningham, Sweet, Miles
(1037) Ellefsen-Gauthier, Ouellet, Fortin
(1038) Eddy, Hasselquist, Howe, Rourke, Coyne, O'Donovan, Batty, Brunye, Mahoney
(1039) Dahm, Rieger
(1040) Ruginski, Geuss, Stefanucci
(1041) Duran, Fusaroli

Embodied Cognition I (1042-1051)
(1042) Soliman, Glenberg
(1043) Lagace, Guerrette, Guerard
(1044) Chiappe, Strybel, Vu, Sturre
(1045) Gill, Jordan, Cutting

(1046) Doneva, Cole
(1047) Xie, Huang, Tse, So
(1048) Dudschig, Mackenzie, Strozyk, Kaup, Leuthold
(1049) Oakes, Searleman, Fredette
(1050) Huang, Tse
(1051) De la Vega, Eikmeier, Ulrich, Kaup

Emotion and Cognition I (1052-1065)
(1052) Gallant, Dyson
(1053) Dalmaijer, Mulckhuyse
(1054) Kennedy, Most
(1055) Yang, Truong
(1056) Domachowska, Goschke, Bolte
(1057) Sturgill
(1058) Boywitt
(1059) Onyper, Sweeney, Frank, Ghiraldi
(1060) Kirkham, Pawling, Tipper
(1061) Karam-Zanders, Lane, Mennie
(1062) Roy-Charland, Perron, Reguigui
(1063) Perron, Roy-Charland, Gélinas
(1064) Purcell
(1065) Huang, Hung, Tzeng, Wu, Tsai, Lee

Cognitive Aging I (1066-1079)
(1066) Chen, Liu
(1067) Giesen, Rothermund
(1068) Costello, Buss, Ratkiewicz, Ream
(1069) Nyström, Sörman, Nilsson
(1070) Jackson, Gutchess
(1071) Jarvis, Delappe, Martinez, Ramos, Miller
(1072) Ryals, O'Neil, Voss
(1073) Hughes, Geraci, Lachman
(1074) Brubaker, Naveh-Benjamin
(1075) Glanc
(1076) Ingram, Wixted
(1077) Rhodes, Parra, Cowan, Logie
(1078) Flores, Bui, Lilienthal, Myerson, Hale
(1079) Mitchell, Kelly, Nelson

Working Memory I (1080-1092)
(1080) Zhamharyan, Rutherford
(1081) Draheim, Hicks, Engle
(1082) Cho, Altarriba, Pompiel
(1083) Blume, Cowan
(1084) Chen, Wyble
(1085) Gilchrist, Cowan
(1086) Festini, Reuter-Lorenz
(1087) Chalmers, Freeman, Karayanidis
(1088) Foster, Harrison, Hicks, Draheim, Engle
(1089) Dube, Basciano, Emrich, Al-Aidroos
(1091) Copeland, Bies-Hernandez, Larson
(1092) Reimer, Wong, Carlos, Miller, Romo, Selim, Rosales

Metamemory/Metacognition I (1093-1105)
(1093) Soderstrom, Clark, Halamish, Bjork
(1094) Susser, Mulligan, Giovanello
(1095) Bassili, Kelemen
(1096) Bui, Pyc, Bailey
(1097) Theodosis, Andrews, Rapp
(1098) Isingrini, Sacher, Gougeon, Taconnat
(1099) Hourihan, Fraundorf, Benjamin
(1100) Lee, Thomas, Bulevich
(1101) Fulton
(1102) Delozier, Rhodes
(1103) Foster, Dunlosky, Sahakyan
(1104) Ariel, Hertzog
(1105) Arnold, Graham, Hollingworth-Hughes

Human Learning and Instruction I (1106-1119)
(1106) Braithwaite, Carvalho, De Leeuw, Goldstone
(1107) Yan, Seneviratna, Soderstrom, Bjork E, Bjork R
(1108) Garcia, Bjork E, Bjork R
(1109) Goldwater, Kurtz, Loewenstein, Ludowici
(1110) Jensen C A, Chrysikou
(1111) Fiorella, Mayer
(1112) Szpunar, Jing, Schacter
(1113) Pilegard, Mayer
(1114) Hays, Garcia, Finley, Bjork
(1115) Huffman, Hahn
(1116) Friedman, Moulton, Gehlbach
(1117) Fiechter, Benjamin
(1118) Searston, Tangen
(1119) Whitten W, Rabinowitz, Whitten, S

Cognitive Control I (1120-1134)
(1120) Kuratomi, Yoshizaki
(1121) Wasylyshyn
(1122) Blandon-Gitlin, Fenn, Pezdek
(1123) Pieczykolan, Huestegge
(1124) Plessow, Cohors-Fresenborg, Kirschbaum, Fan, Fischer
(1125) Lleras, Chu, Buetti
(1126) Levin, Tzelgov
(1127) Dadon, Henik
(1128) Lee, Cho
(1129) Cohen-Shikora, Selmeczy, Bugg
(1130) Atalay, Misirlisoy
(1131) Inan, Atalay
(1132) Halvorson, Hazeltine
(1133) Seli, Wammes, Smilek
(1134) Westbrook, Braver

Attention I (1135-1151)
(1135) McDonnell, Dodd
(1136) Rogers, Garrison, Anderson, Folk
(1137) Dark
(1138) Redden, Hilchey, Klein
(1139) Marsja, Neely, Parmentier, Ljungberg
(1140) Horrey, Lesch, Garabet, Maikala
(1141) Sali, Courtney, Yantis
(1142) Giammarco, Samuels, Fenske, Al-Aidroos
(1143) Sasin, Johnson, Nieuwenstein
(1144) Moore, Wiemers
(1145) Benoni, Gronau
(1146) Harding, Bertenthal
(1147) Collegio, Kakpovi, Whitman, Shomstein
(1148) Garcia-Marques, Fernandes, Fonseca, Prada
(1149) Dolgov, Covey, Volkman
(1150) Dorsi, Rosenblum, Dias, Simmons, Cook, Laleko
(1151) Lischer, Bertenthal

Letter and Word Processing I (1152-1164)
(1152) Nakayama, Verdonschot, Ida, Kinoshita
(1153) Jiménez, Perea, Gomez
(1154) Tan, Yap
(1155) Adelman, Trifonova
(1156) Harris
(1157) Prince, Heathcote, Davis, Andrews
(1158) Morris
(1159) Rimzhim, Fowler, Katz
(1160) Barnhart, Jenkins
(1161) Tejero, Jiménez, Perea
(1162) Gregg, Inhoff
(1163) Eskenazi, Folk
(1164) Zimmer, Townsend, Fific

Bilingualism I (1165-1182)
(1165) Bulgarelli, Weiss
(1166) Bice, Massimino, Kroll
(1167) Poepsel, Weiss
(1168) Casaponsa, Carreiras, Antón, Pérez, Dunabeitia
(1169) Ratiu, Azuma
(1170) Antón, Thierry, Carreiras, Dunabeitia
(1171) Morales, Bajo, Yudes, Gomez-Ariza
(1172) Yu, Tzeng, Hung, Wu
(1173) Fricke, Scharf, Martín, Rossi, Kroll
(1174) Van Assche, Duyck, Gollan
(1175) McClain, Bloodgood, Rossi, Kroll
(1176) Dunabeitia, Ivaz, Casaponsa, Carreiras
(1177) Massol, Berdasco, Molinaro, Dunabeitia, Carreiras
(1178) Lin, Bangert, Schwartz
(1179) Malt, Lebkuecher
(1180) Burchfield, Bradlow
(1181) Cardon, Dunn, Fox Tree
(1182) Heredia, Altamira, Cieslicka

Decision Making I (1183-1200)
(1183) Floyd, Leslie, Baddeley
(1184) Schulze, Newell
(1185) Toglia, Ryndak, Leone
(1186) Casteel
(1187) Tsuzuki, Chiba, Soma
(1188) Hart, Marciano-Romm, Winter
(1189) Davis, Franco-Watkins
(1190) Ariza, Shears
(1191) Joslyn, LeClerc
(1192) Chen, Gates, Li, Proctor
(1193) Luckman, Donkin, Newell
(1194) Fleischhut, Artinger, Hertwig, Volz, Olschewski
(1195) Acklin, Mathews, Lane
(1196) Rae, Brown, Bushmakin, Rubin
(1197) Blanco, Otto, Smayda, Love, Maddox
(1198) Gao, Li
(1199) Josef, Mata, Shing, Pachur, Hertwig
(1200) Marciano-Romm, Romm A, Bourgeois-Gironde, Deouell

FRIDAY, NOVEMBER 21, 2014
8:00 A.M.-12:00 NOON
Spoken Sessions (1-66)

Reasoning/Problem Solving I (1-6) Beacon A

8:00 a.m.-8:15 a.m.	Landy
8:20 a.m.-8:35 a.m.	Zeveney, Marsh
8:40 a.m.-8:55 a.m.	McGillivray, Cheng
9:00 a.m.-9:15 a.m.	Hayes, Pentney, Dunn, Stephens
9:20 a.m.-9:35 a.m.	Barrouillet, Gauffroy
9:40 a.m.-9:55 a.m.	Thompson, Newman, Gibb

Psycholinguistics I (7-11) Regency A-C

8:00 a.m.-8:15 a.m.	Hughes, Schnur
8:20 a.m.-8:35 a.m.	Arnold, Nozari, Thompson-Schill
8:40 a.m.-8:55 a.m.	Gruberg, Ferreira, Ostrand
9:00 a.m.-9:15 a.m.	Pardo, Gash, Urmanche, Decker, Francis, Wiener, Parker
9:20 a.m.-9:35 a.m.	Almor, Boiteau, Peh, Shebusky

Cognitive Control of Working Memory (12-17) Regency D-F, H

8:00 a.m.-8:15 a.m.	Kikumoto, Mayr
8:20 a.m.-8:35 a.m.	Schneider
8:40 a.m.-8:55 a.m.	Kane, Meier, Smeekens, Gross, Chun, Silvia, Kwapil
9:00 a.m.-9:15 a.m.	Hutchison, Bugg, Lim, Olsen
9:20 a.m.-9:35 a.m.	Nijboer, Borst, Van Rijn, Taatgen
9:40 a.m.-9:55 a.m.	Engle

Emotion and Cognition (18-22) Beacon B

8:00 a.m.-8:15 a.m.	Kraft
8:20 a.m.-8:35 a.m.	Biederman, Amir
8:40 a.m.-8:55 a.m.	Kuperman, Shore, Warriner
9:00 a.m.-9:15 a.m.	Lyusin
9:20 a.m.-9:35 a.m.	Abrams, Davis, Martin

Music and Tone Perception (23-27) Shoreline

8:00 a.m.-8:15 a.m.	Gordon, Kobylarz, Ataucusi, Suwangbutra
8:20 a.m.-8:35 a.m.	Fostick, Babkoff
8:40 a.m.-8:55 a.m.	Osaka N, Minamoto, Yaoi, Azuma, Osaka M
9:00 a.m.-9:15 a.m.	Creel
9:20 a.m.-9:35 a.m.	McBeath, Wilkinson, Patten

False Memory (28-32) Seaview A & B

8:00 a.m.-8:15 a.m.	Howe, Garner, Threadgold, Ball
8:20 a.m.-8:35 a.m.	Leamaire, Thomas, Bulevich
8:40 a.m.-8:55 a.m.	Hunt, Smith
9:00 a.m.-9:15 a.m.	Brainerd, Nakamura, Reyna
9:20 a.m.-9:35 a.m.	Brady, Schacter, Alvarez

SYMPOSIUM I: Multi-Voxel Pattern Analyses of Source Memory (33-38) Regency A-C

10:00 a.m.-10:20 a.m.	Rissman
10:25 a.m.-10:40 a.m.	Ranganath
10:45 a.m.-11:00 a.m.	Staresina
11:05 a.m.-11:20 a.m.	Johnson
11:25 a.m.-11:40 a.m.	Preston
11:45 a.m.-12:00 p.m.	Mitchell

Attention: Capture (39-44) Beacon B

10:00 a.m.-10:15 a.m.	Tsal, Benoni, Aven, Boimer, Distle, Shvartz
10:20 a.m.-10:35 a.m.	Lin, Jonker, MacLeod
10:40 a.m.-10:55 a.m.	Vatterott, Vecera
11:00 a.m.-11:15 a.m.	Vachon, Guay, Labonte, Marois, Marsh
11:20 a.m.-11:35 a.m.	Anderson
11:40 a.m.-11:55 a.m.	Lin, Murray

Embodied Cognition (45-49) Regency D-F, H

10:20 a.m.-10:35 a.m.	Rieger
10:40 a.m.-10:55 a.m.	Wagman, Rosenbaum
11:00 a.m.-11:15 a.m.	Thomas
11:20 a.m.-11:35 a.m.	Borrie, Berisha, Liss
11:40 a.m.-11:55 a.m.	McRae, Nguyen, South

Scene Processing (50-54) Beacon A

10:20 a.m.-10:35 a.m.	Greene, Baldassano, Esteva, Beck, Fei-Fei
10:40 a.m.-10:55 a.m.	Potter, Hagmann
11:00 a.m.-11:15 a.m.	Intraub, Beighley, Gaitan
11:20 a.m.-11:35 a.m.	Hubbard, Ruppel
11:40 a.m.-11:55 a.m.	Gronau, Izoutcheev, Amar, Nave

Meaning/Semantics (55-60) Shoreline

10:00 a.m.-10:15 a.m.	Durgin, Sikos, Thibodeau
10:20 a.m.-10:35 a.m.	Huettig, Daum, Mani
10:40 a.m.-10:55 a.m.	Perry, Lupyan
11:00 a.m.-11:15 a.m.	Gorfein
11:20 a.m.-11:35 a.m.	Burgess, Maples
11:40 a.m.-11:55 a.m.	Anderson, Billman, Basehore

Decision Making (61-66) Seaview A & B

10:00 a.m.-10:15 a.m.	Newell, Donkin, Kalish, Dunn
10:20 a.m.-10:35 a.m.	Morais, Schooler, Olsson, Meder
10:40 a.m.-10:55 a.m.	Shiffrin, Busemeyer
11:00 a.m.-11:15 a.m.	Del Missier, Mäntylä, Hansson, De Bruin, Parker, Nilson
11:20 a.m.-11:35 a.m.	Kareev, Avrahami, Goldzweig, Hadar
11:40 a.m.-11:55 a.m.	Reyna, Evans, Chick, Weldon, Corbin, Wilhelms

FRIDAY, NOVEMBER 21, 2014
12:00 NOON-1:30 P.M.
POSTER SESSION II (2001-2200)
GRAND BALLROOM, LONG BEACH CONVENTION CENTER

Audition (2001-2010)
(2001) Abney, Wagman
(2002) LaFlamme, Grondin
(2003) Ljungberg, Parmentier, Marsja, Jones, Neely
(2004) Dickerson, Gaston
(2005) Donnadieu, Risso, Gillet-Perret, N'Guyen, Meunier
(2006) Rice, Church, Klyachman, Mercado
(2007) Lotto, Carbonell
(2008) Holloway, Patten, McBeath
(2009) Lutfi-Proctor, Elliott
(2010) Gaston, Peitsch, Nagel, Dickerson

Spatial Cognition I (2011-2025)
(2011) Padilla, Creem-Regehr, Stefanucci, Cashdan
(2012) Galati, Weisberg, Newcombe, Avraamides
(2013) Gagnon, Stefanucci, Creem-Regehr, Cashdan
(2014) Sjolund, Kelly, McNamara
(2015) Weisberg, Newcombe
(2016) Du, McMillan, Madan, Spetch
(2017) Siegel, Kelly
(2018) Himmelberger, Merrill
(2019) Santistevan, Day
(2020) Clinton, Osterby, Magliano
(2021) Kitson, Sproll, Riecke
(2022) Gardony, Taylor, Brunye, Wolford
(2023) Chao, Kennedy
(2024) Kolesari, Carlson, Bergen
(2025) Sargent, Kellis, Howell, Richmond, Zacks

Associative Learning (2026-2040)
(2026) Janacsek, Skulteti, Gergely, Walter, Antal
(2027) Roman, Kotz
(2028) Miyashita, Kurihara, Sawa
(2029) Ngo, Newcombe, Olson, Weisberg
(2030) Negley, Kelley
(2031) Komsky, Kelley, Jacoby
(2032) Roembke, Freedberg, McMurray, Hazeltine
(2033) Pyc, Jones
(2034) Vaughn, Rawson, Dunlosky
(2035) Bankieris, Aslin
(2036) Ez-Zizi, Farrell, Leslie
(2037) Apfelbaum, McMurray
(2038) Lee, Livesey
(2039) Austerweil, Stanworth, Franklin
(2040) Rolison

Emotion and Cognition II (2041-2049)
(2041) Chamberland, Dickinson
(2042) Okubo, Ishikawa, Kobayashi, Suzuki
(2044) Madan, Scott, Kensinger
(2045) Zhang, Xie
(2046) Kazanas, Altarriba
(2047) Siakaluk, Newcombe, Duffels, Pexman
(2048) Martin, Altarriba
(2049) Ponari, Vinson, Vigliocco

Eyewitness Identification (2050-2057)
(2050) Dasse, Weaver
(2051) Malavanti, Kurinec, Weaver
(2052) Baldassari, Kantner, Lindsay
(2053) Gronlund, Key, Cash, Neuschatz, Price, Wetmore
(2054) Wooten, Carlson
(2055) Moreland, Clark
(2056) Goodsell, McAdoo, Gronlund, Neuschatz,Wetmore
(2057) DeFranco, Zaragoza

Human Learning and Instruction II (2058-2073)
(2058) Ong, Church, Mercado
(2059) Pashler, Lau
(2060) Stull, Hegarty
(2061) Mettler, Kellman
(2062) Tullis, Goldstone, Hanson
(2063) McDonough, Lee, Ramirez
(2064) Wehe, Seger
(2065) Davis, Erdman, Chan
(2066) Fritz, Crowther, Benn, Morris
(2067) Kuepper-Tetzel, McDaniel
(2068) De Jonge, Tabbers, Pecher, Zeelenberg
(2070) Jacovina, Snow, Allen, Roscoe, McNamara
(2071) Snow, Allen, Jacovina, McNamara
(2072) Ploran
(2073) Margulieux, Catrambone

Working Memory II (2074-2086)
(2074) Sims
(2075) Swan, Wyble
(2076) Chow, Gonthier, MacNamara, Conway, Braver
(2077) Ricker, Vergauwe
(2078) Tsukahara, Koshino
(2079) Sehyr, Emmorey
(2080) Shimi, Scerif
(2081) Dai, Thomas, Taylor
(2082) Lilienthal, Myerson, Abrams, Hale
(2083) Holden, Conway
(2084) Banks, Welhaf, Srour
(2085) Salminen, Kühn, Schubert
(2086) Sheremata, Shomstein

Recognition Memory II (2087-2099)
(2087) Goujon, Thorpe
(2088) Bi, Peynircioglu
(2089) Moen, Lloyd
(2090) Fujita, Cho
(2091) Spangler, Criss, Hewett, Shefner, Wang
(2092) Robey, Riggins
(2093) Fukuda, Woodman
(2094) Werner, Hoover
(2095) Price, Leiker, Johnson
(2096) Perry, Gronlund
(2097) Kilic, Oztekin
(2098) Li, Taft
(2099) Selmeczy, Dobbins

Attention II (2100-2110)

(2100) Tokita, Ishiguchi
(2101) Burnham
(2102) Max, Tsal
(2103) Patten, Spalek, Lagroix
(2104) Meyerhoff, Schwan, Huff
(2105) Malcolm, Shomstein
(2106) Koshino, Veltri, Tsukahara, Alderson
(2107) Gaspelin, Margett-Jordan, Ruthruff
(2108) Whiting, Murdock
(2109) Naylor, Lien, Ruthruff
(2110) Donaldson, Yamamoto

Cognitive Control II (2111-2124)

(2111) Conder, Humphreys, Watter
(2112) Hubbard, Kikumoto, Mayr
(2113) Ikeda, Hasegawa
(2114) Gonthier, Braver, Bugg
(2115) Fischer, Plessow, Dreisbach, Goschke
(2116) Hutcheon, Spieler
(2117) Watter, Thomson
(2118) Dreisbach, Baeuml
(2119) Blais, Stefanidi, Brewer
(2120) Teubner-Rhodes, Bolger, Novick
(2121) Wessel, Aron
(2122) Bangert, Harris
(2123) Nieuwenstein, Scholz, Broers
(2124) Hsu, Jaeggi, Novick

Letter and Word Processing II (2125-2138)

(2125) Tao, Healy
(2126) Choi, Ferreira, Henderson
(2127) Juhasz, Lai, Woodcock
(2128) Geller, Morris
(2129) Smith, Orlosky, Aebi, Torres, Van Gunten
(2130) Hermena, Drieghe, Liversedge
(2131) MacNamee, Coane
(2132) Plummer, Abbott, Rayner
(2133) Gagne, Spalding, Nisbet, Armstrong
(2134) Abbott, Angele, Ahn, Rayner
(2135) Sadat, Mousikou, Lucas, Rastle
(2136) Angele, Schotter, Slattery, Chaloukian, Bicknell, Rayner
(2137) Robidoux
(2138) Pritchard, Coltheart, Marinus, Castles

Psycholinguistics I (2139-2150)

(2139) Grey, Van Hell
(2140) Tan, Martin
(2141) Tanner, Bulkes
(2142) Keung, Staub
(2143) Oettl, Jaeger, Kaup
(2144) Christianson, Zhou
(2145) Ting, Van Hell
(2146) Abdollahi, Morid, Van Hell
(2147) Morales, Paolieri, Dussias, Kroff, Gerfen, Bajo
(2148) Ying, Christiansen
(2149) Zirnstein, Van Hell, Kroll
(2150) Kartushina, Hervais-Adelman, Frauenfelder, Golestani

Bilingualism II (2151-2162)

(2151) De Bruin, Bak, Della Sala
(2152) Sullivan, Prescott, Bialystok, Craik
(2153) Neumann, Russell, Shrikhande
(2154) Linck, Michael, Golonka, Kuyatt
(2155) Janus, Bialystok
(2156) Tokowicz, Tuninetti, Warren, Rivera-Torres
(2158) Liburd, Warren, Tokowicz
(2159) Vaid, Lopez
(2160) Incera, Shah, McLennan, Wetzel
(2161) Gustafson, Bradlow
(2162) Olmstead, Viswanathan, Williams, Attanasio

Neural Mechanisms of Cognition (2163-2177)

(2163) O'Boyle, Westney, Yang, Grund, Hou, Fang, Rajmohan
(2164) Schaal, Javadi, Halpern, Pollok, Banissy
(2165) Burte, Turner, Miller, Hegarty
(2166) Brunye, Holmes, Cantelon, Eddy, Gardony, Taylor
(2167) Lowry, Parks, Owen, Tiernan, Mutter
(2168) Liu, Tan, Zhang, Reder
(2169) Pastötter, Bäuml
(2170) Freeman, Dunn, Dennis, Rhodes
(2171) Meyering, Rose, Rosenbaum, Postle
(2172) Bailey, Bartholow, Saults, Lust
(2173) Van Hees, Pexman, Hargreaves, Zdrazilova, Myers-Stewart, Protzner
(2174) Vazquez, Daily, Felton, Chiarello
(2175) Dagenbach, Rzucidlo, Laurienti, Lyday
(2176) Cassey, Heathcote, Brown
(2177) Adams, Tiernan, Anaya, Parks, Lowry, Herricks

Statistics and Methodology (2178-2187)

(2178) Morris, Fritz
(2179) Guan, Vandekerckhove
(2180) Tidwell, Dougherty, Thomas, Chrabaszcz
(2181) Field, Wagenmakers, Newell, Van Ravenzwaaij
(2182) Arnold, Boywitt, Bröder
(2183) Thiele
(2184) Hughes, Linck
(2185) Bramley, Speekenbrink, Nelson, Lagnado
(2186) Plant
(2187) Sagi

Concepts and Categories I (2188-2200)

(2188) Daniel, Goodman, Wright, Katz
(2189) Noh, Yan, Kerr, Bjork, Maddox
(2190) Canty, Pellegrino, Goldman, Dibello, Dejaresco
(2191) Foster, Jones
(2192) Hill, Bohil, Murray
(2193) Zakrzewski, Church, Ashby, Smith, Roeder, Boomer, Valentin
(2194) Wismer, Bohil, Schiebel
(2195) Szymula, McCoy, Ell
(2196) Turner, Kellogg
(2197) Storms, Djalal, Ameel
(2198) Hoffmann, Von Helversen, Rieskamp
(2199) Homa
(2200) Meder, Mayrhofer

FRIDAY, NOVEMBER 21, 2014
1:30 P.M.-5:30 P.M.
Spoken Sessions (67-131)

Human Learning and Instruction I (67-72)
Regency D-F, H

1:30 p.m.-1:45 p.m.	Kornell, Hausman
1:50 p.m.-2:05 p.m.	Taraban
2:10 p.m.-2:25 p.m.	Abel, Holterman, Baeuml
2:30 p.m.-2:45 p.m.	Luck
2:50 p.m.-3:05 p.m.	Ridgeway, Mozer
3:10 p.m.-3:25 p.m.	Wolfe, Reyna, Brust-Renck, Widmer, Cedillos, Weil, Fisher

Numerical Cognition (73-77) Shoreline

1:30 p.m.-1:45 p.m.	Faulkenberry, Cruise, Lavro, Shaki
1:50 p.m.-2:05 p.m.	Beilock, Maloney
2:10 p.m.-2:25 p.m.	Fazio, Siegler, Kennedy
2:30 p.m.-2:45 p.m.	Campbell, Dufour
2:50 p.m.-3:05 p.m.	Content

Word Recognition (78-82) Beacon A

1:30 p.m.-1:45 p.m.	Jared, Jouravlev, Joanisse
1:50 p.m.-2:05 p.m.	Vergara-Martinez, Comesaña, Gutiérrez, Perea
2:10 p.m.-2:25 p.m.	Grainger, Hannagan, Holcomb, Ktori, Ziegler
2:30 p.m.-2:45 p.m.	Inhoff, Gregg
2:50 p.m.-3:05 p.m.	Balota, Aschenbrenner, Scaltritti, Besner

Vision I (83-87) Beacon B

1:30 p.m.-1:45 p.m.	White, Phillips, Hahn, Hill, O'Toole
1:50 p.m.-2:05 p.m.	Cain, Boettcher, Wolfe
2:10 p.m.-2:25 p.m.	Makovski, Pertzov
2:30 p.m.-2:45 p.m.	Cole, Wright, Hibbard
2:50 p.m.-3:05 p.m.	Lachter, Durgin

Judgment (88-92) Seaview A & B

1:30 p.m.-1:45 p.m.	Treat, Church, Viken
1:50 p.m.-2:05 p.m.	Isham, Wulf
2:10 p.m.-2:25 p.m.	Brase
2:30 p.m.-2:45 p.m.	Cokely, Ghazal, Garcia-Retamero
2:50 p.m.-3:05 p.m.	Trueblood, Pothos, Mistry

SYMPOSIUM II: Cognitive Science in the Attention Economy (93-98) Regency A-C

1:30 p.m.-1:40 p.m.	Atchley P
1:40 p.m.-2:00 p.m.	Atchley P
2:05 p.m.-2:25 p.m.	Lane, Cash
2:30 p.m.-2:50 p.m.	Henkel
2:55 p.m.-3:15 p.m.	Atchley R
3:20 p.m.-3:40 p.m.	Atchley P, Lane

Statistics and Methodology (99-104) Beacon B

3:30 p.m.-3:45 p.m.	Fific
3:50 p.m.-4:05 p.m.	Houpt
4:10 p.m.-4:25 p.m.	Little
4:30 p.m.-4:45 p.m.	Morey, Wagenmakers, Hoekstra, Rouder, Lee
4:50 p.m.-5:05 p.m.	Vandekerckhove, Nunez, Baribault, Srinivasan
5:10 p.m.-5:25 p.m.	Altieri, Hudock

Metamemory/Metacognition I (105-109) Regency D-F, H

3:50 p.m.-4:05 p.m.	Brewer, Stefanidi
4:10 p.m.-4:25 p.m.	Muntean, Kimball
4:30 p.m.-4:45 p.m.	Koriat
4:50 p.m.-5:05 p.m.	Metcalfe
5:10 p.m.-5:25 p.m.	Schwartz, Boduroglu, Tekcan

Priming (110-115) Shoreline

3:30 p.m.-3:45 p.m.	Crepaldi, Bottini
3:50 p.m.-4:05 p.m.	Rastle, Lavric, Elchlepp, Crepaldi
4:10 p.m.-4:25 p.m.	Andrews, Xia
4:30 p.m.-4:45 p.m.	Kinoshita, Aji
4:50 p.m.-5:05 p.m.	Forster, Drake
5:10 p.m.-5:25 p.m.	Gordon

Ad Hoc Cognition (116-119) Regency A-C

4:10 p.m.-4:25 p.m.	Casasanto
4:30 p.m.-4:45 p.m.	Elman
4:50 p.m.-5:05 p.m.	Spivey
5:10 p.m.-5:25 p.m.	Lupyan

Visual Search (120-125) Beacon A

3:30 p.m.-3:45 p.m.	Becker, Venini, Retell, Wolfe
3:50 p.m.-4:05 p.m.	Wolfe, Drew, Boettcher
4:10 p.m.-4:25 p.m.	McDonald, Gaspar, Lagroix, Di Lollo, Jolicoeur
4:30 p.m.-4:45 p.m.	Chen, Cave
4:50 p.m.-5:05 p.m.	Mitroff, Biggs, Adamo, Dowd, Winkle, Clark
5:10 p.m.-5:25 p.m.	Horowitz

Judgment and Decision Making I (126-131) Seaview A & B

3:30 p.m.-3:45 p.m.	Kusev, Van Schaik, Alzahrani, Lonigro, Kuvaldina
3:50 p.m.-4:05 p.m.	Cohen, Ahn
4:10 p.m.-4:25 p.m.	Corey, Keysar, Hayakawa, Aparici, Foucart, Costa
4:30 p.m.-4:45 p.m.	Ratcliff
4:50 p.m.-5:05 p.m.	Wang, Ong, Tan
5:10 p.m.-5:25 p.m.	Stevenson, Amador, Mony, Hannah

FRIDAY, NOVEMBER 21, 2014
6:00 P.M.-7:30 P.M.
POSTER SESSION III (3001-3200)
GRAND BALLROOM, LONG BEACH CONVENTION CENTER

Vision II (3001-3017)
(3001)	Urakawa, Mori
(3002)	Lappe, Masselink
(3003)	Yakushijin, Ueda
(3004)	Inverso, Wright, Chubb, Sun, Sperling
(3005)	Koop, Criss
(3006)	Miller, Urgen, Florendo, Cook, Saygin
(3007)	Bao, Poeppel
(3008)	Poeppel, Bao, Zhou
(3009)	Carrigan, Palmer, Kellman
(3010)	Newell, Murtagh, Hutzler
(3011)	Talasli, Inan
(3012)	Wu, Sim, Hibbard, Klatzky
(3013)	Walenchok, Reichle, Goldinger
(3014)	Mullane, Okhovat, Difley, Quiroga, Ziogas, Bartlett, Littlewort, Wixted, Chiba
(3015)	Yokosawa, Asano, Kanazawa, Shloss, Palmer
(3016)	Reppa, McDougall
(3017)	Bittner, Schill, Blaha, Mohd-Zaid

Action and Perception II (3018-3030)
(3018)	Tiggelbeck, Musseler
(3019)	Nishimura, Suzuki, Yokosawa
(3020)	Schroeter, Birngruber, Bratzke, Miller, Ulrich
(3021)	Pedersen, Lien, Proctor
(3022)	Weidler, Abrams
(3023)	Smith, Vul
(3024)	Sack, Granowski, Müsseler, Sutter
(3025)	Overvliet, Smeets, Van der Kooij
(3026)	Moher, Song
(3027)	Musseler, Kreutzfeldt, Leisten
(3028)	Wulf, Wall, Isham
(3029)	Barton, Bertenthal
(3030)	Urgen, Li, Berka, Kutas, Saygin

Spatial Cognition II (3031-3045)
(3031)	Varner, Dopkins, Hoyer
(3032)	Tarampi, Atit, Petcovic, Shipley, Hegarty
(3033)	Lazareva, Mack, Kraft
(3034)	Newcombe, Marchette, Holmes
(3035)	Beighley, Intraub
(3036)	Arduino, Primativo, Daini, De Luca, Toneatto, Martelli
(3037)	Hegarty, Barrett, McKenzie, Goodchild
(3038)	Zhou, Mou
(3039)	Wolter, Hauptmann, Hund
(3040)	Hoyer, Dopkins, Philbeck
(3041)	Adams, Galeucia, Kolesari, Carlson, Coventry
(3042)	Wang, Vong, Liu
(3043)	Sampaio, Williams, Barnard, Fleck
(3044)	Gokce, Müller, Geyer
(3045)	Richmond, Sargent, Flores, Zacks

Recall I (3046-3059)
(3046)	Aue, Criss
(3047)	Chan, Campbell, Zurlo
(3048)	De Loof, Naert, Verguts, Abrahamse
(3049)	Morton, Polyn
(3050)	Kouchel, Abushanab, Sahakyan
(3051)	Chung, Dees, Przemyslaw
(3052)	Vieane, Clegg
(3053)	Christman, Hasabelnaby
(3054)	Ljung, Israelsson, Hygge
(3055)	Kliegl, Baeuml
(3056)	Ravizza
(3057)	Briere, Marche
(3058)	Robinson, Altarriba
(3059)	Angello, Smith, Storm

Recognition Memory I (3060-3072)
(3060)	Zobel, Dube, Sanders, Rotello
(3061)	Franks, Hicks
(3062)	Lindsay, Fallow, Konieczny
(3063)	Dopkins, Varner, Hoyer
(3064)	Swagman, Rouder
(3065)	Osth, Dennis
(3066)	Chen, Starns, Rotello, Zobel
(3067)	Murray, Donaldson
(3068)	Papesh
(3069)	Blake, Nazarian, Castel
(3070)	Miller, Kantner
(3071)	Vlach
(3072)	Fraundorf, Hourihan, Benjamin

False Memory I (3073-3089)
(3073)	Gray, Gallo
(3074)	Doss, Bluestone, Gallo
(3075)	Chen, Lytell, Gallo
(3076)	Bookbinder
(3077)	Rindal, Chrobak, Zaragoza, Weihing
(3078)	Kiat, Belli
(3079)	Desouky, Arduengo, Douglas, Bartlett
(3080)	Harman, Franklin
(3081)	Putnam, Roediger
(3082)	Olszewska, Reuter-Lorenz, Munier, Bendler
(3083)	Guillory, Geraci
(3084)	Rich, Zaragoza, Riccio
(3085)	Knott, Litchfield, Crawford, Donovan
(3086)	Michael, Garry
(3087)	Threadgold, Howe, Garner, Ball
(3088)	Ecker, Lewandowsky
(3089)	Sherman, Tudor

Metamemory/Metacognition II (3090-3101)
(3090) Holder, Price, Hertzog
(3091) Little, McDaniel
(3092) Blake, Castel
(3093) Wright, Harrison, Iqbal, Sharpe, Grate, Killion, Price
(3094) Miller, Geraci
(3095) Heslin, Curley, Jackiewicz, Flowers, Phelan, Toppino
(3096) Lee, Park
(3097) Yan, Sungkhasettee, Murayama, Castel
(3098) Tsai, Yue, Oppenheimer, Bjork E, Bjork R
(3099) Mueller, Foster, Dunlosky
(3100) Eakin
(3101) Sackur

Cognitive Aging II (3102-3110)
(3102) Harada, Okawa, Tanaka, Daimon
(3103) Gardner, Xi, Burke
(3104) Smith, Wong, Barber, Gallo, Thomas
(3105) Gorlick, Schnyer, Abdul-Razzak, Maddox
(3106) Middlebrooks, Kerr, Murayama, Castel
(3107) Ngo, Hasher
(3108) Badham, Maylor
(3109) Tat, Deason, Flannery, Gosselin, Budson
(3110) Barber, Opitz, Martins, Sakaki, Mather

Prospective Memory (3111-3119)
(3111) Scullin
(3112) Rummel, Einstein
(3113) Scolaro
(3114) Shelton, Christopher, Scott
(3115) Smith, Khoja, Hunt
(3116) Reese-Melancon, Davoli, Kytola, Smith, Multhaup
(3117) Conte, McBride
(3118) Hicks, Spitler
(3119) Harrison, Shipstead, Hicks, Foster, Trani, Sloan, Redick, Bunting, Engle

Visual Search I (3120-3131)
(3120) Livingstone, McDonald, Christie
(3121) Christie, Wright, McDonald
(3122) Klein, Stolz
(3123) Goldstein, Beck
(3124) Blagrove, Zupan, Watson
(3125) Chong, Ngo, Vu
(3126) Conley, Heller, Pockat, Brinkman
(3127) Williams, Smith
(3128) Donk
(3129) Mangano, Oliveri, Li, Turriziani, Smirni, Cipolotti
(3130) Lagroix, Spalek, Di Lollo
(3131) Kim, Chang, Cho

Discourse Processes I (3132-3138)
(3132) Cranford, Moss, Lewis
(3133) Collins, Gonzalez
(3134) Kopp, Mills, Graesser, D'Mello
(3135) Asiala, Wiemer
(3136) Ozuru, Myers
(3137) Ashby, Agauas
(3138) Jones

Language Production/Writing (3139-3148)
(3139) Pinet, Hamamé, Longcamp, Vidal, Alario
(3140) Kuzmina, Weekes
(3141) Davis, Crutcher, Mattancheril, White, Abrams
(3142) Schmank, James
(3143) Allen, Snow, McNamara
(3144) Fink, Goldrick
(3145) Frazer, O'Seaghdha, Rehrig
(3146) Oliver, Humphreys
(3147) Penta, Pearlmutter
(3148) Mayu, Fujiki

Meaning/Semantics (3149-3160)
(3149) Sokoloff, Burros, Kunigel, Lien, Allen
(3150) Campbell, Raney
(3151) Yoshihara, Hino, Kusunose
(3152) Stafura, Perfetti
(3153) Bueno
(3154) Danguecan, Buchanan
(3155) Wei, Schnur
(3156) Ruby, Smallwood
(3157) Mooneyham, Schooler
(3158) Kunkel, MacKenzie, Filik, Leuthold
(3159) George, Wiley
(3160) Terai, Nakagawa, Kusumi, Koike, Jimura

Psycholinguistics II (3161-3177)
(3161) Faust, Hill, Pierce
(3162) Hussey, Brehm, Christianson
(3163) Pozzan, Trueswell
(3164) Nozari, Trueswell, Thompson-Schill
(3165) Noonan, Archibald
(3166) Foraker
(3167) Zhou, Christianson
(3168) Galeucia, Carlson
(3169) Erickson, Kaschak, Thiessen, Berry
(3170) Lukacs, Kemeny
(3171) Lam, Marian
(3172) Shaoul, Van Rij, Milin, Baayen
(3173) Matsuki, Kuperman, Van Dyke
(3174) Bicknell, Levy
(3175) Willits, Jones
(3176) Moores, McGowan, Sumner, Frank
(3177) Paquette-Smith, Johnson

Reasoning and Judgment I (3178-3188)
(3178)   Livins, Doumas, Spivey
(3179)   Blanchette, Viau-Quesnel
(3180)   Spiridonov, Volkonskii, Muhutdinova
(3181)   Travers, Feeney, Rolison, Bright
(3182)   Swan, Revlin
(3183)   Bradford, Jentzsch, Gomez
(3184)   Horne, Cimpian, Hummel
(3185)   Bixter, Luhmann
(3186)   Gauffroy, Barrouillet
(3187)   Scholz, Jahn, Krems
(3188)   Nakamura

Decision Making II (3189-3200)
(3189)   Li
(3190)   Hemmer, Robbins, Persaud, Tang
(3191)   Fechner, Borst, Mehlhorn, Schooler, Pachur, Battal,
         Volz
(3192)   Cooper, Gorlick, Worthy, Beevers, Maddox
(3193)   Jenny
(3194)   Herzog
(3195)   Wilford, Wells
(3196)   Pang, Byrne, Worthy
(3197)   Khader, Pachur, Jost, Weber
(3198)   Menon, Kemp, White
(3199)   White
(3200)   Fiedler, Hillenbrand

SATURDAY, NOVEMBER 22, 2014
8:00 A.M.-12:00 NOON
Spoken Sessions (132-197)

Memory: Reward and Motivation (132-136)
Regency D-F, H
8:00 a.m.-8:15 a.m.	Most, Kennedy, Petras
8:20 a.m.-8:35 a.m.	Hupbach, Dorskind
8:40 a.m.-8:55 a.m.	Hertel, Hayes, Barrionuevo, Mor
9:00 a.m.-9:15 a.m.	Hennessee, Cohen, Castel, Knowlton
9:20 a.m.-9:35 a.m.	Finn

Eyewitness Identification (137-140) Regency A-C
8:00 a.m.-8:15 a.m.	Carlson C, Carlson M
8:20 a.m.-8:35 a.m.	Dodson, Dobolyi
8:40 a.m.-8:55 a.m.	Mickes, Seale-Carlisle, Wixted
9:00 a.m.-9:15 a.m.	Jones, Robinson, Steel

Psycholinguistics II (141-146) Seaview A & B
8:00 a.m.-8:15 a.m.	Staub, Kretzschmar, Schlesewsky
8:20 a.m.-8:35 a.m.	Berent, Brem, Zhao, Seligson, Pan, Stern, Epstein, Galaburda, Pascual-Leon
8:40 a.m.-8:55 a.m.	Poletiek, Lai
9:00 a.m.-9:15 a.m.	McKoon
9:20 a.m.-9:35 a.m.	Jolsvai, McCauley, Christiansen
9:40 a.m.-9:55 a.m.	Jackson, Eddington, Tokowicz, Van Hell, Kotz

Working Memory I (147-152) Beacon A
8:00 a.m.-8:15 a.m.	Donkin
8:20 a.m.-8:35 a.m.	Mathy, Chekaf, Gauvrit
8:40 a.m.-8:55 a.m.	Vergauwe, Roemer, Cowan
9:00 a.m.-9:15 a.m.	Camos, Brosch, Sander, Barrouillet
9:20 a.m.-9:35 a.m.	MacKay
9:40 a.m.-9:55 a.m.	Rose, LaRocque, Riggall, Gosseries, Postle

Metamemory/Metacognition II (153-157) Beacon B
8:00 a.m.-8:15 a.m.	Stevens, Carlson
8:20 a.m.-8:35 a.m.	Ackerman
8:40 a.m.-8:55 a.m.	De Bruin, Kok, Lobbestael, De Grip
9:00 a.m.-9:15 a.m.	Voss, Wang
9:20 a.m.-9:35 a.m.	Weinstein, Nunes, Karpicke

Animal Learning and Cognition (158-163) Shoreline
8:00 a.m.-8:15 a.m.	Brown, Saxon
8:20 a.m.-8:35 a.m.	Blaisdell, Garlick, Fountain
8:40 a.m.-8:55 a.m.	Pepperberg, Koepke, Gray
9:00 a.m.-9:15 a.m.	Stevens, Kennedy, Morales, Burks
9:20 a.m.-9:35 a.m.	Beran, Evans, Parrish, Perdue
9:40 a.m.-9:55 a.m.	Harley, Fellner, Losch

Speech Perception (164-169) Beacon B
10:00 a.m.-10:15 a.m.	Bent, Marks, Atagi
10:20 a.m.-10:35 a.m.	Cooper, Bradlow
10:40 a.m.-10:55 a.m.	Mitterer, Reinisch
11:00 a.m.-11:15 a.m.	Toscano, Anderson, Garnsey, Fabiani, Gratton
11:20 a.m.-11:35 a.m.	Remez, Thomas, Wycoff, Crank, Giglio
11:40 a.m.-11:55 a.m.	Samuel

Perception and Action (170-174) Seaview A & B
10:20 a.m.-10:35 a.m.	Magen
10:40 a.m.-10:55 a.m.	Jordan, Gill, Dupuis
11:00 a.m.-11:15 a.m.	Herbort, Kunde
11:20 a.m.-11:35 a.m.	Fournier, Gallimore
11:40 a.m.-11:55 a.m.	Van der Wel

Cognitive Skill Acquisition (175-179) Shoreline
10:20 a.m.-10:35 a.m.	Redick, Melby-Lervåg, Grovak, Hulme
10:40 a.m.-10:55 a.m.	Yamaguchi, Logan
11:00 a.m.-11:15 a.m.	Strobach, Schubert
11:20 a.m.-11:35 a.m.	Seymour, Goodman
11:40 a.m.-11:55 a.m.	Patterson, Yang, Wong

Event Cognition (180-185) Regency D-F, H
10:00 a.m.-10:15 a.m.	Zacks, Kurby, Landazabal, Krueger, Grafman
10:20 a.m.-10:35 a.m.	Bezdek, Gerrig, Wenzel, Schumacher
10:40 a.m.-10:55 a.m.	Cutting
11:00 a.m.-11:15 a.m.	Huff, Meitz, Meyerhoff
11:20 a.m.-11:35 a.m.	Kaiser, Li, Ouyang
11:40 a.m.-11:55 a.m.	Dennis, Sreekumar

Automatic Processing (186-190) Beacon A
10:20 a.m.-10:35 a.m.	Bugg, Braver
10:40 a.m.-10:55 a.m.	Verwey, Abrahamse, Ruitenberg
11:00 a.m.-11:15 a.m.	Hubner, Töbel
11:20 a.m.-11:35 a.m.	Hyman, Cutshaw, Drever, Jalbert, Blythe
11:40 a.m.-11:55 a.m.	Bertenthal, Harding

SYMPOSIUM III: Memory, Sleep, and Dreams (191-197)
Regency A-C
9:50 a.m.-10:05 a.m.	Gaskell, Mirković
10:10 a.m.-10:25 a.m.	Coutanche, Thompson-Schill
10:30 a.m.-10:45 a.m.	Fenn, Frenda, Zaragoza, Loftus, Berkowitz
10:50 a.m.-11:05 a.m.	Rickard, Pan
11:10: a.m.-11:25 a.m.	Payne
11:30 a.m.-11:45 a.m.	Schweickert, Han, Xi, Viau-Quesnel
11:50 a.m.-12:00 p.m.	Schweickert

SATURDAY, NOVEMBER 22, 2014
12:00 NOON-1:30 P.M.
POSTER SESSION IV (4001-4200)
GRAND BALLROOM, LONG BEACH CONVENTION CENTER

Multi-Sensory Integration (4001-4014)
(4001)   Ouellet, Fortin
(4002)   McGill, Elliott
(4003)   Andre, Schreffler, Hall, Kalavritinos
(4004)   Wilson, Jeska, Barath
(4005)   Chunharas, Ramachandran
(4006)   D'ettorre, Bueno, Megherbi, Seigneuric
(4007)   Ostrand, Blumstein, Ferreira, Morgan
(4008)   Ulrich, Schroeter, Leuthold, Birngruber
(4009)   Baart, Samuel
(4010)   Dias, Rosenblum
(4011)   Rosenblum, Simmons, Dorsi, Dias, Cook
(4012)   Shaw, Gaafar, Baart, Bortfeld
(4013)   Bratzke, Bryce, Seifried-Dübon
(4014)   Miller, Longo, Saygin

Event Cognition (4015-4025)
(4015)   Maurer, Papenmeier, Huff
(4016)   Flores, Bailey, Eisenberg, Zacks
(4017)   Baker, Levin
(4018)   Niven, Wolters, Logie
(4019)   Kurby, Bezy
(4020)   Gomes, Sandhu, Qi, Lee, Connolly
(4021)   Larson, Copeland
(4022)   Cane, Ferguson, Douchkov, Wright
(4023)   Bezdek, Wenzel, Schumacher
(4024)   Eisenberg, Zacks, Fowose, Flores
(4025)   Swallow, Atir

Autobiographical Memory (4026-4038)
(4026)   Özbek, Özvarol, Tekcan
(4027)   Gu, Tse
(4028)   Cohen, Dreisbach
(4029)   Mugayar-Baldocchi, Bishara, Greenberg
(4030)   Ikeda
(4031)   Drivdahl, Hiatt, Arnold, Hyman
(4032)   Deffler, Rubin
(4033)   Ece, Oner, Gulgoz
(4034)   Oner, Ece, Gulgoz
(4035)   Sanson, Newman, Garry
(4036)   Berger
(4037)   Herting, Legerski, Bunnel, Bray, Petros
(4038)   Nosofsky, Cox, Cao, Shiffrin

Recall II (4039-4056)
(4039)   Lehman, Karpicke
(4040)   McKinley, Benjamin, Ross
(4041)   Gerbier, Koenig, Mazza
(4042)   Kroneisen, Kuepper-Tetzel
(4043)   Bobbitt, Kimball, Mann
(4044)   Popp, Serra
(4045)   Crutcher
(4046)   DeWinstanley, Cox, Golay, Greenberg
(4047)   Gomes, Brainerd
(4048)   Ditta, Storm
(4049)   Claxton, Cleary
(4050)   Stefanidi, Brewer
(4051)   Corral, Rozbruch, Healy
(4052)   Jonker, MacLeod
(4053)   Metzger, Meyers, Embrescia, Vanata
(4054)   Myers, Metzger
(4055)   Cantor, Marsh
(4056)   Arnold, Umanath, Marsh

Testing Effects (4057-4072)
(4057)   Fernandez, Carpenter
(4058)   Jones, Wardlow-Lane, Zepeda, Pan, Heyman, Dunlosky, Rickard
(4059)   Sana, Clark, Soderstrom, Bjork E, Bjork R, Kim
(4060)   Foss, Pirozzolo
(4061)   Pierce, Hawthorne, Gallo
(4062)   Van den Broek, Takashima, Segers, Verhoeven
(4063)   Kornell, Hausman
(4064)   Cho, Neely
(4065)   Sparck, Bjork R, Bjork E
(4066)   Minear, Coane, Boland, Albat, Cooney, Grendahl
(4067)   Whiffen, Karpicke
(4068)   Schumacher, Taraban
(4069)   Chang, Delaney, Verkoeijen
(4070)   Pan, Rickard
(4071)   Malejka, Erdfelder
(4072)   Lim

Cognition and Technology (4073-4080)
(4073)   Atchley, Lane
(4074)   Hutcheson
(4075)   Kaastra, Arias-Hernández, Fisher
(4076)   Lanagan-Leitzel, Grandhi
(4077)   Fleck, Griffin, Uitvtlugt, Ravizza, Fenn
(4078)   Jennings, Taraban
(4079)   Still, Masciocchi, Still
(4080)   Katidioti, Borst, Taatgen

Implicit Memory (4081-4096)
(4081)   Key, Pollaro, Musselman, Shin
(4082)   Tanaka
(4083)   Tane, Michimata
(4084)   Otsuka, Saiki
(4085)   Heimbauer, Qian, Aslin, Weiss
(4086)   Hirsch, Was
(4087)   Singh, Smith, Daltrozzo, Conway
(4088)   Nemeth, Janacsek
(4089)   St-Louis, Vachon, Noireau, Tremblay
(4090)   Müller, Loran T, Loran I, Frings, Tempel
(4091)   Nickel, Henke, Hannula
(4092)   Oates, Peynircioglu, Parker
(4093)   White, Curl
(4094)   Park, Donaldson
(4095)   Laubrock, Kinder
(4096)   Fischer-Baum, Holloway

**Memory and Reward, Motivation,
and Emotion (4097-4109)**
(4097)   Burros, Lien, Ruthruff, Allen
(4098)   Spaniol, Biel, Wegier, Lapp, Dyson, Williams, Lyons
(4099)   Parks, Luttrell, Steen, Resner, Mutter
(4100)   De Forrest, Geraci
(4101)   Hopkins, Helmstetter, Hannula
(4102)   Emmert, Rogers, Drummey, Kan
(4103)   Kato
(4104)   Kleider, Hegerty
(4105)   Cheng
(4106)   Cohen, Rissman, Castel, Knowlton
(4107)   Mason, Farrell
(4108)   Han, Schweickert
(4109)   Horn, Mata, Pachur

Working Memory III (4110-4119)
(4110)   Parasiuk, Croco, Salgado-Benz, Kelley
(4111)   Jaeger, Jarosz, Wiley
(4112)   Klein, Stancil, Schnell, Abel, Verslues, Que, Awuah-Offei
(4113)   Fogler, Thoreson, Dyche
(4114)   Au, Sheehan, Tsai, Duncan, Buschkuehl, Jaeggi
(4115)   Hicks, Harrison, Engle
(4116)   Heyman, Van Rensbergen, Storms, Hutchison, de Deyne
(4117)   Whitlock, Caplan, Van Dyke
(4118)   Blacker, Vergara, Courtney
(4119)   Duarte, Ball, Brewer, Unsworth

Cognitive Controll III (4120-4131)
(4120)   Ashitaka, Shimada
(4121)   Morrison, Goolsarran, Tang-Smith, Rogers, Jha
(4122)   Chang, Van Hedger, Henry, Norman, Beilock
(4123)   Marczinski, Stamates
(4124)   Talboom, Lau, Ball, Brewer
(4125)   Chao
(4126)   Leuthold, MacKenzie
(4127)   Adam, Jennings, Bovendeerdt, Van Gerven, Hurks
(4128)   Dowman, Ritz, Fowler
(4129)   Diede, Bugg
(4130)   Janssens, Pourtois, Boehler, Verguts
(4131)   Evans, Caplan, Starns

Visual Search II (4132-4142)
(4132)   Yang, Chang, Little
(4133)   Godwin, Menneer, Liversedge, Cave, Holliman, Donnelly
(4134)   Glavan, Houpt
(4035)   Fougnie, Zhang, Cormiea, Gong, Alvarez, Wolfe
(4136)   Hout, Godwin, Fitzsimmons, Robbins, Menneer
(4137)   Ohyanagi, Kanaya, Sengoku, Miyazaki
(4138)   Saro, Ito, Kawahara
(4139)   Matzen, Haass, Silva, Trumbo, Stevens-Adams, Speed, McNamara
(4140)   Cunningham, Pailian, Egeth
(4141)   Buttaccio, Lange, Thomas, Dougherty
(4142)   Biggs, Adamo, Dowd, Mitroff

Bilingualism III (4143-4157)
(4143)   Shook, Marian
(4144)   Goh, Sim
(4145)   Yeh, Hsiao, Chan
(4146)   Fernandez, Litcofsky, Van Hell
(4147)   Von Bastian, Souza, Gade
(4148)   Lagrou, Brysbaert
(4149)   Molnar, Martin, Carreiras
(4150)   Francis, Taylor, Penalver, Liano
(4151)   Lebkuecher, Malt
(4152)   Strobach, Francis, Ransom
(4153)   Kleinman, Gollan, Ferreira
(4154)   Nam, Baik, You, Ryu, Kim, Park
(4155)   Giezen, Emmorey
(4156)   Cop, Keuleers, Dreighe, Duyck
(4157)   Baese-Berk, Morrill, Dilley

Psycholinguistics III (4158-4174)
(4158)   Michael, Colflesh, Karuzis, Key, Cook, Silbert,
             Green, Browne, Rytting, Pelzl, Bunting
(4159)   Wang, Li, Yu, Li
(4160)   Spinelli, Chevrot, Bellanger
(4161)   Smayda, Rao, Yi, Chandrasekaran, Maddox
(4162)   Zhao, Berent
(4163)   Tillman, Van Ravenzwaaij, Brown, Benders
(4164)   Kapnoula, McMurray
(4165)   Spaulding, Gagne, Park, Nisbet
(4166)   Davis, Abrams
(4167)   Hahn, Blaetz, Walters
(4168)   Warren, Milburn, Dickey
(4169)   Buchanan, Valentine, Teasley, Jordan, Beauchamp
(4170)   Howard, Benson, Liversedge
(4171)   Sajin, Connine
(4172)   Hartshorne, Gerstenberg, O'Donnell, Tenenbaum
(4173)   Snefjella
(4174)   Henry, Kuperman, Van Dyke

Letter and Word Processing III (4175-4188)
(4175)   Jouravlev, Lupker
(4176)   Chetail, Content
(4177)   Fitsimmons, Weal, Drieghe
(4178)   Laishley, Liversedge, Kirkby
(4179)   Pagan, Blythe, Paterson, Liversedge
(4180)   Bélanger, Schotter, Rayner
(4181)   Frye, Creel
(4182)   Armstrong, Abad, Samuel
(4183)   Ulicheva, Coltheart
(4184)   Rosa-Martínez, Díaz, Perea
(4185)   Rong, Isenberg, Sun, Hickok
(4186)   Was, Jones, Todaro
(4187)   Loboa, Reichle
(4188)   Sheridan, Reichle, Reingold

Decision Making II (4189-4200)
(4189)   Garcia-Retamero, Cokely
(4190)   Green, Baumann, Myerson
(4191)   Ludwig, Evens
(4192)   Mitsuda
(4193)   Johnson, Fific, Zimmer, Rydecki
(4194)   Barca, Arduino, Pezzulo, Veronelli
(4195)   Liu, Li, Hsu, Lai
(4196)   Lesch, Horrey
(4197)   Chang, Cho, Kim
(4198)   Powell
(4199)   Van Ravenzwaaij, Brown, Heathcote
(4200)   Thompson, Tangen

SATURDAY, NOVEMBER 22, 2014
1:30 P.M.-5:30 P.M.
Spoken Sessions (198-258)

Reward, Motivation, and Decision Making (198-202)
Regency D-F, H
1:30 p.m.-1:45 p.m.	Liu, Safin, Yang, Luhmann
1:50 p.m.-2:05 p.m.	Pachur, Schulte-Mecklenbeck, Hertwig
2:10 p.m.-2:25 p.m.	Theeuwes, Failing
2:30 p.m.-2:45 p.m.	Yechiam, Pachur, Abofol
2:50 p.m.-3:05 p.m.	Leising, Wolf, Ruprecht

Recall I (203-208) Seaview A & B
1:30 p.m.-1:45 p.m.	Mulligan, Peterson
1:50 p.m.-2:05 p.m.	Roediger, DeSoto
2:10 p.m.-2:35 p.m.	Soares, Polack, Miller
2:30 p.m.-2:45 p.m.	Racsmany, Keresztes
2:50 p.m.-3:05 p.m.	McDaniel, Cahill, Bugg
3:10 p.m.-3:25 p.m.	Mueller, Thanasuan

Attention: Features and Objects I (209-213) Beacon A
1:30 p.m.-1:45 p.m.	Flombaum
1:50 p.m.-2:05 p.m.	Störmer, Alvarez
2:10 p.m.-2:25 p.m.	Wyble, Chen
2:30 p.m.-2:45 p.m.	Qadri, Cook
2:50 p.m.-3:05 p.m.	Matsukura, Vecera

Reading (214-219) Beacon B
1:30 p.m.-1:45 p.m.	Liversedge, Drieghe, Cutter
1:50 p.m.-2:05 p.m.	Reichle, Mancheva, Guerin-Dugue, Lemaire, Valdois
2:10 p.m.-2:25 p.m.	Schotter
2:30 p.m.-2:45 p.m.	Li
2:50 p.m.-3:05 p.m.	Drieghe, Weal, Fitzsimmons
3:10 p.m.-3:25 p.m.	Pattamadilok, Ponz, Bonnard

Perceptual Processes (220-225) Shoreline
1:30 p.m.-1:45 p.m.	Medina
1:50 p.m.-2:05 p.m.	Chechile
2:10 p.m.-2:25 p.m.	Peterson, Sanguinetti, Trujillo, Schnyer, Allen
2:30 p.m.-2:45 p.m.	Wagemans, Sleurs, Kubilius
2:50 p.m.-3:05 p.m.	Palmer, Flatley-Feldman, Hara, Griscom
3:10 p.m.-3:25 p.m.	Balcer, Shirtz, Rolison, Ziat

SYMPOSIUM IV: New Ideas About Memory Development
(226-231) Regency A-C
1:30 p.m.-1:40 p.m.	Gómez
1:40 p.m.-2:00 p.m.	Gómez
2:05 p.m.-2:25 p.m.	Newcombe
2:30 p.m.-2:50 p.m.	Edgin
2:55 p.m.-3:15 p.m.	Ghetti, Demaster, Coughlin
3:20 p.m.-3:40 p.m.	Newcombe

Vision II (232-237) Beacon A
3:30 p.m.-3:45 p.m.	Witt
3:50 p.m.-4:05 p.m.	Belopolsky, Jonikaitis
4:10 p.m.-4:25 p.m.	Sloutsky, Deng
4:30 p.m.-4:45 p.m.	Von Muehlenen, Sunny
4:50 p.m.-5:05 p.m.	Norman J, Cheeseman, Norman H, Rogers, Baxter, Adkins
5:10 p.m.-5:25 p.m.	Kimchi, Pirkner

Working Memory II (238-242) Beacon B
3:50 p.m.-4:05 p.m.	Rouder, Thiele, Cowan
4:10 p.m.-4:25 p.m.	Cowan, Saults, Blume
4:30 p.m.-4:45 p.m.	Morey C, Cong, Zheng, Price, Morey R
4:50 p.m.-5:05 p.m.	Jou, Silva, Garcia
5:10 p.m.-5:25 p.m.	Zeelenberg, Quak, Pecher

Human Learning and Instruction II (243-248)
Regency D-F, H
3:30 p.m.-3:45 p.m.	Carr, Hicks, Hostetter, Batsell
3:50 p.m.-4:05 p.m.	Camp, Goossens, Verkoeijen, Tabbers, Zwaan
4:10 p.m.-4:25 p.m.	Chan, Davis
4:30 p.m.-4:45 p.m.	Tversky, Bobek
4:50 p.m.-5:05 p.m.	Rohrer, Dedrick, Stershic
5:10 p.m.-5:25 p.m.	Healy, Jones, Lalchandani, Tack

Neural Mechanisms of Cognition (249-253) Seaview A & B
3:50 p.m.-4:05 p.m.	Chrysikou
4:10 p.m.-4:25 p.m.	Töllner, Conci, Müller
4:30 p.m.-4:45 p.m.	Hommel, Colzato, Zmigrod, Szapora
4:50 p.m.-5:05 p.m.	Brodeur
5:10 p.m.-5:25 p.m.	Cassey, Gaut, Steyvers, Brown

Associative Learning (254-258) Shoreline
3:50 p.m.-4:05 p.m.	Parker, Limebeer, Rock
4:10 p.m.-4:25 p.m.	Stahl, Haaf
4:30 p.m.-4:45 p.m.	Urushihara
4:50 p.m.-5:05 p.m.	Jamieson
5:10 p.m.-5:25 p.m.	Livesey, Bethmont, Hutchings

SATURDAY, NOVEMBER 22, 2014
6:00 P.M.-7:30 P.M.
POSTER SESSION V (5001-5200)
GRAND BALLROOM, LONG BEACH CONFERENCE CENTER

Music Cognition (5001-5011)
(5001) Raman, Dowling
(5002) Anaya, Pisoni, Kronenberger
(5003) Mauer, Zhao
(5004) Bowman, Yamauchi
(5005) Akan, Bilge, Mungan
(5006) Justus, Yates, Atalay, Curtis
(5007) Yates, Justus, Atalay, Trehub
(5008) Kleinsmith, Neill
(5009) Rosenthal
(5010) Sifonis, Fuss, Saulter, Lekander, Ventline
(5011) Knowles, Ingvalson, Wong

Numerical Cognition (5012-5028)
(5012) Lindskog, Winman, Poom
(5013) Alards-Tomalin, Kravetz, Leboe-McGowan J, Leboe-McGowan L
(5014) Muscarella, Sasanguie, Van den Bussche, Reynvoet, Brysbaert
(5015) Mielicki, Wiley
(5016) Masson, Guedin, Fayol, Thevenot
(5017) Lindemann
(5018) Sasanguie, de Smedt, Reynvoet
(5019) Lo, Andrews
(5020) Kowalsky, Kaschak
(5021) Chen, Campbell
(5022) Jaeggi, Daubert, Buschkuehl, Ramani
(5023) Baggett, Ehrenfeucht
(5024) Moore, Ashcraft
(5025) Uittenhove, Thevenot, Barrouillet
(5026) Thevenot, Barrouillet, Castel
(5027) Reynvoet
(5028) Charlesworth

Embodied Cognition II (5029-5038)
(5029) Bottini, Casasanto, Crollen, Collignon, Crepaldi
(5030) Kumar, Masson, Bub
(5031) Miller, Kaup
(5032) Dudley, Guo, Cerrati, Vlajnic, Del Cid, Goedert
(5033) Suh, Abrams
(5034) Vicario, Rafal, Avenanti
(5035) Kobelsky, Bub, Masson
(5036) Jones, Vigliocco
(5037) Risko, Dunn, Medimorec
(5038) Martin, Davoli

Cognitive Skill Acquisition (5039-5046)
(5039) Bai, Jones, Moss, Doane
(5040) Chrabaszcz, Bolger, Calloway, Brown, Wettroth, Doughterty
(5041) Schneider, Healy, Tack, Barshi
(5042) Blaum, Britt, Kopp, Durik, Hastings
(5043) Walbaum
(5044) Feltman, Ferraro, Bernhardt, Hill
(5045) Xie, Myers
(5046) Da Silva, Meisenberg

Emotion and Cognition III (5047-5058)
(5047) Hashiguchi, Honma, Moriguchi, Kuriyama, Tsuzuki
(5048) Rungratsameetaweemana, Arndt
(5049) Steakley-Freeman, McBride
(5050) Kurita, Fukushima, Murohashi, Lang
(5051) Zhao
(5052) Mansouri, Iran-Nejad, Bordbar
(5053) Kim, Shinkareva, Wedell
(5054) Tiernan, Chambers, Anaya
(5055) Sprute, Beilock
(5056) Matsuda, Nakamoto, Morioka, Hiyama, Goto, Koganei, Kusumi
(5057) Caparos, Blanchette
(5058) Buetti, Robinson

False Memory II (5059-5075)
(5059) Marche, Elliot
(5060) Wilson, Mickes, Evrard, Stolarz-Fantino, Fantino
(5061) Crump, Blecher, Jamieson
(5062) Olszewska, Ulatowska
(5063) Calvillo, Parong, Mills
(5064) Azad, Lindsay
(5065) Lapaglia, Chan
(5066) Huff, McNabb, Hutchison
(5067) Huff, Weinsheimer, Bodner
(5068) Ulatowska, Olszewska
(5069) Lanska, Westerman
(5070) Taylor, Ashworth, Fischer, Skou, Perry
(5071) Ball, Brewer
(5072) Neuschatz, Wetmore, Key, Cash, Gronlund, Goodsell
(5073) Sabia, Hupbach
(5074) Crisostomo, Kimball
(5075) Aßfalg, Currie, Bernstein

Working Memory IV (5076-5086)
(5076)   Zhou, Meredith, Thomas
(5077)   Qin, Basak, Ramakrishnan
(5078)   Loaiza, Camos
(5079)   Wen, Yip
(5080)   Doherty, Morey, Logie
(5081)   Dagry, Vergauwe, Barrouillet
(5082)   Liu, Caplan
(5083)   Arber, Tolan, Tehan
(5084)   Bennett, Tehan, Tolan
(5085)   Tolan, Kennedy, Tehan
(5086)   Bui, Myerson, Hale

Human Learning and Instruction III (5087-5104)
(5087)   Blunt, Nunes, Karpicke S, Karpicke J
(5088)   Giebl, Yue, Yan, Bjork
(5089)   Clark, Yue, Johl, Krasileva, Bjork
(5090)   Maddox, Bui, Hale
(5091)   Xu, Metcalfe
(5092)   Barideaux, Pavlik
(5093)   Magreehan, Serra
(5094)   Flores, Serra
(5095)   Van Eersel, Verkoeijen, Rikers
(5096)   Yue, Soderstrom, Bjork
(5097)   Bard, Weinstein
(5098)   Lyle, Simpson
(5099)   Nunes, Smith, Karpicke
(5100)   Wammes, Meade, Fernandes
(5101)   Paneerselvam, Roberts, Callender
(5102)   Ibrahim, Shah
(5103)   Baker, Azuma
(5104)   Sanchez

Collaborative Memory (5105-5111)
(5105)   Meade, Numbers, McNabb
(5106)   Wissman, Rawson
(5107)   Pociask, Marsh, Rajaram
(5108)   Webster, Barnier, Van Bergen, Meade, Numbers
(5109)   Scully, Goodwin
(5110)   Choi, Kensinger, Rajaram
(5111)   Li, Cai, Graesser, Shaffer

Cognitive Control of Working Memory (5112-5122)
(5112)   Nöstl
(5113)   Hitchins, Wynn, Sohn
(5114)   Wynn, Hitchins, Sohn
(5115)   Vaccariello, Moffitt, Watson, Miller, Strayer, Hutchison
(5116)   Aben, Verguts, Van den Bussche
(5117)   Hart, Moffitt, Watson, Marchak, Hutchison
(5118)   Hall-Ruiz, Jonides
(5119)   Goodwin, Palmer
(5120)   Weaver, Arrington, Reiman, Wylie
(5121)   Öztekin, Mizrak
(5122)   Reiman, Arrington

Discourse Processes II (5123-5131)
(5123)   Wiemer, Neal, Asiala, Tapia, Zamorano
(5124)   Van der Wege, Mansour, Cherry, Cocroft, Crews, Danielsson, Jacobsen, Magats, Park, Roman, Serres
(5125)   Millis, Boveri, Asiala, Wiemer
(5126)   Tolins, Zeamer, Fox Tree
(5127)   Shears, Ariza, Kim, Bond, Lam, Sam
(5128)   Boylan, Katz
(5129)   Upadhyay, Klin
(5130)   Kovaz, Riordan, Trichtinger, Kreuz
(5131)   Ryskin, Wang, Brown-Schmidt

Speech Perception (5132-5149)
(5132)   Strori, Scharenborg, Mattys
(5133)   Ishida, Samuel, Arai
(5134)   Kaplan, Jesse
(5135)   Valdes-Laribi, Wendt, MacDonald, Cooke, Mattys
(5136)   Zhang, Samuel
(5137)   Yi, Maddox, Mumford, Chandrasekaran
(5138)   Cook, Dias, Rosenblum
(5139)   Morton, Jacoby, Sommers
(5140)   Zellou, Dahan
(5141)   Narayan, Mak, Bialystok
(5142)   Lewandowski, Nygaard
(5143)   Strand, Simenstad, Berg, Slote
(5144)   McMurray, Galle
(5145)   Kapnoula, Winn, Kong, Edwards, McMurray
(5146)   Wyatt, Peynircioglu
(5147)   Viswanathan, Bennett
(5148)   Alexander, Blankenship, Mills, Hogan
(5149)   Magnotti, Feng, Zhou B, Mallick, Zhou W, Beauchamp

Psycholinguistics IV (5150-5167)
(5150)   Runge, Sommers, Barcroft
(5151)   Mulatti, Piai, Job
(5152)   Ivanova, Ferreira
(5153)   Piai, Roelofs, Rommers, Maris
(5154)   Jordan, Buchanan, Delmonico, Carney
(5155)   Ramey, McCartin, Lopez, Schuberth
(5156)   Henry, Hopp, Jackson
(5157)   Nagy, Bryant
(5158)   Karimi, Ferreira
(5159)   Yoon, Brown-Schmidt
(5160)   Kovaz, Kreuz
(5161)   Dupuis, Berent
(5162)   Waters, Caplan, Bertram, Howland, Ostrowski, Michaud
(5163)   Vinson, Dale
(5164)   Salomon, Rapp
(5165)   Sherrill, Eerland, Magliano, Zwaan
(5166)   Au-Yeung, Kaakinen, Liversedge, Benson
(5167)   Ceccherini, Coltheart, Mulatti, Saunders

Concepts and Categories II (5168-5177)
(5168)   Miyatsu, Sanders, McDaniel, Nosofsky
(5169)   Eglington, Kang
(5170)   Clapper, Smith, Miller
(5171)   Tran, Pashler
(5172)   Sana, Yan, Kim, Bjork E, Bjork R
(5173)   Freedberg, Maddox, Hazeltine
(5174)   Clapper, Miller, Smith
(5175)   Carvalho, Goldstone
(5176)   Ramsburg
(5177)   Davis, England, Serra

Consciousness and Automatic Processing (5178-5186)
(5178)   Bryce, Bratzke
(5179)   Bastian, Wyart, Sackur
(5180)   Poulet, Didierjean, Ruthruff, Goujon
(5181)   Marti, King, Dehaene
(5182)   Xiong, Proctor
(5183)   Liendo, Garza, Heredia, Cieslicka
(5184)   Kiyokawa
(5185)   Blumenthal, Ciliberti
(5186)   Van den Bussche, Muscarella, Smets, Soetens,
         Hughes

Animal Learning and
Cognition (5187-5193)
(5187)   Nakajima, Katayama
(5188)   Wasserman, Roembke, Casler, McMurray
(5189)   Washburn, Bramlett, Callery
(5190)   Schroeder, Garlick, Blaisdell
(5191)   Wolf, Leising
(5192)   Pisklak, McDevitt, Dunn, Spetch
(5193)   Parrish, Beran

Reasoning and Judgment II (5194-5200)
(5194)   Grunewald, Beeman
(5195)   Vendetti, Noh, Kerr, Friedman
(5196)   Koppel, Storm, Wiley
(5197)   Hussak, Cimpian
(5198)   Schloss, Sobel
(5199)   Ludwig, Navarick, Morales
(5200)   Van Stockum, DeCaro

SUNDAY, NOVEMBER 23, 2014
8:00 A.M.-12:00 NOON
Spoken Sessions (261-326)

Recognition (261-265) Regency D-F, H
8:00 a.m.-8:15 a.m.	Starns
8:20 a.m.-8:35 a.m.	Garcia-Marques, Marques
8:40 a.m.-8:55 a.m.	Humphreys
9:00 a.m.-9:15 a.m.	Kersten, Earles, Berger
9:20 a.m.-9:35 a.m.	Yonelinas, Ritchey

Judgment and Decision Making II (266-271) Beacon B
8:00 a.m.-8:15 a.m.	Franco-Watkins, Mattson
8:20 a.m.-8:35 a.m.	Budescu, Por, Broomell, Smithson
8:40 a.m.-8:55 a.m.	Von Helversen, Scholz, Rieskamp
9:00 a.m.-9:15 a.m.	Myerson, Vanderveldt, Green
9:20 a.m.-9:35 a.m.	Nelson, Meder, Szalay, Crupi, Tentori
9:40 a.m.-9:55 a.m.	Tangen, Searston, Thompson

Attention: Features and Objects II (272-277) Seaview A&B
8:00 a.m.-8:15 a.m.	Franconeri
8:20 a.m.-8:35 a.m.	Folk, Anderson, Garrison, Rogers
8:40 a.m.-8:55 a.m.	Gwinn, Leber
9:00 a.m.-9:15 a.m.	Cave, Menneer, Nomani, Stroud, Donnelly
9:20 a.m.-9:35 a.m.	Sperling, Sun, Wright, Chubb
9:40 a.m.-9:55 a.m.	Leonard, Luck

Bilingualism (278-282) Regency A-C
8:00 a.m.-8:15 a.m.	Schwartz, Negron, Schleicher
8:20 a.m.-8:35 a.m.	Emmorey, Petrich, Gollan
8:40 a.m.-8:55 a.m.	Paap, Johnson, Sawi
9:00 a.m.-9:15 a.m.	Gollan, Goldrick
9:20 a.m.-9:35 a.m.	Caldwell-Harris, Hocaoğlu, Chang, Aycicegi-Dinn

Letter and Word Processing (283-288) Beacon A
8:00 a.m.-8:15 a.m.	Schroeder, Schröter
8:20 a.m.-8:35 a.m.	Burt, Leggett, Ceccato
8:40 a.m.-8:55 a.m.	Robidoux, Besner
9:00 a.m.-9:15 a.m.	Vibert, Ros, Braasch, Belkadi, Rouet
9:20 a.m.-9:35 a.m.	Feldman, Cho, Milin
9:40 a.m.-9:55 a.m.	Finley

Autobiographical Memory (289-293) Shoreline
8:00 a.m.-8:15 a.m.	Handy, Smith
8:20 a.m.-8:35 a.m.	Scoboria
8:40 a.m.-8:55 a.m.	Ozubko, Robin, Grady, Rosenbaum, Winocur, Moscovitch
9:00 a.m.-9:15 a.m.	Janssen, Parker
9:20 a.m.-9:35 a.m.	Nairne, Pandeirada, Vanarsdall

Discourse Processes (294-298) Seaview A&B
10:20 a.m.-10:35 a.m.	Paxton, Dale
10:40 a.m.- 10:55 a.m.	Pettijohn, Radvansky
11:00 a.m.-11:15 a.m.	Miller, Raney
11:20 a.m.-11:35 a.m.	Fusaroli, Weed, Fein, Naigles
11:40 a.m.-11:55 a.m.	Wang, Frisson, Apperly

Recall II (299-304) Shoreline
10:00 a.m.-10:15 a.m.	Tempel, Frings
10:20 a.m.-10:35 a.m.	Day
10:40 a.m.-10:55 a.m.	Polyn, Kragel, Morton
11:00 a.m.-11:15 a.m.	Ferreira, Schmitz, Anderson
11:20 a.m.-11:35 a.m.	Baeuml, Dobler, Schlichting
11:40 a.m.-11:55 a.m.	Halamish, Bjork

Reasoning/Problem Solving II (305-309) Beacon B
10:20 a.m.-10:35 a.m.	Leite, Molenaar
10:40 a.m.-10:55 a.m.	De Neys
11:00 a.m.-11:15 a.m.	Cohen, Staub, Hedrick
11:20 a.m.-11:35 a.m.	Ranney, Clark, Lamprey, Le, Shonman, Hu, Zhang
11:40 a.m.-11:55 a.m.	Marsh, Threadgold, Garner, Ball

Spatial Cognition (310-314) Beacon A
10:20 a.m.-10:35 a.m.	Riecke, Jordan, Prpa, Feuereissen
10:40 a.m.-10:55 a.m.	Van der Ham, Faber, Venselaar, Van Kreveld, Löffler
11:00 a.m.-11:15 a.m.	Mishra, Prasad, Jayaraman, Patil, Klein
11:20 a.m.-11:35 a.m.	Niimi, Ehara, Yokosawa

Cognitive Aging (315-320) Regency A-C
10:00 a.m.-10:15 a.m.	Ballesteros, Prieto, Mayas, Toril, Pita, Ponce De León, Reales
10:20 a.m.-10:35 a.m.	Shafto, Tyler
10:40 a.m.-10:55 a.m.	Ramscar, Baayen, Love
11:00 a.m.-11:15 a.m.	Naveh-Benjamin, Brubaker
11:20 a.m.-11:35 a.m.	Rendell, Rose, Sapega, Terrett, Bailey
11:40 a.m.-11:55 a.m.	James, Placzek, Chambers

Cognitive Control (321-326) Regency D-F, H
10:00 a.m.-10:15 a.m.	Finkbeiner, Heathcote
10:20 a.m.-10:35 a.m.	Dodd, Mills, Grubaugh, Dalmaijer, Van der Stigchel
10:40 a.m.-10:55 a.m.	Goschke, Walser, Beck, Ruge, Moeschl, Fischer
11:00 a.m.-11:15 a.m.	Dambacher, Bieleke, Hübner, Gollwitzer
11:20 a.m.-11:35 a.m.	Borst, Ahr, Roell, Houdé
11:40 a.m.-11:55 a.m.	Ell, Hutchinson, Hawthorne, Szymula, McCoy

Reasoning/Problem Solving I
Beacon A, Friday Morning, 8:00-10:00
Chaired by David Landy, Indiana University

8:00-8:15 (1)

Inference to the Best Analogy? DAVID LANDY, *University of Richmond*. — Analogies are often treated as giving hypotheses they support ('candidate inferences') a vague 'boost': inferences reached by analogy are treated as more plausible, as more sensible, or as good heuristic starting places. However, they are generally not treated as providing evidence for their implications—the application of an analogy is not thought to increase the probability that an inference is true in the manner that new evidence does. In a series of experiments, I explore the relationship between analogical implication and traditional sources of evidence through an abductive lens: in each experiment, an analogy from A to B makes certain candidate inferences in B; the question is whether the corresponding source information in A is treated as more or less likely by reasoners after hearing new evidence about B. Bayesian principles mandate that if (and only if) analogies serve as evidence for candidate inferences, it is normative to shift confidence in information about A on the basis of evidence about B; across a series of biological, social, and physical scenarios, I trace when and how analogies meet this important criterion for evidence.
Email: David Landy, dlandy@indiana.edu

8:20-8:35 (2)

The Influence of Multiple Routes to Category Membership on Category Beliefs. ANDREW S. ZEVENEY and JESSECAE MARSH, *Lehigh University* (Presented by Jessecae Marsh). — People tend to think all members of a category (e.g., birds) became category members in the same way (e.g., through an expression of their DNA). However, in categories like health categories, there are multiple ways to become a member of the same category (e.g., developing lung cancer due to smoking vs. a genetic predisposition). We explored how people's beliefs about categories change when they learn that there are multiple routes to membership. We created novel category descriptions and varied whether there were one, two, or no explicitly described membership routes (Experiment 1). Participants rated categories with two membership routes as less likely to possess a causal essence, or an underlying causal feature that generates other category features. We replicated this finding in real-world mental and medical disorder categories (Experiment 2). We discuss implications of these findings for theories of categorization.
Email: Jessecae Marsh, jem311@lehigh.edu

8:40-8:55 (3)

Analytic Versus Empirical Knowledge of the Concept of Causal Invariance. SHANNON MCGILLIVRAY, *Weber State University*, PATRICIA CHENG, *University of California, Los Angeles* (Presented by Patricia Cheng). — The present paper examines whether we humans learn the concept of causal invariance, the independence of causal powers, from our experiences or know it a priori. Causal invariance plays an essential role in the construction of a parsimonious representation of the causal world, but the environment provides no feedback on how the concept is defined. There must therefore exist analytic knowledge of the concept in all cognitive systems capable of causal learning. The current paper reports an experiment using a blocking paradigm, taking advantage of the two distinct manifestations of causal invariance for continuous and binary outcome variables. In support of the analytic view, human participants showed more blocking of learning when the same outcome variable was perceived as continuous rather than binary, despite identical experiences with the target outcome except for experience conveying its continuous or binary nature.
Email: Patricia Cheng, cheng@psych.ucla.edu

9:00-9:15 (4)

Comparing the Time Course of Inductive and Deductive Reasoning. BRETT HAYES and LAURA PENTNEY, *University of New South Wales*, JOHN DUNN and RACHEL STEPHENS, *University of Adelaide*. — Two experiments examined the time course of inductive and deductive reasoning. Participants were asked to judge the strength of text arguments that varied in their deductive validity and their consistency with background causal knowledge. Separate groups evaluated the arguments using either deductive or inductive criteria. Evaluations were made without time pressure (unspeeded) or under a response deadline (speeded). In the unspeeded condition we replicated the crossover interaction reported by Rips (2001); deduction instructions led participants to weight item validity more than causal consistency in judging argument strength but this weighting reversed under induction instructions. Notably this interaction disappeared in the speeded group, where the induction and deduction groups appeared to use similar criteria to evaluate arguments. These results suggest that the two types of reasoning follow different time courses. The implications for single- and dual-process models of reasoning are considered.
Email: Brett Hayes, b.hayes@unsw.edu.au

9:20-9:35 (5)

Is Conditional Reasoning Probabilistic? A Developmental Test. PIERRE BARROUILLET and CAROLINE GAUFFROY, *Université de Genève*. — Probabilistic theories have been claimed to constitute a new paradigm for the psychology of reasoning. A key assumption of these theories is captured by what they call the Equation, the hypothesis that the meaning of the conditional is probabilistic in nature, and that the probability of If p then q is the conditional probability, in such a way that P (if p then q) = P (q|̂p). Using the probabilistic truth-table task in which participants are required to evaluate the probability of If p then q sentences, the present study explored the pervasiveness of the Equation from early adolescence to adulthood on different types of conditionals (basic, causal, and inducements) with different contents. The results reveal that the Equation is a late developmental achievement only endorsed by a narrow majority of educated

adults for certain types of conditionals depending on their content, thus questioning the probabilistic nature of human conditional reasoning.
Email: Pierre Barrouillet, pierre.barrouillet@unige.ch

9:40-9:55 (6)
Fast Logic and Slow Beliefs: A Challenge for Dual Process Theories of Reasoning. VALERIE THOMPSON, IAN R. NEWMAN and MAIA GIBB, *University of Saskatchewan.* — According to Dual Process Theories, many reasoning biases occur because autonomous processes deliver answers based on belief that may not be overturned by slower analyses based on logic and probability. Data from two tasks (base rate neglect, N = 54) and conditional inference (N = 42) challenge this assumption. Participants made initial judgments of probability and logic under time restrictions and a second judgment under free time. As expected, initial judgments were sensitive to beliefs; unexpectedly, they also varied as a function of validity and probability. Both effects increased at time 2. These data provide clear evidence that both logic and probability judgments can be made intuitively and that deliberate thinking may produce belief bias. Thus, Dual Process Models of many reasoning biases need to be revised; a revised model is proposed to accommodate these findings.
Email: Valerie Thompson, valerie.thompson@usask.ca

Psycholinguistics I
Regency A-C, Friday Morning, 8:00-9:40
Chaired by Tatiana Schnur, Rice University

8:00-8:15 (7)
Semantic Interference in Naming is Cumulative. JULIE WALKER HUGHES and TATIANA SCHNUR, *Rice University* (Presented by Tatiana Schnur). — People name pictures more slowly grouped in semantically related (DOG, CAT, PIG) vs. unrelated blocks (DOG, BUS, EAR) where semantic interference accumulates as blocks repeat across cycles (blocked-cyclic naming). Following an analysis of 17 blocked-cyclic experiments, Belke and Stielow (2013) propose that people strategically hold items in working memory to anticipate pictures, which attenuates interference after the first cycle such that it does not accumulate. However, experiments included 30 or fewer subjects, and the statistical analysis was conservative (MinF'; potentially a type II error). We present blocked-cyclic naming data from 122 subjects and examine cumulative interference using linear mixed effects modeling. We find that semantic interference increases, and subjects do not exhibit a naming pattern indicative of anticipating pictures (no rapid naming at cycle-end). Our results suggest that interference results from long-lasting compounding changes to the language system where these changes are relatively independent of working memory processes.
Email: Tatiana Schnur, ttschnur@rice.edu

8:20-8:35 (8)
Stimulation of Left Prefrontal Cortex Increases Discourse Connectedness and Reduced References. JENNIFER E. ARNOLD, *University of North Carolina, Chapel Hill,* NAZBANOU NOZARI, *Johns Hopkins University*, SHARON THOMPSON-SCHILL, *University of Pennsylvania.* — We examined the role of utterance planning on the choice of referring expressions, e.g., pronouns (it), zeros (…and went down), or descriptive NPs (the pink pentagon), in normal language production, and used anodal (facilitatory) transcranial direct current stimulation (tDCS) to test the involvement of the left prefrontal cortex on utterance planning and reference production in a discourse context. 22 subjects (11 under stimulation, 11 sham) described fast-paced actions, e.g., The gray oval flashes, then it moves right 2 blocks. We only examined trials in contexts that supported pronoun/zero use. For sham participants, pronouns/zeros increased for a) shorter previous trials, which interfered less with current planning than longer trials, and b) later latencies to begin speaking, which enabled greater pre-planning and greater discourse connectedness. For the stimulation participants, the latency effect disappeared. Stimulation appeared to enable participants to maintain a wider scope of focus and produce utterances with greater discourse connectedness.
Email: Jennifer E. Arnold, jarnold@email.unc.edu

8:40-8:55 (9)
Speakers Don't Just Syntactically Prime, They Syntactically Entrain: Event-Specific Syntactic Adaptation in Language Production. NICHOLAS GRUBERG, VICTOR FERREIRA and RACHEL OSTRAND, *University of California, San Diego* (Presented by Victor Ferreira). — Speakers' overall structural preferences can change based on recent experience, as in the well known syntactic priming effect. Separate from this, can speakers' preferences for describing particular events with particular structures similarly change? In three experiments, experimenters and subjects described sets of twelve scenes to one another. Rounds began with the experimenter describing each scene using particular syntactic structures (e.g., actives and passives), manipulated across subjects and scenes. Subjects then described the same scenes back. Results showed that when subjects described scenes, they repeated the same structures they heard experimenters use for that scene (up to 21 trials earlier), an effect we term syntactic entrainment. Follow-up experiments assessed whether syntactic entrainment is person-specific across a range of experimental conditions. In all, language preferences can change language-wide (syntactic priming) and event-specifically (syntactic entrainment), showing that speakers exhibit linguistic adaptation at multiple levels of grain.
Email: Victor Ferreira, vferreira@ucsd.edu

9:00-9:15 (10)
Talker Sex and Item Type Influence Phonetic Convergence in Shadowed Speech. JENNIFER PARDO, HANNAH GASH, ADELYA URMANCHE, ALEXA DECKER, KEAGAN FRANCIS, JACLYN WIENER and SARA PARKER, *Montclair State University.* — Studies of phonetic convergence in speech shadowing tasks vary with respect to the number of model talkers, the number of shadowers, and the types of items employed. The current study was designed to provide a rigorous examination of the impact of talker sex on phonetic convergence, and to assess whether the effects of

word frequency and type of word (mono- vs. bisyllabic) are consistent across male and female talkers. A total of 48 talkers (24 female) provided baseline and shadowed versions of words produced by 12 model talkers (6 female) in both same and mixed sex pairings. The word set comprised 160 words (80 monosyllabic, 80 bisyllabic), evenly split into high and low frequency items. Overall, phonetic convergence among male shadowers was relatively unaffected by word frequency and word type, but phonetic convergence among female shadowers was greatly affected by word frequency and word type. Because phonetic convergence varied according to the sex of the talker and the type of words used, future studies should employ talker sets that are balanced with respect to talker sex and avoid using only monosyllabic or high frequency words with female talkers.
Email: Jennifer Pardo, pardo@optonline.net

9:20-9:35 (11)

Visuomotor Interference Differences Between Conversations With Friends and Strangers. AMIT ALMOR, TIMOTHY WOOD BOITEAU, ALAN PEH and KAREN SHEBUSKY, *University of South Carolina*. — Boiteau et al. (2014) showed that different aspects of conversation (speech planning and monitoring, talking, and listening) interfere with concurrent visuomotor tasks to different degrees: interference is greatest when subjects begin a speaking turn and is minimal when the other person is speaking. The present work examined whether the familiarity of conversation partners modulates this interference. We recruited 20 participant triads consisting of two friends and one stranger. One of the two friends performed a visuomotor target-tracking task while having a conversation with their friend, and then the stranger or vice versa. An intimacy rating scale was also administered after the experiment to assess the participants' familiarity with their friends. Conversation segments were coded as either speaking, listening, or preparing to speak, and performance on the visuomotor task during these segments was compared across conversations with a friend and a stranger. The results indicate that talking to friends poses less interference than talking to strangers on performing a concurrent visuomotor task and that people dynamically allocate resources to conversation and other tasks.
Email: Amit Almor, almor@sc.edu

Cognitive Control of Working Memory
Regency D-F, H, Friday Morning, 8:00-10:00
Chaired by Ulrich Mayr, University of Oregon

8:00-8:15 (12)

Using the Contralateral Delay Activity to Probe the Nature of Task Set Representations. ATSUSHI KIKUMOTO and ULRICH MAYR, *University of Oregon* (Presented by Ulrich Mayr). — Working memory (WM) and task switching are usually not correlated, raising the question how these different aspects of cognitive control are functionally related. We used the EEG-derived contralateral delay activity (CDA; Vogel et al., 2004) to probe the content of WM while people prepared

for each trial a novel task set of either two or four stimulus-response rules. Consistent with results using standard WM tasks, there was a CDA set-size effect (2 vs. 4 rules) for high, but not low-WM individuals. In contrast, when only four task sets were presented throughout the experiment (similar to standard task-switching experiments), the CDA indicated a sustained, yet set-size independent use of WM. We conclude that while novel task sets are represented in WM in a detailed, load-dependent manner, familiar tasks probably rely on WM pointers to long-term memory representations. We speculate that each pointer requires about "one slot" worth of WM capacity.
Email: Ulrich Mayr, mayr@uoregon.edu

8:20-8:35 (13)

Isolating a Mediated Route for Response Congruency Effects in Task Switching. DARRYL SCHNEIDER, *Purdue University*. — Response congruency effects in task switching reflect worse performance for incongruent targets associated with different responses across tasks than for congruent targets associated with the same response. The author investigated whether the effects can be produced by a mediated route for response selection, whereby targets are categorized with respect to both tasks, as opposed to a nonmediated route, whereby target–response instances from past experience are retrieved from long-term memory. The mediated route was isolated in three experiments by having subjects perform semantic categorization tasks on targets that were never repeated, thereby making the nonmediated route nonfunctional. Response congruency effects were observed for both response time and error rate in all experiments, indicating that the mediated route is sufficient to produce such effects by itself. The results imply that subjects engaged in dual-task processing despite no requirement to do so, challenging theoretical views of mental task-set switching.
Email: Darryl Schneider, dws@purdue.edu

8:40-8:55 (14)

Executive Control of Memory, Attention, and Action: Normal and Atypical Variation. MICHAEL KANE, MATT MEIER, BRIDGET SMEEKENS, GEORGINA GROSS, CHARLOTTE CHUN, PAUL SILVIA and THOMAS KWAPIL, *University of North Carolina-Greensboro*. — To assess the psychometric structure of executive-function capabilities that reflect the control of working memory (maintaining and updating mental representations), the control of attention (sustaining on-task thought and constraining conscious focus amid distraction), and the control of action (restraining habitual but inappropriate responses), and to better understand how particular executive deficits contribute to daily-life functioning and mental-health disorders (namely, risk for schizophrenia, as indicated by schizotypal personality dimensions), we tested over 500 young-adult subjects in a 3-session, 6-hour battery of computerized tasks, thought-probe measures of mind wandering, and self-report questionnaires. Our findings demonstrate correlated but distinguishable factors of executive control, including substantial associations between mind-wandering reports and

attention-task performance, and differential relations between these executive-control factors and those of schizotypy (i.e., its positive-, paranoid-, disorganized-, versus negative-symptom dimensions).

Email: Michael Kane, mjkane@uncg.edu

9:00-9:15 (15)

Effects of Pre-Cues and Working Memory Capacity Reveal the Interactivity of Proactive and Reactive Control. KEITH HUTCHISON, *Montana State University*, JULIE BUGG and YOU BIN LIM, *Washington University in St. Louis*, MARIANA R. OLSEN, *Montana State University*. — The current studies tested the effectiveness of trial-by-trial congruency pre-cues at enhancing or relaxing proactive control in the Stroop task. Pre-cue effectiveness was measured alongside more traditional variables thought to influence both proactive control [i.e., list proportion congruence (PC) and working memory capacity (WMC)] and reactive control (i.e., item specific proportion congruency, ISPC). Results demonstrated that pre-cueing participants to expect an incongruent trial not only reduced the size of the Stroop effect, but also reduced the magnitude of ISPC effects. In addition, pre-cueing congruency eliminated the effects of listwide PC or WMC on ISPC effects. This suggests that pre-cueing directly influences engagement in proactive control and, as a result, blocks the impact of other variables that usually moderate its use such as list experience and individual predispositions towards early selection.

Email: Keith Hutchison, khutch@montana.edu

9:20-9:35 (16)

The Influence of Cognitive Strategies on Performance in Working Memory Tasks. MENNO NIJBOER, JELMER BORST, HEDDERIK VAN RIJN and NIELS TAATGEN, *University of Groningen* (Presented by Niels Taatgen). — Working memory (WM) is normally considered a capacity-limited system. This suggests that WM performance is purely determined by the structure of the underlying architecture and the storage requirements of the task. Here, we argue instead that WM performance is much more flexible and dependent on task-specific strategies. In a concurrent dual-task, an n-back task was performed simultaneously with one of two secondary tasks. These tasks were designed to be comparable on all aspects, and especially capacity, expect for the procedure required to update the information in WM when a new stimulus is presented. One secondary task showed more interference with n-back than the other: This indicates that a difference in WM strategy – without a difference in capacity requirements – can result in greater interference between tasks. This suggests that there is a strategic and task dependent factor determining performance in WM-constrained tasks.

Email: Niels Taatgen, n.a.taatgen@rug.nl

9:40-9:55 (17)

Working Memory Capacity and Fluid Intelligence: Maintenance and Disengagement. RANDALL ENGLE, *Georgia Institute of Technology*. — We have shown repeatedly that tasks reflecting working memory capacity (WMC) and fluid intelligence (gF) are highly related at the construct level with correlations in the .6 to .8 range. We will present a new theory that the two types of tasks depend on two highly related but actually opposing processes: maintenance and disengagement. We will present data from several tasks (verbal fluency and n-back) demonstrating that fluid intelligence is related to disengaging from, or suppressing, irrelevant information. From this perspective working memory capacity and fluid intelligence reflect separate mental functions. Each serves complex cognitive activities by respectively keeping important information in a highly active state and allowing irrelevant information to be forgotten. We view the strong correlation between these functions, not as steps in a causal sequence, but instead arising from a common reliance on top-down attention control.

Email: Randall Engle, randall.engle@gatech.edu

Emotion and Cognition
Beacon B, Friday Morning, 8:00-9:40
Chaired by Robert Kraft, Otterbein University

8:00-8:15 (18)

Violent Thoughts: A Cognitive Analysis of Perpetrator Testimony. ROBERT KRAFT, *Otterbein University*. — What are the thought processes that lead to violent acts? To address this question, I analyzed the testimony of violent perpetrators given to South Africa's Truth and Reconciliation Commission. Such testimony disclosed the phenomenology of these perpetrators. Drawing on more than 200 hours of videotaped and transcribed testimony from 74 perpetrators, the study categorized and tabulated the remembered thoughts and explanations for committing violence. Analysis of the testimony revealed three levels of influence: 1) a platform of personal history, consisting of collective knowledge and specific memories, 2) active priming from ongoing events, and 3) specific triggers that translated thoughts into violent actions. The concept of priming is drawn directly from the literature on attention and memory; triggers are analogous to retrieval cues. Violence was justified within an abbreviated ideology that supported the goodness of one's actions, constrained one's lexicon, and connected to the central concept of war. While planning violence, perpetrators referenced their ideology. When carrying out violence, perpetrators focused attention exclusively on their tasks, without considering larger ideological concepts.

Email: Robert Kraft, rkraft@otterbein.edu

8:20-8:35 (19)

The Real-Time Neural Genesis of a Punchline. IRVING BIEDERMAN and ORI AMIR, *University of Southern California*. — Unlike humor appreciation, the fMRI study of humor creation has been unexplored. 15 professional improv comedians viewed drawings of human interactions and, in one condition (HUM), generated a humorous caption, and, in another (MUN), a mundane caption. The HUM condition produced bilaterally greater activation in temporal association regions (particularly the temporal poles, superior temporal gyrus and temporo-occipital junction), and bilaterally in the ventral striatum of the reward pathway. A dose response function was evident such that greater activation in those

regions correlated with funnier punchlines. While the same regions were involved in both humor appreciation and creation, only in humor creation did activation in reward regions precede activation in temporal association regions. These temporal association regions are rich in μ-opioid receptors so the convergence there of the remote associations that produce humor and insight may provide the neural correlate of the mirth and joy that accompanies such cognitive achievements.
Email: Irving Biederman, bieder@usc.edu

8:40-8:55 (20)

New Approaches to Gender Differences in Attitudes. VICTOR KUPERMAN, DAVID SHORE and AMY BETH WARRINER, *McMaster University*. — Men and women have different attitudes towards many phenomena, but determining which presents a research challenge. We present a corpus-linguistic study consisting of distributional and cluster analyses to compare three methods of characterizing attitudes across genders. Specifically, we analyzed (a) author-given keywords to 4,000 recently published papers, (b) responses from 160 participants asked to name things that males/females like more than females/males, and (c) category labels provided by 80 participants for the 458 words with the strongest gender differences from the set of valence norms to 14,000 English words (Warriner et al., 2013, Behaviour Research Methods, 45, 1191-1207). These three assessments of biases in attitudes—Expert Keywords, Explicit Categories, and Implicit Categories—revealed both similarities and differences. The use of implicit judgements to provide an unbiased assessment of attitudes and beliefs was the key innovation here. The discrepancy between the expert keywords and the other two analyses provides fruitful areas for future guidance for topic coverage and selection in research into gender differences in attitudes.
Email: Victor Kuperman, vickup@mcmaster.ca

9:00-9:15 (21)

Principles of Congruency and Complementarity in Emotional Information Processing. DMITRY LYUSIN, *Higher School of Economics*. — The study aimed to reveal the correspondence between perceivers' emotional traits (ETs) and their sensitivity to particular types of emotions in other people. The congruency hypothesis predicts that individuals should be more sensitive to those types of emotions that would be consistent with their own ETs. The complementarity hypothesis predicts that certain pairs of emotions would be in the complementary relations in the sense that individual's sensitivity to one type of emotion would correspond to his or her own ET of another type. The hypotheses were tested for two pairs of emotions, fear-anger and happiness-sadness. Sensitivity of 140 participants to particular emotion types was measured with a specially developed video test that consisted of a set of short videos. ETs were measured with self-report questionnaires. The complementarity hypothesis was supported for fear and anger; the congruency hypothesis was supported for happiness and sadness.
Email: Dmitry Lyusin, ooch@mail.ru

9:20-9:35 (22)

Winning an Olympic Gold Medal: Emotional Arousal Increases Tip-of-the-Tongue States. LISE ABRAMS, DANIELLE K. DAVIS and LEA M. MARTIN, *University of Florida*. — Tip-of-the-tongue (TOT) states represent a temporary inability to retrieve a known word. Despite anecdotal claims that arousing states such as stress or anxiety increase susceptibility to TOTs, the empirical evidence linking emotion and TOTs has been mixed. In this experiment, emotion was induced using International Affective Picture System (IAPS) pictures. After rating a picture for valence and arousal, participants read a general knowledge question whose answer was a proper name or a non-name and indicated whether they knew, did not know, or were having a TOT for the answer. Results revealed that for both names and non-names, arousal ratings were higher before questions that produced a TOT than questions that did not. In contrast, valence ratings were equivalent for subsequent TOT and non-TOT responses. These results demonstrate a causal link between high emotional arousal and TOTs, a relationship that could arise from emotional processing and phonological retrieval utilizing the same underlying brain regions.
Email: Lise Abrams, abrams@ufl.edu

Music and Tone Perception
Shoreline, Friday Morning, 8:00-9:40
Chaired by Michael Gordon, William Paterson University

8:00-8:15 (23)

We Got the Beat: Absolute Rhythm Perception in a Listening Task. MICHAEL GORDON, DANIEL KOBYLARZ, ALEJANDRO ATAUCUSI and JITWIPAR SUWANGBUTRA, *William Paterson University*. — Absolute rhythm perception was investigated using a two-choice, forced alternative paradigm. Participants were presented selections of highly recognizable hip-hop and rock music in matched pairs. Each of the pairs contained one original sample and one speeded or slowed sample of a particular musical selection from which participants attempted to determine the original. The results from this testing were that listeners are highly accurate–to within 4%—in determining the absolute rhythm of music. Additionally it was found that speeded tempi were more discriminable from an original sample than were equidistant slowed samples. The results were used to suggest the general capacity of this absolute rhythm perception, and how this capacity may represent a special case of memory encoding.
Email: Michael Gordon, gordonm10@wpunj.edu

8:20-8:35 (24)

Temporal Deficit in Dyslexia: Specific to Short Intervals but not to Discriminating Short Tone Durations. LEAH FOSTICK, *Ariel University Center*, HARVEY BABKOFF, *Bar-Ilan University*. — Deficit in auditory temporal processing has been suggested as a possible etiological basis of dyslexia, specifically, a limited ability to process short duration auditory stimuli. We compared the performance of normal and dyslexic readers on five different auditory processing tasks: 1) dichotic temporal order judgment (TOJ); 2) spectral (two tones

of different frequency) TOJ; 3) gap detection; 4) duration discrimination; and 5) intensity discrimination. Dyslexics are poorer than normal readers on dichotic, spectral TOJ and gap detection. Dyslexic and normal readers do not differ significantly in either duration or intensity discrimination. All the psychophysical threshold distributions are Guassian except for spectral TOJ, which is an inverted J with the left mode at < 5msec. We conclude that dyslexics have difficulty in discriminating very short temporal intervals separating two short sounds, but do not seem to have any difficulty in discriminating either the durations or the intensities of short tones.
Email: Leah Fostick, leah.fostick@ariel.ac.il

8:40-8:55 (25)

Two Brains Make One Mind: Hyperscanning Study on Synchronized Singing/Humming Between Two People Using fNIRS. NAOYUKI OSAKA, *Kyoto University*, TAKEHIRO MINAMOTO, *Osaka University*, KEN YAOI, *Kyoto University*, MIYUKI AZUMA and MARIKO OSAKA, *Osaka University*. — Human brains have been developed to communicate with others, however it seems unclear how our brain achieves interactive communication. Here, we report the neural synchronization for singing/humming between two people, simultaneously measuring two brain activities using a hyperscanning approach. Using a functional near-infrared spectroscopy (fNIRS), brain activity of two individuals was measured while they performed a cooperated humming or singing with face-to-face and face-to-wall (preventing them from observing the other's face by a wall). The results showed a significant increase in the neural synchronization in the left inferior frontal cortex (IFC) in both the singing and humming regardless of existence of the wall, in comparison to the single singing/humming. On the other hand, the right IFC showed an increase in the neural synchronization during humming but not singing, possibly due to higher dependence on musical processing. Those results suggest a usefulness of the fNIRS-based hyperscanning in natural social interaction.
Email: Naoyuki Osaka, nosaka@bun.kyoto-u.ac.jp

9:00-9:15 (26)

Top-Down Processing of Metrical Patterning in Music and Language. SARAH CREEL, *University of California, San Diego*. — How much of listeners' auditory pattern perception is present in the signal, and how much is filled in from memory? A series of experiments explores factors shaping memory-based illusory perceptions of musical meter. In each experiment, listeners were first exposed to metrically-ambiguous melodies with one of two unambiguous metrical settings. Next, listeners heard each ambiguous melody in isolation, and judged a following probe drumbeat that matched one of the two metrical settings. As in earlier studies, listeners preferred the probe drumbeats matching the metrical setting they had previously heard with that particular melody, suggesting that listeners "fill in" metrical information from memory. The main contributors to the strength of fill-in were (1) rhythmic (duration) patterns, and (2) both local and global

pitch contours. Results suggest that memory resources greatly enrich auditory perceptual experiences in the present. Related metrical fill-in phenomena in language are discussed.
Email: Sarah Creel, creel@cogsci.ucsd.edu

9:20-9:35 (27)

The Fundamental Illusion: Misperception of the Fundamental Frequency of Calls of Some Extreme Sized Animals. MICHAEL MCBEATH, ZACHARY D. WILKINSON and K. JAKOB PATTEN, *Arizona State University*. — A natural regularity of terrestrial acoustics is that salient resonant sources like animal calls and musical instruments typically produce a harmonic series of frequencies. The perception of auditory pitch is normally a single-tone representation of the lowest frequency or first harmonic of the series (called f0). We examine the ability of listeners to discern f0 of 21 animals, from insects to whales. Our results reveal listeners are quite accurate at discerning f0 of animals close to human size and acoustic frequency range, but that we systematically misperceive f0 of several that are much smaller or larger, such as the pinewoods tree frog and the elephant. Our findings confirm that tree frogs produce high frequency pulses at a repetition rate fast enough to induce illusory perception of an artificially lower f0, while elephants produce systematic formants (high frequency energy bands) that are heard as an artificially higher f0. The findings support that the Fundamental Illusion is a classic example in which an auditory scene analysis algorithm accurately filters and represents f0 of auditory objects within a functional range of sizes, while systematically failing in some extreme cases, possibly as a result of deimatic display.
Email: Michael K. McBeath, m.m@asu.edu

False Memory
Seaview A & B, Friday Morning, 8:00-9:40
Chaired by Mark Howe, City University London

8:00-8:15 (28)

Using False Memories to Prime Analogical Reasoning. MARK HOWE, SARAH GARNER and EMMA THREADGOLD, *City University London*, LINDEN BALL, *University of Central Lancashire*. — Like true memories, recent research has shown that false memories are capable of priming solutions to simple reasoning problems. In the current research, we extend this priming effect to more advanced problem solving tasks and report three experiments where false memories are shown to prime solutions to complex analogical reasoning tasks. In Experiment 1, we showed that false memories facilitate solutions to analogical reasoning problems even when backward associative strength among the problem terms was eliminated. In Experiments 2a and 2b, we demonstrated additional priming effects on a series of more difficult, newly created homonym analogies, problems that can only be solved by inhibiting semantic associations within the analogy. Together, these findings provide evidence

that false memory priming extends beyond simple problem solving tasks to ones that are more complex and require sophisticated analogical reasoning.
Email: Mark Howe, drmarkl.howe@gmail.com

8:20-8:35 (29)

Attending to New Information after Testing Results in Witness Memory Errors. GORDON LEAMAIRE and AYANNA THOMAS, *Tufts University*, JOHN BULEVICH, *Stockton College* (Presented by Ayanna Thomas). — Retrieval Enhanced Suggestibility (RES) is the phenomenon that immediate testing increases susceptibility to post-event misinformation. In the present study we attempt to elucidate the underlying mechanism that results in RES, or enhanced learning of post-event misinformation after testing. Specifically, we examine how testing may alter attention to tested concepts. Across multiple experiments, we found that attention, as indexed by reading time and performance on a secondary task, was directly affected by prior testing. In addition, greater attention was directed to information that conflicted with original retrieval. Moreover, when attention was exogenously manipulated, participants demonstrated levels of RES similar to those observed when it was endogenously manipulated through testing. Finally, when attention was suppressed, we found that post-test learning was impacted. The research presented overwhelmingly points to the interaction between testing and attention in test-potentiated learning effects in eyewitness memory.
Email: Ayanna Thomas, ayanna.thomas@tufts.edu

8:40-8:55 (30)

Why Do Pictures Reduce False Memory. R. REED HUNT and REBEKAH SMITH, *University of Texas at San Antonio*. — Israel and Schacter (1997) demonstrated that pairing pictures with auditory presentation of DRM lists reduces false memory, a result replicated many times. The interpretation of the effect assumes that sensory/perceptual processing of the picture enhances the distinctiveness of the representation allowing for more precise discrimination between studied items and critical lures, an instance of the distinctiveness heuristic. Norms that we collected on labels assigned to the pictures used in these studies showed considerable variability in the veridicality with which the pictures depict the DRM list words. We investigated the role of the mismatch between visually presented stimuli and the accompanying auditory word. Results indicate that the mismatch contributes to false memory reduction. Implications for theories of memory monitoring are discussed.
Email: R. Reed Hunt, reed.hunt@utsa.edu

9:00-9:15 (31)

Memory Is Illogical Too: Disjunction and Conjunction Illusions in Episodic Memory. CHARLES BRAINERD, K. NAKAMURA and VALERIE REYNA, *Cornell University*. — An unexpected feature of fuzzy-trace theory's gist explanation of reasoning biases is its prediction that episodic memory will be infected by some of those same biases. That is because basing memory for the events of our lives on gist retrieval superposes them on multiple states, which causes them to be over-remembered as belonging to too many states—including incompatible ones (e.g., old and new). Under that scenario, memory will exhibit analogues of two classic reasoning biases: disjunction and conjunction illusions. It does. We obtained robust evidence of disjunction illusions in 200+ sets of false-memory data and in a series of source-memory experiments. In some further source-memory experiments, we obtained robust evidence of conjunction illusions too. In a final series experiments, we manipulated subjects' reliance on gist versus verbatim retrieval, finding that disjunction and conjunction illusions were directly proportional to the former and inversely proportional to the latter.
Email: Charles Brainerd, cb299@cornell.edu

9:20-9:35 (32)

The Adaptive Nature of False Memories Is Revealed by Gist-based Distortion of True Memories. TIMOTHY BRADY, DANIEL SCHACTER and GEORGE ALVAREZ, *Harvard University*. — Human memory systems are subject to many imperfections, including memory distortions and the creation of false memories. Here, we demonstrate a case where memory distortion is actually adaptive, increasing the overall accuracy of memories. Participants viewed multiple real-world objects from a given category (10 airplanes, 10 backpacks…), and later recalled the color of each object via a psychophysical adjustment task that allows us to examine both the variability of internal representations of color and the probability of forgetting an object's color altogether (see Brady et al. 2013, Psych. Science). Participants were generally accurate, but even when they remembered having seen an item and remembered its color, they nevertheless reported the color as closer to the average color of its category than it really was. Although participants' memories were systematically distorted, they were distorted in a way that is consistent with minimizing their average error according to a simple Bayesian analysis. Thus, memory distortion may not always be maladaptive: in some cases, distortion can result from a memory system that optimally combines information in the service of the broader goals of the person.
Email: Timothy Brady, tbrady@wjh.harvard.edu

SYMPOSIUM I: Multi-Voxel Pattern Analyses of Source Memory
Regency A-C, Friday Morning, 10:00-12:00
Organized by Karen J. Mitchell, West Chester University of Pennsylvania

10:00-10:20 (33)

The Patterns of Our Past: Decoding FMRI Signatures of Real World Event Memories. JESSE RISSMAN, *University of California*. — The act of retrieving the source context associated with a memory probe is known to engage a distributed network of cortico-hippocampal regions that facilitate the reinstatement of event details and monitor the emerging mnemonic content. I will discuss how multi-voxel pattern analysis can be applied to capture neural signatures of this retrieval process. I will then describe an experiment aimed at decoding memories for real world experiences,

captured via necklace-mounted cameras over a 3-week period. Prior to scanning, participants previewed photographs of a subset of their own life events as well as others' life events. Then fMRI data were collected as participants evaluated these photos along with ones they had not previously seen. Our analyses demonstrate robust decoding of self vs. other status, even when others' photos had been pre-exposed to diminish their novelty. Thus, brain patterns can distinguish the reliving of personally-experienced events from memories for second-hand event knowledge.
Email: Jesse Rissman, rissman@psych.ucla.edu

10:25-10:40 (34)
Context-Specific Coding of Memories in the Hippocampus. CHARAN RANGANATH, *University of California, Davis.* — The ability to form memories is useful to the extent that the right memories can be accessed to guide future behavior. However, the optimal way to store those memories can vary across situations. In some situations, it is better to assign similar representations to memories that involve similar people/things. In other cases, it is better to assign similar representations to memories that involve different people/ things encountered in the same spatiotemporal context. I will present evidence from multivariate analyses of fMRI data demonstrating that the brain adopts multiple representational strategies. Neocortical areas exhibit similar activity patterns during processing of items that share attributes; the hippocampus exhibits highly specific patterns that distinguish between multiple encounters of the same item in different contexts. This is consistent with the idea that the hippocampus contributes to episodic memory by forming context-dependent representations that link temporally contiguous, but distinct, inputs and segregates conceptually similar, but temporally-distinct episodes.
Email: Charan Ranganath, cranganath@gmail.com

10:45-11:00 (35)
Stimulus-Specific Reactivation During Post-Learning Offline Periods and During Recollection. BERNHARD STARESINA, *MRC Cognition and Brain Sciences Unit, The University of Cambridge, UK.* — The transformation of new experiences into durable memory traces and the phenomenological experience of recollection have remained among the most intriguing questions for memory researchers. In the first part of my talk, I will present functional neuroimaging data showing that individual experiences are reactivated in the brain during post-learning rest periods, and that the amount of such 'offline reactivation' predicts later memory success. The second question I will address concerns the subjective feeling of re-living the past when we recollect. I will present data showing that neural patterns of individual experiences indeed come back online when we remember. Together, these data suggest that MVPA can be used to track the mnemonic fate of individual learning experiences during post-learning rest and during recollection.
Email: Bernhard Staresina,
bernhard.staresina@mrc-cbu.cam.ac.uk

11:05-11:20 (36)
Source Memory Confidence and Tracking Neural Reactivation During Retrieval. JEFFREY D. JOHNSON, *University of Missouri.* — MVPA of fMRI data has revealed that episodic memory retrieval involves reactivating neural patterns that were present during encoding. Whereas such reactivation appears to be more prevalent as recognition confidence increases and as qualitative information is recollected, the neural mechanisms by which reactivation is tracked in support of retrieval judgments is unknown. We have begun to address this issue by having subjects encode items under different source (task) conditions and then acquiring confidence ratings about source retrieval. MVPA provides an index of source-related neural patterns from encoding being reactivated during retrieval and has revealed the expected reactivation increase with source confidence. Furthermore, activity in a region of posterior parietal cortex – previously established as sensitive to the amount of information recollected – correlates positively with the level of reactivation. These findings suggest that parietal cortex tracks changes in the magnitude of neural reactivation in support of subjective judgments about source memory retrieval.
Email: Jeffrey D. Johnson, johnsonjeffre@missouri.edu

11:25-11:40 (37)
The Role of Episodic Reinstatement in Mnemonic Decision Making. ALISON R. PRESTON, *The University of Texas at Austin.* — Numerous theories propose that successful remembering depends on reinstating the neural activation patterns engaged during the initial learning experience. To test this prediction, we employed pattern information analysis across several human fMRI studies to directly compare brain patterns during encoding and retrieval in a variety of decision making contexts. Our data show that during episodic decision making (e.g., cued recall and source memory), reinstatement of encoding patterns within both medial temporal lobe and neocortex are associated with superior performance. For instance, the similarity between encoding and retrieval patterns within the temporal lobe tracked the speed and accuracy with which participants made decisions about reinstated memories as well as novel decisions about the relationships among memories. Moreover, reinstatement of encoding patterns in the temporal lobe was associated with decision signals in prefrontal and parietal cortex. Collectively, these results highlight the important role of episodic reinstatement across a variety of memory behaviors.
Email: Alison R. Preston, apreston@mail.clm.utexas.edu

11:45-12:00 (38)
Panel Q&A: Discussion of Outstanding Questions and Future Directions. KAREN J. MITCHELL, *West Chester University of Pennsylvania.*
Email: Karen J. Mitchell, kmitchell@wcupa.edu

Attention: Capture
Beacon B, Friday Morning, 10:00-12:00
Chaired by Yehoshua Tsal, Tel Aviv University

10:00-10:15 (39)

Singleton Capture Can Be a Top Down Phenomenon.
YEHOSHUA TSAL, HANNA BENONI, ALINA AVEN,
MICHAL BOIMER, AMIT DISTLE and ROEE SHVARTZ,
Tel Aviv University. — Attentional capture produced by a
task-irrelevant color singleton is assumed to reflect a stimulus
driven effect, completely governed by bottom-up factors.
Here we demonstrate the same capture effect when the color
singleton is expected in a given location or color but is not
actually presented. We conclude that singleton capture can be
a top-down phenomenon originated from pervasive mental
programs directing the attentional system to seek out unique
items in the visual field irrespective of task demands. We
speculate that the rationale for such programs may derive
from the fact that whereas processing several identical non-
singleton items is redundant, processing the singleton, which
is statistically most likely to be missed (one vs. many), provides
important unique information.
Email: Yehoshua Tsal, jehoshua@freud.tau.ac.il

10:20-10:35 (40)

Characterizing Color-Word Contingency Learning. OLIVIA
Y.-H. LIN, TANYA R. JONKER and COLIN MACLEOD,
University of Waterloo (Presented by Colin MacLeod). — In
the color-word contingency learning task, a word is presented
in color on each trial. The participant is to identify the color by
a key press, ignoring the irrelevant word. The key manipulation
is that each word is most often presented in one color (high
contingency) and less often presented in the other colors (low
contingency). Quite quickly as trials progress, responding is
more rapid to high contingency items than to low contingency
items, evidence of learning of the contingencies. We report a
series of experiments examining this learning, investigating
issues such as low-contingency cost vs. high-contingency
benefit, the role of stimulus frequency as opposed to stimulus
contingency, and other fundamental aspects. Our goal is to
characterize how contingency learning develops and the
factors that influence this learning.
Email: Colin MacLeod, cmacleod@uwaterloo.ca

10:40-10:55 (41)

**Influence on Attention by a Salient Distractor: Capture,
Search Mode, or Neither?** DANIEL B. VATTEROTT
and SHAUN VECERA, *University of Iowa* (Presented by
Shaun Vecera). — Salient distractors can disrupt observers
performing a simple visual search. This response time (RT)
slowing has been explained through attentional capture (e.g.,
Theeuwes, 2010) or a filtering cost (e.g., Becker, 2007; Folk
& Remington, 1998). We replicate the finding that a salient
color singleton distractor slows RTs and produces an apparent
capture effect. However, RTs are also slowed when the target
is a salient singleton on a portion of trials, a result at odds
with a model in which attention is prioritized to the most
salient item. We find that a singleton target does not receive
an attentional priority if (a) its color is different from that

of a singleton distractor and (b) it occurs frequently. Our
findings do not fit cleanly within existing accounts, such as
salience-based models, search mode accounts, or traditional
filtering accounts. We propose that adaptive filtering, in which
experience shapes attentional control, better explains our
results.
Email: Shaun Vecera, shaun-vecera@uiowa.edu

11:00-11:15 (42)

**Can Task-Irrelevant Neutral Semantic Information
Capture Auditory Attention?** FRANCOIS VACHON,
KARIANNE GUAY, KATHERINE LABONTE and
ALEXANDRE MAROIS, *Universite Laval*, JOHN E. MARSH,
University of Central Lancashire. — Task-irrelevant sound is
known to interfere with cognitive functioning. While there
is broad consensus about the attention-grabbing power of
the acoustical properties of the sound, it is unclear whether
attention can be captured by the content of the sound. So far,
semantic distraction effects explained in terms of attentional
capture have been limited to personally-significant stimuli
such as one's own name. In the present study, we tested
whether irrelevant, non-significant (or neutral) semantic
information can involuntarily attract attention, as indexed by
the disruption of visual serial recall, by inducing a categorical
deviation—i.e. the rare occurrence of a digit among letters
and vice versa—within the to-be-ignored auditory channel.
The presence of a categorical deviant was found to disrupt
not only the serial recall of letters and digits (Exp. 1) but also
symbols (Exp. 2) and unfamiliar faces (Exp. 3), suggesting that
the capture effect is not reliant on the activation of categorical
verbal codes in the focal task. The demonstration that
neutral semantic sounds can capture attention despite being
task-irrelevant provides novel evidence for the existence of
preattentive post-categorical processing.
Email: Francois Vachon, francois.vachon@psy.ulaval.ca

11:20-11:35 (43)

**Value-Driven Attentional Capture Is Modulated by Spatial
Context.** BRIAN A. ANDERSON (2014 Member Select-
Speaker Award Recipient), *Johns Hopkins University*. — When
stimuli are associated with reward outcome, their visual
features acquire high attentional priority such that stimuli
possessing those features involuntarily capture attention.
Whether a particular feature is predictive of reward, however,
may vary based on spatial context: for example, red berries
are likely to be found in low-lying bushes, whereas yellow
bananas are likely to be found on treetops. Here, I examine
whether such contextual dependencies modulate value-
driven attention. Participants completed a training procedure
comprising visual search in which different color-defined
targets were only rewarded when appearing in a particular
region of space (e.g., red on right, green on left). A test
phase followed in which rewards were no longer delivered
and previous target color stimuli served as task-irrelevant
distractors. The results show that value-driven attentional
capture is modulated by spatial context: a color stimulus only
captures attention when presented in a position in which it
was previously rewarded.
Email: Brian A. Anderson, bander33@jhu.edu

11:40-11:55 (44)

When Weaker Is Stronger: Robust Attentional Orienting and Alerting Evoked by Subliminal, but Not Supraliminal, Cues. ZHICHENG LIN (2014 Member Select-Speaker Award Recipient) and SCOTT O. MURRAY, *University of Washington*. — Unconscious effects are typically thought of as a weaker version of their conscious counterparts. Here we asked whether an effect could be present only when the stimulus is subliminal but not when supraliminal. Two series of experiments focused on attentional orienting and alerting using uninformative cues. For orienting, the cue location was first fixed across blocks and then removed in subsequent blocks: when the cue location was fixed, the orienting effect was robust for subliminal cues but absent for supraliminal cues; when the cue was removed, a negative attentional aftereffect emerged in the cue-absence blocks for supraliminal cues, suggesting a location-based inhibition mechanism responsible for the absence of the supraliminal orienting effect. For alerting, compared with no cue, two uninformative cues improved target detection when they were subliminal but not when supraliminal. Together these results from exogenous orienting and alerting provide novel evidence against the weaker-version characterization of unconscious effects.
Email: Zhicheng Lin, zhichenglin@gmail.com

Embodied Cognition
Regency D-F, H, Friday Morning, 10:20-12:00
Chaired by Martina Rieger, University for Health Science, Medical Informatics & Technology

10:20-10:35 (45)

Execution Benefits Imagery of Unfamiliar Actions. MARTINA RIEGER, *University for Health Science, Medical Informatics & Technology*. — Action imagery relies on memories of the imagined action. Imagination of unfamiliar actions is therefore more difficult than imagination of familiar actions. Executing unfamiliar actions should result in better action imagery. In two experiments participants executed or imagined performing a familiar and an unfamiliar action (1: walking vs. one-legged jumping; 2: typing as usual vs. with one finger). The same action mode (imagination, execution) was repeated 5 times in alternation for each familiarity condition. With unfamiliar actions, imagination durations were shorter than execution durations in both Experiments. With familiar actions imagination durations resembled execution durations (Experiment 2) or were longer than execution durations (Experiment 1). Execution and imagination durations became more similar with repeated performance (Experiment 2), and correlations between imagination and execution durations increased with repetitions (Experiment 1 and 2). In conclusion, imagination of unfamiliar (and to some degree also familiar) actions improves based on recent execution experience.
Email: Martina Rieger, martina.rieger@umit.at

10:40-10:55 (46)

Getting a Good Grasp: Object Mass Distribution Affects Grasp Location and Orientation. JEFFREY WAGMAN, *Illinois State University*, DAVID ROSENBAUM, *Pennsylvania State University*. — People grasp objects differently depending on what they plan to do with the objects. When people rotate objects, they tend to adopt initially uncomfortable grasps (e.g. palm-up grasps) that allow for more comfortable post-rotation grasps (e.g., palm-down grasps). This has been called the end-state comfort effect. In the present study, we asked how the distribution of weight within a horizontally oriented dowel affects the way the object is grasped prior to its being turned 90 degrees and brought to a specified target. Our university-student participants moved a symmetrically weighted dowel in Experiment 1 and an asymmetrically weighted dowel in Experiment 2. The end state comfort effect was found in both experiments. The main new finding was that, in addition, in Experiment 2 grasp location was influenced by initial weight location, whereas grasp orientation was influenced by final weight location. The implications of this dissociation will be discussed.
Email: Jeffrey Wagman, jeffreywagman@ilstu.edu

11:00-11:15 (47)

Grasp Posture Alters Visual Processing Biases Near the Hands. LAURA THOMAS, *North Dakota State University*. — Observers experience biases in visual processing for objects within easy reach of their hands, biases that may assist them in evaluating items that are candidates for action. I investigated the hypothesis that hand postures affording different types of actions differentially bias vision. Participants performed global motion detection and global form perception tasks while their hands were positioned a) near the display in an open palm posture affording a power grasp, b) with the thumb and forefinger resting near the display in a precision grasp posture, or c) in their laps. Although the power grasp posture facilitated performance on the global motion task, the precision grasp posture instead facilitated performance on the global form task. These results suggest that the visual system weights processing based on an observer's current affordances for specific actions: fast and forceful power grasps enhance processing in the magnocellular pathway, while detail-oriented precision grasps enhance parvocellular processing.
Email: Laura Thomas, laura.e.thomas@ndsu.edu

11:20-11:35 (48)

Computational Modelling of Conversational Entrainment: A Novel Framework for Examining Spoken Interaction in Communication Disorders. STEPHANIE BORRIE (2014 Member Select-Speaker Award Recipient), VISAR BERISHA and JULIE LISS, *Arizona State University*. — Conversational entrainment is the natural tendency for communication partners to adapt their behavior to more closely align with one another. This behavioral coordination is considered essential for effective communication, supporting social and emotional connection and facilitating sense-making and information exchange. It is likely that a variety of communication disorders—those characterized by deficits in perception and/or production—induce entrainment disruptions in conversation (Borrie & Liss, 2014). This presentation will (i) explore the relevance of entrainment to the study of communication disorders; (ii) present a novel paradigm for building a model of entrainment in disordered settings; and (iii) discuss data (under collection) in which interaction samples involving individuals with disordered speech and healthy communication partners are captured within the modelling paradigm. A model of

entrainment in communication disorders is entirely novel, and forms the basis for a diagnostic tool to reveal and understand a source of breakdown in disordered interaction.
Email: Stephanie Borrie, steph.borrie@gmail.com

11:40-11:55 (49)

Parkinson Patients' Upper and Lower Limb Motor Impairments Differentially Influence Action Verb Processing. KEN MCRAE, PETER NGUYEN and ANGELA SOUTH, *University of Western Ontario*. — Theories of grounded cognition emphasize the role of sensorimotor simulation in conceptual knowledge. With regard to action concepts, the motor system is hypothesized to play a central role in their representation and processing. The present study investigated whether persons with Parkinson disease (PD) who have greater upper versus greater lower limb impairments show different patterns of performance when processing action verbs denoting upper and lower limb movements. Persons with PD and matched controls made action decisions ("Does this word refer to a physical or mental action?") on upper-limb (reach), lower-limb (kick), and psych verbs (think). The most important result was an interaction between PD motor impairment dominance (PD upper vs. lower limb motor impairments) and verb type (upper vs. lower limb verbs). PD patients with greater upper limb impairment were slower in processing upper limb versus lower limb verbs, whereas those with greater lower limb impairment performed similarly on these verb types. The results support a relatively fine-grained functional role of the motor system in the conceptual representation of action verbs.
Email: Ken McRae, kenm@uwo.ca

Scene Processing
Beacon A, Friday Morning, 10:20-12:00
Chaired by Michelle Greene, Stanford University

10:20-10:35 (50)

Scene Categories Reflect Affordances. MICHELLE GREENE, CHRISTOPHER BALDASSANO and ANDRE ESTEVA, *Stanford University*, DIANE BECK, *University of Illinois*, LI FEI-FEI, *Stanford University*. — Research on human scene perception often focuses on scene categorization, but this task has little utility in our everyday lives. Rather than ask ourselves whether we are in (for example) a "beach" scene, we tend to use our vision for actions such as navigation and search. Because we act within scenes, here we test the hypothesis that scene categories arise from actions or affordances. We collected a large-scale scene category similarity matrix using existing scene databases (5 million trials) from participants on Amazon's Mechanical Turk. Using the action lexicon from the American Time Use Study, we normed these scenes by what actions could be done in each scene (1.4 million trials). Action-based similarity predicted category similarity just as well as one half of the category similarity matrix predicted the other. Furthermore, this correlation was higher than alternative similarity spaces such as perceptual, semantic or object-based similarity, suggesting that conceptual scene representations largely reflect affordances.
Email: Michelle Greene, mrgreene09@gmail.com

10:40-10:55 (51)

Detecting Picture Meaning in Extreme Conditions. MARY POTTER and CARL HAGMANN, *Massachusetts Institute of Technology*. — Can a new pictured scene in an RSVP sequence be understood (matched to a name) with durations as brief as 13 ms, as reported by Potter, Wyble, Hagmann, & McCourt (2014)? New replications varied the method: randomizing all the nontarget pictures across all trials, for each subject; randomizing durations instead of blocking them; using grayscale sequences; presenting an equal proportion of target-present and absent trials instead of 75-25%; or using a different set of pictures with superordinate or basic object names for targets. All those conditions gave results that were similar to those of the earlier study: above-chance detection at durations of 13, 27, 53, or 80 ms/picture whether the name came before or after the sequence, with increasing d' as duration increased. Only two conditions, blurring the picture or presenting only low spatial frequencies, gave different and lower levels of detection. Whether these results indicate feedforward processing (as we suggest) or are accounted for in some other way, they represent a challenge to models of visual attention and perception.
Email: Mary Potter, mpotter@mit.edu

11:00-11:15 (52)

Spatial Story Telling: The Role of Imagination in Scene Perception and Memory. HELENE INTRAUB, STEVEN BEIGHLEY and HELENA GAITAN, *University of Delaware*. — Recognition tests validate common sense: longer viewing times yield better picture memory. A spatial memory task, however (border adjustment) yielded the opposite outcome. When 3 scene-photos were presented at a rate of 1 photo/10 sec, a 17%-21% increase in remembered area (boundary extension: BE) occurred for 10-s picture durations whereas no BE occurred for 250-ms durations. Importantly, other groups' prose descriptions of the photos and their anticipated surroundings in these conditions showed no difference in the number of: words, spatial terms, or imagined objects. The 10-s group was also compared to a repeated-group who saw each picture 10 times for 1 s each (thus, total viewing time was equivalent). Ten repetitions did not eliminate BE and prose again did not differ. However, uninterrupted viewing led to slightly more BE (7%-9%). Results suggest that increased, uninterrupted viewing time encourages high quality spatial imagination, increasing (rather than decreasing) an adaptive memory error.
Email: Helene Intraub, intraub@psych.udel.edu

11:20-11:35 (53)

The (Dynamic) Mind in the Cave: Looming of Paleolithic Paintings and Petroglyphs. TIMOTHY HUBBARD, *Unaffiliated*, SUSAN RUPPEL, *University of South Carolina Upstate*. — Dobrez (2013) suggested the representational space of Paleolithic artwork resulted in perceived looming of the depicted images. This notion was tested in two experiments that presented pictures of cave paintings and petroglyphs. In both experiments, a target image followed by a probe image was presented. The viewpoint of the probe was closer, the same as, or further from the artwork than the viewpoint of the target. In Experiment 1, participants judged whether the probe was the same as or different from the target;

in Experiment 2, participants judged whether the viewpoint of the probe was closer than, the same as, or further than that of the target. Results of both experiments suggest memory for the target was displaced away from participants (toward a more distant viewpoint). A model for looming effects is proposed that involves an initial boundary extension followed by a mismatch of remembered (displaced) information and perceived information during subsequent perception.
Email: Timothy L. Hubbard, timothyleehubbard@gmail.com

11:40-11:55 (54)
The Necessity of Attention to Scene 'Gist' Perception: A Dissociation Between Task-Relevant and Task-Irrelevant Stimuli. NURIT GRONAU, ANNA IZOUTCHEEV, ROTEM AMAR and TSAFNAT NAVE, *Open University of Israel.* — During a brief visual glance people mainly grasp the main category, or the "gist" of a scene. Are scenes categorized automatically in the absence of attention? While previous studies utilizing explicit detection and categorization methods have yielded mixed results, here we utilized implicit (indirect) measures to assess unattended scene categorization. Participants searched for a superordinate scene category (e.g., "nature") among briefly presented pairs of images. Within pairs containing scenes from non-searched categories (e.g., "urban", "indoor"), items either belonged to same or to different categories. When both scenes were attended, RT for same-category pairs was significantly shorter than for different-category pairs, indicating that scene category was registered. When participants were cued to respond to one of two scenes in a pair, while its counterpart scene served as an unattended (irrelevant) distractor, the categorical effect was eliminated. An unattended scene affected behavior only if it served as a to-be-detected target appearing outside the focus of attention. Our results suggest that when unattended scenes serve as task-irrelevant (i.e., non-searched) distractors, they may not be automatically categorized.
Email: Nurit Gronau, nuritgro@openu.ac.il

Meaning/Semantics
Shoreline, Friday Morning, 10:00-12:00
Chaired by Frank Durgin, Swarthmore College

10:00-10:15 (55)
Priming Conceptual Metaphors: An ERP Study. FRANK DURGIN and LES SIKOS, *Swarthmore College*, PAUL THIBODEAU, *Oberlin College.* — Novel extended metaphors are understood more quickly when preceded by conventional metaphors that instantiate a similar mapping between the metaphoric source domain and the target domain (Thibodeau & Durgin, 2008). Is this facilitation due to priming of the mapping, or is it a more general form of semantic priming? Using a large set of novel extended metaphors following conventional metaphors, we investigated whether semantic priming was sufficient to explain the variance in event-related potentials (ERPs) in the N400 temporal window. Three principal components (PC) were extracted from 64-channel ERP activity during the N400 window in response to a novel metaphor.

The second PC reflected a semantic relationship between the preceding context and the novel metaphor, consistent with semantic priming. However, the first PC of ERP activity was more strongly related to measures of metaphor quality (e.g., "aptness"), suggesting that the metaphoric mapping was primed by conventional instantiations of the mapping.
Email: Frank Durgin, fdurgin1@swarthmore.edu

10:20-10:35 (56)
"Pro-Active" in Many Ways: Evidence for Multiple Mechanisms in Prediction. FALK HUETTIG, *Max Planck Institute for Psycholinguistics*, MORITZ DAUM, *University of Zurich, Switzerland*, NIVEDITA MANI, *University of Goettingen, Germany*. — We examined whether the associative strength between two linguistic stimuli influences the degree to which listeners predict upcoming linguistic input. When listeners hear the words "The boy reads a", are they more likely to predict book as an appropriate continuation, relative to letter, based on the strength of the association between the words read and book (strong association) and read and letter (weak association)? The results suggest that associations influence predictive language processing in both two-year-olds and adults but that such an influence is context-dependent. The current study also replicated previous findings that children's prediction abilities are strongly related to their language production skills in line with views that listeners use the production system covertly to anticipate what the other person might be likely to say. We conclude that multiple mechanisms simultaneously influence listeners' anticipation of upcoming linguistic input and that only such a dynamic approach to prediction can fully capture listeners' prowess at predictive language processing.
Email: Falk Huettig, falk.huettig@mpi.nl

10:40-10:55 (57)
How Language Dynamically Structure Our Concepts: Evidence From Transcranial Direct Current Stimulation. LYNN PERRY (2014 Member Select-Speaker Award Recipient) and GARY LUPYAN, *University of Wisconsin, Madison*. — Does language affect the structure of our concepts? We propose that language, particularly the act of verbal labeling, increases selective representation of category-diagnostic information. On this account, the ease with which individuals can use labels should determine the breadth of semantic representations with respect to between-concept relatedness. We tested the hypothesis that perturbing activity in a classic language region (via transcranial direct current stimulation over Wernicke's area) would lead to changes in semantic representations. Participants were stimulated while generating word associates; e.g., given the cue "dog" people generated 4-8 associates (e.g., bark). We found that up-regulating cortical excitability increased listing of words more uniquely related to cue words. For example, given the cue "dog", the response "bark" is more strongly related to "dog" and is associated with fewer other words than the response "cat." Together, our results suggest the labeling process leads to narrower, more specific semantic representations.
Email: Lynn Perry, lkperry@wisc.edu

11:00-11:15 (58)

On the Extended Effects of Lexical Ambiguity Resolution. DAVID GORFEIN, *University of Texas, Dallas.* — Theories of meaning selection for lexically ambiguous words (homographs and homophones) typically focus on the immediate effects of such selection or the effects of such selection over at most tens of seconds within the task. In contrast, the present paper examines such factors as the form of priming and the repetition of a primed experience on meaning selection when the previously primed item requires meaning resolution in a different task occurring at longer intervals. The study reports the effects of form of priming in a variety of tasks (relatedness decision, sentence sensibility judgment, picture priming, reading for comprehension) on transfer to such tasks as word association, relatedness decision, and sentence sensibility judgment. The studies conclusively support a view that meaning selection alters the probability that a specific meaning of an ambiguous word is selected.
Email: David Gorfein, dgorfein@yahoo.com

11:20-11:35 (59)

The Semantic Credentials of High-Dimensional Memory Models. CURT BURGESS and SARAH MAPLES, *University of California, Riverside.* — High-dimensional memory models (such as HAL, LSA and other related models) have been used to mimic a broad range of human memory phenomen that have been characterized as semantic in nature. Burgess & Lund (2001) suggest that these models that encode meaning, as a function of the word's global lexical co-occurrence history, result in representations that go beyond semantic and are best characterized as contextual relationships. The range of meaning is broader and has included grammatical categorization, thematic and syntactic relations in humans and primitive meaning information in dolphins and regional dialect information in the songs of humpback whales. The statistical information in language is very rich, but is it sufficiently rich that the representations encode non-semantic (or contextual) information? The English Lexicon Project was used as a source of word informaiton about the word's phonological, orthographic, morphological characteristics and behavioral data in the form of lexical decision and naming latencies. To summarize the results, HAL word density was relatively unrelated to the non-semantic features, but predicted word naming latencies and to an even stronger extent lexcial decision latencies.
Email: Curt Burgess, curt@ucr.edu

11:40-11:55 (60)

Aspects of Learning in Implicit Association. RICHARD ANDERSON, ADAM BILLMAN and ZACHARIAH BASEHORE, *Bowling Green State University.* — The implicit association test (IAT) is a tool to assess particular attitudes that a person cannot or will not express explicitly. However, given that the test presumes an underlying learning mechanism, IAT performance may reflect not just learned attitudes but also an individual's ability reorganize associative knowledge (to maximize the speed and accuracy) over the course of testing. Using laboratory-trained associations (between fictitious groups and personality dispositions), an experiment demonstrated that the magnitude of IAT scores decreased over trial blocks (where each block including associative training together with IAT testing), thus suggesting that individual differences in IAT scores may reflect individual differences in task-learning and not just attitudes. Another result was that the pattern of IAT responses reflected semantics and not just intra-sentence associations. For example, having learned that Ampovians are not nice people, participants found it difficult to use the same response key for both Ampovian and nice.
Email: Richard Anderson, randers@bgsu.edu

Decision Making
Seaview A & B, Friday Morning, 10:00-12:00
Chaired by Ben Newell, University of New South Wales

10:00-10:15 (61)

Identifying Strategy Use in Category Learning Tasks: A Case for More Diagnostic Data and Models. BEN NEWELL and CHRIS DONKIN, *University of New South Wales*, MICHAEL KALISH, *Syracuse University*, JOHN DUNN, *University of Adelaide.* — Conclusions about the adoption of different strategies – and their implications for theories about the cognitive and neural bases of category learning – depend heavily on the techniques for identifying strategy use. We examine performance in an often-used 'information-integration' category structure and demonstrate that strategy classification is affected markedly by the type of data, the range of models under consideration, and model selection techniques. Using a full set of 25 potential models and a full set of data that included non-reinforced transfer stimuli, we identified 46% of participants as unequivocally using an information integration strategy. However, when we adopted the standard practice of using a restricted set of models and restricted data, this estimate changed to 88%. We discuss the implications of potentially erroneous strategy classification for conclusions about the categorization capabilities of various participant and patient groups.
Email: Ben Newell, ben.newell@unsw.edu.au

10:20-10:35 (62)

From Causal Models to Sound Heuristic Inference. ANA SOFIA MORAIS and LAEL SCHOOLER, *Max Planck Institute for Human Development*, HENRIK OLSSON, *University of Warwick*, BJÖRN MEDER, *Max Planck Institute for Human Development* (Presented by Lael Schooler). — We investigate whether people rely on their causal intuitions to determine the predictive value of cues. Our real-world data set consists of one criterion variable (child mortality) and nine cues (e.g., GDP per capita). We elicited people's intuitive causal models about the domain. In a second task, we asked them to rank the cues according to their beliefs about the cues' predictive value. Alternative cue importance rankings were derived directly from their causal models using measures of causal centrality. The results show that people's judgments of cue importance corresponded more closely to the causal-based cue orders than to the statistical associations between the cues and the criterion. Using computer simulations, we show that people's causal-based cue orders form a sound basis for making

inferences, even when information about the statistical structure of the environment is scarce or unavailable. These findings suggest that people can rely on their causal intuitions to determine the importance of cues.

Email: Lael Schooler, schooler@mpib-berlin.mpg.de

10:40-10:55 (63)

A Mysterious Finding About Question Order in Surveys and a Quantum Account. RICHARD SHIFFRIN and JEROME BUSEMEYER, *Indiana University*. — When two questions are asked back to back in a national survey the answers often change depending on the order of the questions. When looking at all surveys over the last ten years that asked two questions back to back, a peculiar regularity holds for all: the QQ-equality. The change in the probability of saying yes to both questions plus the change in the probability of saying no to both questions adds to zero. It is hard to come up with any cognitive interpretation or constraints that would require the QQ-equality. We propose that human decision making obeys the laws of quantum probability. The quantum model applied to the QQ-equality has no parameters—it predicts that this finding should hold universally, regardless of parameterization. It does.

Email: Richard Shiffrin, shiffrin@indiana.edu

11:00-11:15 (64)

Predictors of Decision Making Across the Adult Life-Span: An Individual-Differences Study. FABIO DEL MISSIER, *University of Trieste*, TIMO MÄNTYLÄ, *Stockholm University*, PATRIK HANSSON, *Umeå University*, WÄNDI BRUINE DE BRUIN, *Leeds University Business School, Carnegie Mellon University*, ANDREW M. PARKER, *RAND Corporation*, LARS-GÖRAN NILSON, *ARC Karolinska Institutet Stockholm, Stockholm University*. — Age-related decline in complex cognitive tasks has been explained by changes in sensory functioning, processing speed, and working memory. However, there is still no agreement on the relative importance of these factors, and their relative role in decision making has not been investigated. In an individual-difference study on a population-based Swedish sample of adults (N = 563, age range 30-89), we disentangled the contribution of sensory decline, processing speed, and working memory measures to age-related changes in three cognitively-demanding decision-making tasks of the Adult Decision-Making Competence Battery (Resistance to Framing, Applying Decision Rules, Under/Overconfidence). Structural equation modeling showed that working memory is a significant predictor even when the influence of sensory variables, processing speed, and education (as a control for cohort effects) is taken into account. Moreover, the effects of sensory functioning and processing speed on decision making were mediated by working memory. These findings indicate that the age-related decline in complex decision-making tasks may not be entirely explained by changes in lower-level processes, highlighting the functional role of working memory processes.

Email: Fabio Del Missier, delmisfa@units.it

11:20-11:35 (65)

Human Group Foraging for a Scarce Resource: Under-Matching and its Causes. YAAKOV KAREEV, JUDITH AVRAHAMI, AYELET GOLDZWEIG and DANIEL HADAR, *The Hebrew University of Jerusalem*. — Group foraging for a scarce resource describes a group of individuals who decide, privately and simultaneously, where to search for a desirable resource. Resources are often distributed unequally across locations, and there are not enough units of the resource for all foragers. How would the distribution of foragers over locations compare with that of the available units? Optimal Foraging Theory postulates that the two distributions should be the same – irrespective of overall scarcity. Research with animals (Kennedy & Gray, 1993) and humans (Goldstone, Ashpole, & Roberts, 2005), however, revealed an under-matching of the most abundant location. We propose that short-lived reactions to outcomes underlie these results, with the degree of under-matching related to overall scarcity. Data from an experiment employing a repeated choice paradigm with seven different conditions, manipulating both the number of locations (2 or 3) and scarcity, support this thesis.

Email: Yaakov Kareev, yaakov.kareev@mail.huji.ac.il

11:40-11:55 z

Gist Representations Reduce Risk-Taking Despite Heightened Reward Sensitivity. VALERIE REYNA, ALYSSA E. EVANS, CHRISTINA F. CHICK, REBECCA B. WELDON, JONATHAN C. CORBIN and EVAN A. WILHELMS, *Cornell University*. — Understanding the origins of risky decision-making is central to economic and psychological theory. Paradoxically, adolescents are less subject than adults to standard framing biases, as predicted by fuzzy-trace theory (FTT). However, risky choices in adults can be modified by manipulating reliance on gist as opposed to verbatim processing. Hence, preference for risk is malleable in FTT, in contrast to traditional approaches to risk-taking in adolescence that emphasize neurobiological maturation. 85 subjects (46 adolescents; 39 adults) received 60 decision problems (gains and losses involving money, lives and other valued dimensions) under three truncation conditions: verbatim (emphasizing quantitative trade-offs), standard problems, and gist (emphasizing categorical something-nothing contrasts). Adolescents displayed smaller standard framing biases in all conditions, reversing in the verbatim condition. Moreover, powerful and predicted effects of truncation condition in making framing effects appear (indeed grow larger) and disappear were replicated with both adults and adolescents, illustrating the malleability of risky choices.

Email: Valerie Reyna, vr53@cornell.edu

Careers at Liberal Arts Colleges: Maintaining a Successful Research Program

Lunchtime Workshop (Attendance by Advance Reservation Only)
Shoreline, Friday Noon, 12:00-2:00
Speakers: HARRY BAHRICK, *Ohio Wesleyan University,* GIL EINSTEIN, *Furman University,* KRISTI MULTHAUP, *Davidson College* and JOHN NEUHOFF, *The College of Wooster*
Discussants: JULIA STRAND, *Carleton College* and GEOFF MADDOX, *Rhodes College*

Human Learning and Instruction I
Regency D-F, H, Friday Afternoon, 1:30-3:30
Chaired by Nate Kornell, Williams College

1:30-1:45 (67)

Which Benefits More From Retrieval, Word Pairs With Mediators Or Word Pairs Without? NATE KORNELL and HANNAH HAUSMAN, *Williams College*. — The elaborative retrieval hypothesis (Carpenter, 2011) suggests that retrieval enhances learning by strengthening not only cue-target connections but also cue-mediator-target connections. To test this hypothesis directly, we examined the magnitude of the testing effect using two types of word pairs: pairs with a potential mediator (e.g., root-belly, which are both related to beer) and pairs without a mediator (e.g., car-sharp). When participants studied and then restudied, there was no difference in final test performance between mediated and non-mediated pairs. When they studied and then took a test (with feedback), however, the mediated pairs were remembered better than the non-mediated pairs on the final test. In other words, the benefit of retrieval was larger for mediated pairs than it was for non-mediated pairs. This finding provides strong support for the elaborative retrieval hypothesis.
Email: Nate Kornell, nkornell@gmail.com

1:50-2:05 (68)

Temporal Costs of Storing an Idea in Memory. ROMAN TARABAN, *Texas Tech University*. — Landauer (1986) proposed that the average transfer rate of information into long-term memory is approximately 2 bits per second. The present analyses tested the robustness of the Landauer constant using data from several prior experiments involving recall of information from expository texts. Materials included difficult and easy texts, and intact and disconnected texts. Experimental manipulations included self-testing and text segmentation. Participants were mainstream and developmental college students. Average bit transfer rates are presented for immediate and delayed (24-48 hour) recall tests. Analyses show that the Landauer constant is robust and fits average recall data fairly closely, however, is strongly qualified by text, task, and individual differences. Bit rates correlate with alternative measures using total words, propositional representations, and idea units, inviting generalization of the Landauer constant to other representational types. These data can be used to predict the temporal costs of computation for mathematical models that are built from these kinds of representations.
Email: Roman Taraban, roman.taraban@ttu.edu

2:10-2:25 (69)

Sleep Benefits Memories After Restudy, but Not After Retrieval Practice: Evidence for the Distribution-Based Bifurcation Model of the Testing Effect. MAGDALENA ABEL (2014 Member Select-Speaker Award Recipient), CHRISTOPH HOLTERMAN and KARL-HEINZ BAEUML, *Regensburg University*. — Retrieval practice compared to restudy improves memory and reduces time-dependent forgetting. This "testing effect" arises mainly after prolonged retention intervals, which naturally include both wake and sleep delays. Yet, prior research shows that sleep immediately after encoding benefits and strengthens memories as well. In a series of experiments, we investigated whether sleep affects the testing effect. Subjects initially studied paired associates via restudy or retrieval-practice cycles and were tested after 12-h intervals including either nighttime sleep or daytime wakefulness. Sleep benefited memories after restudy, but not after retrieval practice, reducing or even eliminating the testing effect. The finding supports the bifurcation model of the testing effect (Kornell, Bjork, & Garcia, 2011), according to which retrieval strengthens items to a much higher degree than restudy does. Successfully retrieved items may already fall above recall threshold in the absence of sleep, leaving not much room for additional sleep-associated strengthening.
Email: Magdalena Abel, magdalena.abel@ur.de

2:30-2:45 (70)

Using Cognitive Psychology to Improve the Teaching of Cognitive Psychology. STEVEN LUCK, *University of California, Davis*. — Research by cognitive psychologists has demonstrated that learning can be improved by factors such as retrieval practice (the "testing effect") and temporally spaced encoding. In this talk, I will present the results of applying these principles—using a hybrid live/ online teaching format—to a large cognitive psychology course (~200 students). All lectures were delivered online in 5-minute YouTube videos, each of which was followed by an online quiz (see example lecture at https://www.youtube. com/watch?v=m46_GHTlxg8). An additional online quiz was delivered after every 5-8 lecture videos. The online delivery of lecture material made it feasible to implement 1-hour weekly discussion sections with groups of 25 students, which focused on teaching the students to read, evaluate, and explain journal articles. This format led to a significant increase in exam scores and final grades relative to a traditional version of the course with nearly identical content. Thus, the teaching of cognitive psychology can be improved within the constraints of a large university course by combining technology with principles of learning and memory that have been discovered by cognitive psychologists.
Email: Steven Luck, sjluck@ucdavis.edu

2:50-3:05 (71)

Forgetting of Foreign Language Skills: A Corpus-Based Analysis of Rosetta Stone®. KARL RIDGEWAY, *Rosetta Stone®*, MICHAEL MOZER, *University of Colorado* (Presented by Michael Mozer). — We explore the nature of forgetting in a corpus of 125,000 students using the Rosetta Stone® foreign-language instruction software on 48 Spanish lessons. Students are tested on a lesson after its completion and are then retested after a variable time lag. We observe power-law forgetting curves with a temporal decay rate that is small and varies from lesson to lesson. We obtain improved predictive accuracy of the forgetting model by augmenting it with features that encode characteristics of a student's initial study of the lesson and the activities the student engaged in between the two tests. We analyze which features best explain

individual performance, and find that using these features the augmented model can predict about 25% of the variance in an individual's score on the second test.
Email: Michael Mozer, mozer@colorado.edu

3:10-3:25 (72)
Processing Loci of the BRCA Gist Intelligent Tutor: A Fuzzy-Trace Theory Approach. CHRISTOPHER WOLFE, *Miami University*, VALERIE REYNA and PRISCILA G. BRUST-RENCK, *Cornell University*, COLIN L. WIDMER, ELIZABETH M. CEDILLOS, AUDREY M. WEIL and CHRISTOPHER R. FISHER, *Miami University*. — Previous experiments demonstrated the BRCA Gist Intelligent Tutoring System's effectiveness in helping women make decisions about genetic risks and testing. This experiment investigated processes responsible for improved decision-making. Principles of Fuzzy-Trace Theory guided the design: BRCA Gist avatars talk, show text, present graphics and responds to participants' statements, fostering gist representations of risk. Women (N=206) were randomly assigned to BRCA Gist, systematically reduced versions of BRCA Gist, or a control condition. The No-Tutorial-Dialogues condition omitted tutorial dialogues. The No-FTT-Images condition removed images designed following FTT. We assessed knowledge, risk categorization and decision-making. Participants in all BRCA Gist conditions scored significantly higher than controls, demonstrating efficacy. Both No-Tutorial-Dialogues and No-FTT-Images participants scored significantly lower than BRCA Gist on two knowledge tests, particularly decision-relevant knowledge related to medical testing guidelines. Tutorial dialogues also increased knowledge of genetic testing consequences and improved risk categorization. Fine-grained analyses of dialogues further explicated gist-level understanding.
Email: Christopher Wolfe, wolfecr@MiamiOH.edu

Numerical Cognition
Shoreline, Friday Afternoon, 1:30-3:10
Chaired by Thomas Faulkenberry, Tarleton State University

1:30-1:45 (73)
Response Trajectories Capture the Continuous Dynamics of the Size-Congruity Effect. THOMAS FAULKENBERRY, *Tarleton State University*, ALEXANDER CRUISE, *Ariel University*, DMITRI LAVRO, *Ben-Gurion University of the Negev*, SAMUEL SHAKI, *Ariel University*. — The size congruity effect occurs when task irrelevant information (e.g., numerical magnitude) interferes with a decision about the physical size of two numerical digits. Typically, people are faster to respond when numerical and physical size are congruent (i.e., both large or both small) than when they are incongruent. In the present experiment, we used a hand tracking paradigm (Freeman & Ambady, 2010) to study the temporal dynamics of the size congruity effect. Participants were asked to use a computer mouse to select the physically larger of two digits presented at the upper right and left corners of a display. We found that the curvature of responses for incongruent trials was greater than for congruent trials.

Together with distributional analyses of trajectories, this difference in dynamic complexity provides evidence of continuous competition between parallel and partially active mental representations at the decision level, supporting a recent computational model of Santens and Verguts (2010).
Email: Thomas Faulkenberry, faulkenberry@tarleton.edu

1:50-2:05 (74)
Exploring the Developmental Trajectory of Math Anxiety. SIAN LEAH BEILOCK and ERIN MALONEY, *University of Chicago*. — We explored the developmental trajectory of math anxiety. The math anxiety and math achievement of 769 1st and 2nd graders and the math anxiety and homework helping behavior of 465 of their parents was examined. When parents have high math anxiety, the more frequently they help their children with math homework, the less their children learn across the school year [t(230)=2.10, p<.05; 1/3 grade equivalent difference] and the more math anxious their children are [t(227)=2.62,p<.01]. This isn't true for low-math-anxious parents. High-math-anxious parents' homework help can backfire, likely because parents transfer their negative math attitudes to their child and also provide inadequate instruction, as parents high in math anxiety have poor numerical competencies themselves. In adults, math anxiety is associated with difficulties in enumeration, [F(8,208)=3.4, p<0.01], number comparison [F(3,138)=2.8,p< .05], and mental rotation [t(60)=3.98,p<.0001]. Our findings provide an explanation for the intergenerational transfer of low math achievement and high math anxiety.
Email: Sian Leah Beilock, beilock@uchicago.edu

2:10-2:25 (75)
Improving Students' Conceptual Knowledge of Fractions. LISA FAZIO, *University of Pittsburgh*, ROBERT S. SIEGLER and CASEY KENNEDY, *Carnegie Mellon University*. — Students often struggle with understanding fractions as numbers that can be compared and ordered. We examined whether playing a computerized fraction game could improve students' conceptual knowledge of fractions. Fourth and fifth-grade students were given brief instruction about unit fractions and then played the "Catch the Monster" game where they placed fractions on a number line and were given feedback. The entire intervention lasted less than 15 minutes. In Experiment 1, students showed large learning gains from pretest to posttest in their ability to place fractions on number lines, compare fraction magnitudes, and remember fractions. In Experiment 2, a control group showed no improvement after placing fractions on a number line without feedback, while the "Catch the Monster" group again showed improvements in their conceptual knowledge of fractions.
Email: Lisa Fazio, lkf12@pitt.edu

2:30-2:45 (76)
Retrieval-Induced Forgetting of Simple Addition and Multiplication. JAMIE CAMPBELL and KATE DUFOUR, *University of Saskatchewan*. — Adults (N = 72) repeatedly solved either a set of simple addition (0+2, 1+5, 2+3) or multiplication problems (0×2, 1×5, 2×3) during a practice phase and then switched operations during a test phase that

included counterparts to the practiced problems and control problems. Both multiplication and addition showed retrieval-induced forgetting (RIF) for non-rule-based problems. The 0×N, 0+N, and 1+N problems did not present item-specific RIF from practice of the cross-operation counterparts, but 1×N problems did, despite evidence from generalization of practice that they were solved using a general procedure.
Email: Jamie Campbell, jamie.campbell@usask.ca

2:50-3:05 (77)

Is Numerosity a Perceptual Primitive? Further Evidence from the Numerosity Matching Task. ALAIN CONTENT, *Université libre de Bruxelles*. — The notion that the human mind is equipped with a perceptual mechanism aimed at extracting numerosity from collections of visual elements has come under heavy criticism in the recent years. Indeed, several visual dimensions such as aggregated area, density or convex hull are intrinsically correlated with numerosity, and skeptics have argued that the collection comparison and estimation tasks that are mostly used cannot eliminate alternative interpretations based on non-numerical visual cues. I propose here a new approach based on a matching-to-sample paradigm. At each trial, one sample collection of dots was displayed and followed by seven choice collections. Some visual dimensions covaried with numerosity in the sample set and were kept constant among choices, and other varied among choices but not samples, so that none could support matching. In spite of such strong controls, participants performed above chance in most conditions, providing further evidence that numerosity is a perceptual primitive.
Email: Alain Content, alain.content@ulb.ac.be

Word Recognition
Beacon A, Friday Afternoon, 1:30-3:10
Chaired by Debra Jared, University of Western Ontario

1:30-1:45 (78)

Task and Semantic Effects in Morphological Processing. DEBRA JARED, OLESSIA JOURAVLEV and MARC JOANISSE, *University of Western Ontario*. — One goal of the research was to investigate how the task performed by the participant influences whether morphologically complex words undergo an early and automatic suffix stripping process. A second goal was to examine when semantic effects arise in morphological processing. Stimuli included real suffixed words (e.g., CHILDISH), pseudo suffixed words (e.g., VANISH), and orthographic control words (e.g., GRIMACE), as in other studies, but also a group of words with a suffix ending whose meaning is only somewhat related to the parts (e.g., BOOKISH). Three tasks were used with ERP: masked priming with a lexical decision task, masked priming with a semantic decision task, and a semantic decision task in which words were presented in two colors with the color boundary either congruent or incongruent with the morphological boundary. Results differed as a function of both the type of word and the task. Implications for theories of morphological processing will be discussed.
Email: Debra Jared, djjared@uwo.ca

1:50-2:05 (79)

Electrophysiological Correlates of Contextual Diversity in Word Recognition. MARTA VERGARA-MARTINEZ, *Universitat de Valencia*, MONTSERRAT COMESAÑA, *Universidade do Minho*, EVA GUTIÉRREZ, *University College London*, MANUEL PEREA, *Universitat de València*. — A number of behavioral word-recognition experiments have revealed that words that appear in many different contexts are identified faster than the words that appear in few contexts. This contextual diversity (CD) effect has been found to be stronger than the word-frequency (WF) effect (Adelman et al., 2006). Here we examined the electrophysiological correlates of CD by registering the participants' ERPs in two lexical decision experiments. We selected three groups of words: high-CD high-WF words; low-CD high-WF words; and low-CD low-WF words. Whereas high-CD words produced faster responses than low-CD words in the two experiments, their ERPs showed larger negativities (250-400ms) than low-CD words, which is apparently at odds with N400 WF effects. Variations in the distribution and polarity of the WF and CD effects are discussed according to an interpretation of the N400 as the sum of multiple neural generators that are sensitive to lexico-semantic features stored in long term-memory.
Email: Marta Vergara-Martinez, vergara.marta@gmail.com

2:10-2:25 (80)

What Do Transposed-Letter Effects Reflect? JONATHAN GRAINGER and THOMAS HANNAGAN, *CNRS & Aix-Marseille University*, PHILLIP HOLCOMB, *Tufts University*, MARIA KTORI and JOHANNES ZIEGLER, *CNRS & Aix-Marseille University*. — Transposed-letter (TL) effects have attracted much attention in recent research on orthographic processing, and there is a growing consensus around one specific account of what TL effects reflect. Indeed, practically all theories of orthographic processing assume that TL effects reflect nothing more than generic positional noise operating on letter position coding mechanisms that would otherwise not exhibit TL effects. Going against this consensus, here we present evidence in favor of an alternative account of TL effects. According to this alternative view, over and above effects of positional noise common to all visual object processing, TL effects also reflect the very nature of the mechanism used to code for letter position information. Evidence for this theory is provided by experiments examining: 1) transposition effects in different kinds of stimuli; 2) the time-course of adjacent and non-adjacent TL effects; and 3) the developmental trajectory of TL effects.
Email: Jonathan Grainger, jonathan.grainger@univ-amu.fr

2:30-2:45 (81)

Misperception of Visual Words. ALBRECHT INHOFF and JULIE GREGG, *Binghamton University, SUNY*. — Visual words can be misperceived, but properties of misperception are rarely of interest, the assumptions being that these are cases of mistaken identity or of premature responding. To generate misperception, target words which had orthographic neighbors were presented for short durations at the screen center. Four alternatives were then shown in different quadrants (the target, an orthographic neighbor, an onset

competitor, and a dissimilar word), and the target was to be selected from these alternatives while eye movements were monitored. With correct choices, growth curve analyses revealed initial competition between targets, neighbors, and onset competitors, and this was followed by increased target viewing and decreased viewing of alternatives. With incorrect choices, competition between targets, neighbors, and onset competitors was unresolved or showed a nondistinct viewing preference for neighbors. Errors were thus neither instances in which a competitor was quickly mistaken for the target nor the result of premature responding.
Email: Albrecht Inhoff, inhoff@binghamton.edu

2:50-3:05 (82)
Exploring the First Letter Advantage in Masked Priming of a Two Alternative Forced Choice Task. DAVID BALOTA and ANDREW ASCHENBRENNER, *Washington University in St. Louis*, MICHELE SCALTRITTI, *University of Padova*, DEREK BESNER, *University of Waterloo*. — There is accumulating evidence of a robust first letter advantage across a variety of tasks; however, the advantage at other positions appears to be task dependent. Here we explored a masked priming two alternative forced choice task in which a prime was both forward and backward masked and the participant's task was to determine which of two alternatives matched the prime. The target and distractor differed by only one letter which varied across positions (e.g., SUNG and LUNG mismatch in the first position and FISH and FIST mismatch in the fourth position). The results from horizontal presentation have yielded a robust first letter advantage with little difference across remaining positions, potentially reflecting an elongated receptive field at the beginning of orthographically presented strings. This paradigm is extended to a vertical presentation and again yielded a first position advantage. Discussion focuses on the locus of this effect.
Email: David Balota, dbalota@artsci.wustl.edu

Vision I
Beacon B, Friday Afternoon, 1:30-3:10
Chaired by David White, The University of New South Wales

1:30-1:45 (83)
Expertise in Facial Image Comparison. DAVID WHITE, *The University of New South Wales*, P. JONATHON PHILLIPS, *National Institute of Standards and Technology*, CARINA A. HAHN, MATTHEW Q. HILL and ALICE O'TOOLE, *University of Texas at Dallas*. — In forensic and security occupations unfamiliar people are often identified by comparing images of faces. Experiments consistently show that viewers are poor at this task. However, these experiments typically examine performance of non-specialists and not people who are trained or experienced in face matching. Here we tested performance of trained forensic image examiners with many years experience comparing face images for law enforcement and government agencies. Accuracy of examiners exceeded control performance in a standard test (Glasgow

Face Matching Test), and also in more challenging matching conditions where image capture settings were unconstrained (Good, Bad and Ugly Test). This advantage generalized to images presented upside down, but was specific to longer study durations (30 seconds), and was not observed when forcing experts to make more intuitive judgments (2 seconds). Our results suggest that visual expertise in facial forensic examiners is driven by an effortful, image-bound comparison strategy that augments underlying perceptual ability.
Email: David White, david.white@unsw.edu.au

1:50-2:05 (84)
Hybrid Foraging Search: Visual Search for Multiple Examples of Multiple Target Types Held in Memory. MATTHEW S. CAIN and SAGE E.P. BOETTCHER, *Brigham & Women's Hospital*, JEREMY M. WOLFE, *Brigham and Women's Hospital/Harvard Medical School*. — When the number of targets available in a visual search task is large (e.g., berry picking), human behavior in the laboratory is well-described by ecological models of foraging behavior. What happens when there are multiple types of target (e.g., a bird foraging for several types of insects)? Do searchers exhaust one target type before switching, collect whatever target is closest, regardless of type, or do they use an alternative strategy? To study this hybrid visual/memory foraging behavior, we employ a novel search paradigm with up to 120 objects in constant motion. The motion discourages spatially systematic search (e.g., 'reading'). Switches between target types are not random nor do observers exhaust one target type before switching. Optimal foraging models that account for switches between patches can be used to explain switches within patches. Switch behavior is also modulated by the number of target types held in memory.
Email: Matthew S. Cain, mcain@partners.org

2:10-2:25 (85)
Attention Modulates the Quantity, Quality and Location Correspondence of Visual Working Memory Representations. TAL MAKOVSKI, *The Open University of Israel*, YONI PERTZOV, *The Hebrew University of Jerusalem*. — Visual Working Memory (VWM) and attention share common characteristics and much research has studied how the two interact. Here we used a partial-report, orientation memory task to examine how attention affects different aspects of VWM. During the retention interval two orthogonal attentional manipulations were applied: dividing attention by introducing a secondary interfering task and focusing attention by presenting informative retro-cues. A mixture-model analysis revealed that compared to a no-interference condition, performing a secondary task impaired recall precision and increased guessing rate and swap-errors (reporting a wrong item in memory). Precision was further impaired when the secondary task was visual rather than auditory, suggesting that VWM quality is sensitive to new visual information. Retro-cues, compared to uninformative cues, also improved all aspects of performance. Furthermore, an interaction between retro-cue and secondary

task interference was found for swap-errors, indicating that feature-location correspondences are fragile but can be strengthen by attention. Together these results suggest that focusing attention within VWM enhance both the quantity and quality of VWM representations.
Email: Tal Makovski, tal.makovski@gmail.com

2:30-2:45 (86)
The Fundamentals of Attractive Faces. GEOFF COLE, *University of Essex*, DAMIEN WRIGHT, *University of Liverpool*, PAUL HIBBARD, *University of Essex*. — Following Lorenz, many authors have attempted to reduce facial attraction to some basic structural components (e.g., symmetry and infant-like features). However, one of the most fundamental characteristics of image processing concerns spectral power and spatial frequency. We performed a Fourier analysis on 82 adult and 82 infant faces and asked observers to rate each for attractiveness/cuteness. In line with previous reports, results showed that faces possess a similar spectral property to that found in natural images; as spatial frequency increases, power decreases in a log linear fashion. Again, consistent with previous findings, this slope is steeper for faces than for other images, such as landscapes. More significantly, however, was the finding that the log-log plot of power vs. spatial frequency predicts how attractive a face is deemed to be; the steeper the slope the more attractive the face. We argue that the analysis of power (amplitude squared) at different spatial frequencies provides another method for determining attractiveness. These results are also inconsistent with a previous suggestion that faces with a shallower slope, that are thus more typical of other natural images, would be considered more attractive.
Email: Geoff Cole, ggcole@essex.ac.uk

2:50-3:05 (87)
The Microgenesis of Metacontrast. JOEL LACHTER, *NASA-Ames Research Center*, FRANK DURGIN, *Swarthmore College*. — When a target is presented briefly, followed by a "mask" that surrounds it, the target is rendered less visible, an effect called metacontrast masking. Metacontrast is modulated by the time between target and mask (stimulus onset asynchrony or SOA). Under some conditions, metacontrast is strongest with short SOAs (type-A) while in others it occurs mainly at intermediate SOAs (type-B). Lachter and Durgin (1999) argued that this difference was largely due to speed of response. Faster responses resulted in type-A results while slower responses resulted in type-B results. Here we refine that conclusion. Using a novel paradigm that allows us to collect fast and slow responses from a single trial, we found that brightness judgments remained non-monotonic (type-B) across all speeds of response, but that form discrimination judgments shifted from a type-A pattern, for fast responses, to a type-B pattern for slower responses.
Email: Joel Lachter, Joel.B.Lachter@nasa.gov

Judgment
Seaview A & B, Friday Afternoon, 1:30-3:10
Chaired by Teresa Treat, University of Iowa

1:30-1:45 (88)
Using Explicit Instruction to Enhance Processing of Women's Sexual Interest. TERESA TREAT and ERIN K. CHURCH, *University of Iowa*, RICHARD J. VIKEN, *Indiana University*. — Impoverished processing of women's nonverbal sexual-interest cues has been linked to perceivers' gender and rape-supportive attitudes, as well as women's clothing style and attractiveness (CSA). The present study evaluates whether explicit instruction about sexual-interest (SI) cues prior to judging women's SI enhances reliance on SI and decreases reliance on women's CSA. 358 undergraduate men and women judged how sexually interested college-age women in full-body photographs feel right now. Half received additional instructions to focus on facial expression and body language and to ignore CSA when discerning momentary sexual interest. Explicit instruction increased reliance on SI, particularly among women, and decreased focus on CSA, particularly among men. Gender differences in cue utilization emerged while judging sexual interest, such that women focused more than men on SI and clothing style, whereas men focused more than women on attractiveness. Those endorsing more rape-supportive attitudes also focused more on SI and less on CSA. Overall, this study supports the use of explicit instruction in enhancing the accuracy of perceptions of women's dating-relevant cues.
Email: Teresa Treat, teresa-treat@uiowa.edu

1:50-2:05 (89)
Reported Moment of Intent is a Biased Measure of Consciousness. EVE ISHAM and KRYSTAL WULF, *University of California, Davis*. — Understanding how the brain and mind code intention remains a fundamental yet largely unsolved in cognitive psychology. Pioneering, yet controversial, work by Benjamin Libet (1983) established that action-related neural events preceded the conscious moment of intent. However, observations from our lab motivated the investigation of the temporal aspect of intention. Specifically, we asked whether the timing of intent can be accurately represented, reported, and whether it is a reliable temporal marker of awareness. We observed that while the timing of intent is mentally represented, it is not accurately reported. This report, instead, is inferred and reconstructed from relevant contextual cues surrounding the action. Based on these findings, we have explored an alternative measure to access that true moment in which intention is experienced. We propose that not until this moment is accurately assessed can we validly relate this mental timing with the timing of neural events of intention.
Email: Eve Isham, eaisham@ucdavis.edu

2:10-2:25 (90)

Using Statistical Reasoning Performance to Reveal Information Parsing Preferences in the Mind. GARY BRASE, *Kansas State University*. — Many cognitive tasks require the parsing of information into smaller, discrete units in order to enable effective information processing. This parsing can, broadly speaking, be done along either situationally ad hoc dimensions or done preferentially along ecologically and evolutionarily relevant dimensions. The present research systematically evaluates these two possibilities within the statistical reasoning field. After replicating results that appear to support item parsing as equipotential based on subtle linguistic cues, this result was found to be in large part due to confounds in the nature of the tasks rather than the partitioning manipulations. Additionally, a frequency presentation of the same task not only eliminated the earlier confounds but also improved performance directly and as predicted by the alternative hypothesis. Attempts to reintroduce a biasing partition frame and a process study of participants' task representation also both failed to support the equipotential hypothesis. These results favor an ecological rationality perspective and the associated hypotheses regarding statistical reasoning.
Email: Gary Brase, gbrase@ksu.edu

2:30-2:45 (91)

Predicting Superior Judgment and Decision Making: Influences of Numeracy and Metacognition. EDWARD COKELY and SAIMA GHAZAL, *Michigan Technological University*, ROCIO GARCIA-RETAMERO, *University of Granada*. — We investigated the relations between numeracy and superior judgment and decision making in two large (n=5408) community outreach studies in Holland (e.g., a link to an experiment appeared in a newspaper article about human decision making). In these very highly educated samples (e.g., 30–50% held graduate degrees), the Berlin Numeracy Test was a robust predictor of financial, medical, and metacognitive task performance (i.e., lotteries, intertemporal choice, denominator neglect, and confidence judgments), independent of education, gender, age, and another numeracy assessment. Metacognitive processes partially mediated the link between numeracy and superior performance. More numerate participants performed better because they deliberated more during decision making and more accurately evaluated their judgments (e.g., less overconfidence). Results suggest that well-designed numeracy tests tend to be robust predictors of superior judgment and decision making because they simultaneously assess (1) mathematical competency and (2) metacognitive skills and strategies.
Email: Edward Cokely, ecokely@mtu.edu

2:50-3:05 (92)

A Quantum Probability Approach to Human Causal Reasoning. JENNIFER TRUEBLOOD (2014 Member Select-Speaker Award Recipient), *University of California, Irvine*, EMMANUEL POTHOS, *City University, London*, PERCY MISTRY, *University of California, Irvine*. — When people make inferences about causal situations with vague and imperfect information, their judgments often deviate from the normative prescription of classical probability. As a result, it is difficult to apply classical probability models, which provide good accounts of behavior in casual learning tasks and tasks where statistical information is provided directly. We propose a unified explanation of human causal reasoning using quantum probability theory that can account for causal reasoning across many different domains. In our approach, we postulate a hierarchy of mental representations, from fully quantum to fully classical, that could be adopted for different situations. We illustrate our approach with new experiments and model comparisons.
Email: Jennifer Trueblood, jstruebl@uci.edu

**SYMPOSIUM II: Cognitive Science
in the Attention Economy**
Regency A-C, Friday Afternoon, 1:30-3:40
*Organized by Sean M. Lane, Louisiana State
University, and Paul Atchley, University of Kansas*

1:30-1:40 (93)

Introduction. PAUL ATCHLEY, *University of Kansas*

1:40-2:00 (94)

The Attention Economy: Increasing Risk in a World of Divided Attention. PAUL ATCHLEY, *University of Kansas*. — Cellular phones are not the first technology to worry traffic safety professionals. A 1939 *Journal of Applied Psychology* paper titled "Radio Listening and Automobiles" (Suchman, 1939) noted that many drivers, automobile safety clubs, and legislatures worried that radios would result in "interference with proper operation of the vehicle" (p. 148). New technologies are often social in nature and they challenge our attention in new ways. This talk will briefly discuss the safety challenges we now face from ubiquitous social technologies. But the primary goal of the talk will be consider a model of the effect of the attention economy on cognition (Atchley & Lane, in press) both as a way to understand challenges to safety and to preview subsequent talks in the symposium.
Email: Paul Atchley, patchley@ku.edu

2:05-2:25 (95)

Effects of Information Technology on Self-Regulation. SEAN M. LANE AND DANIELLA CASH, *Louisiana State University*. — Self-regulatory cognitive processes and skills are critical for helping us achieve interpersonal, educational, and professional goals. These processes allow us to monitor our performance and overcome obstacles, as well as influence our emotional experience and motivation. For all its benefits, information technology (IT) often appears to undermine our self-regulatory capacity. For example, distraction from IT devices can prevent self-regulatory processes from being deployed when they are needed. In this talk, we first discuss current theoretical understanding of self-regulation with respect to 1) learning and 2) the experience of emotion. We then discuss ways that IT might interfere with self-regulation

in these domains. We conclude by examining how IT might be used to support self-regulation rather than hinder it, and explore potential new directions for research on the topic. Email: Sean Lane, slane@lsu.edu

2:30-2:50 (96)

"Say Cheese!": How Taking and Viewing Photos Shapes What People Remember. LINDA A. HENKEL, *Fairfield University*. — Modern technology has made taking, sharing, and digitally altering photos part of our everyday experience. The number of photos taken each day is staggering, though many people are overwhelmed by the mass they accumulate and do not organize or even look at many of the photos they have taken. This talk examines some trends in the use of digital photography, and juxtaposes that against research addressing how taking and viewing photos can shape what people remember. This will include research on the impact of viewing real and doctored photos on memory, research on the effects of photos accompanying news stories on subsequent knowledge and beliefs about public events, and research on how taking photos during a museum tour can influence people's recollection of details about what they experienced. Email: Linda Henkel, LHenkel@mail.fairfield.edu

2:55-3:15 (97)

Go Outside: Nature is the Cure for Impoverished Attention. RUTH ANN ATCHLEY, *University of Kansas*. — One aspect of processing that distinguishes low and high verbally creative individuals is that high creatives maintain multiple subordinate word associations for longer periods of time (R. A. Atchley, Keeney & Burgess, 1999). This would suggest that distraction could harm creative output by disrupting the ability to maintain multiple representations in mind. Consistent with this idea is recent work showing that disconnecting from distracting devices and being immersed in natural settings for an extended period of time can boost the production of creative verbal associations by 50% (R. A. Atchley, Strayer & Atchley, 2012). The current talk will review this work and explore how these findings inform us that removing distractions and making time for reflection moves creative output to its peak. It will also explore how the positive aspects of natural environments may improve cognitive function by improving other features of psychological functioning such as mood. Email: Ruth Ann Atchley, ratchley@ku.edu

3:20-3:40 (98)

Discussion and Questions. PAUL ATCHLEY, *University of Kansas*, and SEAN LANE, *Louisiana State University*.

Statistics and Methodology
Beacon B, Friday Afternoon, 3:30-5:30
Chaired by Mario Fific, Grand Valley State University

3:30-3:45 (99)

Double Jeopardy in Inferring Cognitive Processes. MARIO FIFIC, *Grand Valley State University*. — Inferences we make about underlying cognitive processes can be jeopardized in two ways due to two problematic forms of aggregation. First, averaging across individuals is typically considered a very useful tool to remove random variability. The threat is that averaging across subjects leads to averaging across different cognitive strategies, thus harming our inferences. The second threat comes from "averaging" across research designs, in which more complex research designs are simplified for practical use. Only certain research designs meet the sufficient and necessary criteria to make correct inferences about rigorously defined properties of cognitive processes. The systems factorial approach (SFT) proposes quantitative criteria for the minimal limits of research design complexity. It aims to improve inferences regarding processing order (serial, parallel), stopping rule (terminating, exhaustive), process dependency and capacity. We compare and contrast results from several cognitive studies showing failures in data interpretation under the influence of the aforementioned jeopardies. Email: Mario Fific, fificm@gvsu.edu

3:50-4:05 (100)

A Comparison of Statistical Analyses for the Survivor Interaction Contrast. JOSEPH HOUPT, *Wright State University*. — The survivor interaction contrast (SIC) is a powerful measure for distinguishing among parallel and serial use of information in cognitive and perceptual processes. Although the SIC was first published in 1995, there are a number of relatively new statistical analyses. In this talk, I will compare among two point wise tests of the SIC (bootstrap and t-test), a nonparametric test based on the maximum deviation of the SIC, a nonparametric Bayesian test of the functional form, and two parametric approaches. Each of these approaches have been used in various published and unpublished work to test for important properties of the SIC, but no systematic evaluation of all of the approaches has been undertaken. I will give confusion probabilities for each analysis using a range of simulated data. These results will be useful in guiding researchers in the appropriate statistical measure for a given data set. Email: Joseph Houpt, joseph.houpt@wright.edu

4:10-4:25 (101)

How Do information Processing Systems Deal With Conflicting Information? DANIEL LITTLE, *The University of Melbourne*. — In this presentation, we analyze how different information processing architectures deal with conflicting information. A robust finding is that RTs are slower when dealing with conflicting sources of information (e.g., determining whether a whale is a fish or a mammal? A whale has biological properties which make it a mammal but lives in an environment typically populated by fish) than when dealing with congruent sources of information (e.g., determining whether a trout is a mammal or a fish). The costs of conflicting information depend on the underlying processing architecture (e.g, serial, parallel, and coactive). We explore new developments in using conflicting information to indentify information processing architecture using a new measure of information processing called resiliency. Email: Daniel Little, daniel.little@unimelb.edu.au

4:30-4:45 (102)
The Fallacy of Placing Confidence in Confidence Intervals. RICHARD MOREY, *University of Groningen*, ERIC-JAN WAGENMAKERS, *University of Amsterdam*, RINK HOEKSTRA, *University of Groningen*, JEFFREY ROUDER, *University of Missouri*, MICHAEL D. LEE, *University of California Irvine.* — A crucial aspect of psychological science is making inferences from data. As dissatisfaction mounts with the currently popular paradigm of significance testing for drawing inferences, the question arises: what methods can replace significance testing? The answer to this question has the potential to shape psychological research for years to come; good inferential tools have the potential to lay the foundation for better reserch, while bad ones will cause more difficulties for psychological researchers attempting to learn from data. For years, confidence intervals (CIs) have been suggested as a replacement for significance testing. The conventional wisdom, as expressed through the methodological guidelines for many psychological journals, is that confidence procedures are a valuable inferential tool. We doubt this conventional wisdom. Confidence intervals, in general, do not have the properties ascribed to them. They have no necessary relationship to the precision of an estimate; they do not necessarily contain likely or probable values for a parameter; and they do not even necessarily provide for coherent inference. Bayesian procedures, on the other hand, offer all the properties that the proponents of CIs desire.
Email: Richard Morey, richarddmorey@gmail.com

4:50-5:05 (103)
Latent Variable Models for the Joint Analysis of Multiple Data Modalities. JOACHIM VANDEKERCKHOVE, MICHAEL NUNEZ, BETH BARIBAULT and RAMESH SRINIVASAN, *University of California, Irvine.* — We present a latent variable modeling approach to the joint analysis of multiple data modalities, such as behavioral and personality data, or behavioral and neural data. The approach relies on first defining a series of appropriate measurement models for each modality's raw data (e.g., behavioral models of choice response time [CRT] that are drawn from the cognitive science literature), and then defining a fully unobserved structure that determines the covariance between the relevant parameters of each measurement model (examples of which can be found in a broad psychometrical literature). Two example applications will include the simultaneous analysis of CRT data from an executive functions experiment with measures of trait dysphoria, and the joint analysis of CRT data from an steady state visually evoked potential experiment with EEG data.
Email: Joachim Vandekerckhove, joachim@uci.edu

5:10-5:25 (104)
Using a Comprehensive Capacity Measure to Obtain Normative Data on Audiovisual Speech Integration Ability. NICHOLAS ALTIERI and DANIEL HUDOCK, *Idaho State University.* — The ability to use visual speech information and integrate it with auditory cues is especially vital for listeners with mild to moderate hearing-impairment (Erber, 2003). It is thus important to develop comprehensive methods to assess integration skills, which ideally should incorporate both accuracy scores as well as processing speed since speech recognition is a dynamic process. A recently developed capacity-assessment measure (Altieri, Townsend, & Wenger, 2013; Townsend & Altieri, 2012), is one promising approach that examines audiovisual integration efficiency relative to race model predictions derived from auditory and visual-only abilities. In this study, normative data on integration skills were obtained from a large group of volunteers. Each listener participated in a multimodal sentence recognition experiment, and also a forced-choice speeded word recognition task in which capacity was measured. T-scores were computed with the purpose of providing a standardized sample to which a listener with suspected hearing impairment or perceptual deficits may be compared.
Email: Nicholas Altieri, altinich@isu.edu

Metamemory/Metacognition I
Regency D-F, H, Friday Afternoon, 3:50-5:30
Chaired by Gene Brewer, Arizona State University

3:50-4:05 (105)
Memory and Importance: Memory Accessibility Biases Judgments of Importance. GENE BREWER and AIKATERINI STEFANIDI, *Arizona State University.* — Judgments of importance are made on a daily basis, but researchers do not possess a reasonable scientific account for how these judgments are rendered. Importantly, noncriterial sources of information may bias judgments of importance in ways similar to other metacognitive assessments. Two experiments examined how memory test, retrieval feedback, and retrieval accuracy influence judgments of importance. In Experiment 1, participants studied a list of scientific theories and later tried to retrieve the name of each theory in either a cued recall or a recognition test. Following each retrieval attempt, participants rated the importance of the theory. Theories that were correctly remembered were rated as being more important than the theories that were not remembered. In Experiment 2 we used a similar procedure with the exception that all participants performed a recall test for half of the theories and a recognition test for the other half of the theories. The retrieval bias effect from Experiment 1 was replicated. Many times throughout a day an individual will rely on judgments of importance to facilitate their decision-making and lifestyle regulation. Memory retrieval processes systematically bias these judgments.
Email: Gene Brewer, gene.brewer@asu.edu

4:10-4:25 (106)
Effects of Episodically Related Information on Metacognitive Judgments During Learning. WILLIAM J. MUNTEAN and DANIEL KIMBALL, *University of Oklahoma* (Presented by Daniel Kimball). — Metacognitive judgments made during learning often reflect intrinsic properties of the to-be-learned material, such as encoding fluency and processing fluency. By contrast, when delayed judgments occur under conditions that allow for covert retrieval, retrieval fluency

is a potent and reliable indicator of future memorability. Unfortunately, the generation of potent mnemonic cues is not possible during learning, for the very presence of to-be-learned material prevents its covert retrieval. However, retrieval of episodically related information, such as previously studied material, is possible. Three experiments explored the effects of retrieving episodically related information on making immediate JOLs. Presented with previously studied cue-target word pairs, participants considered them when making JOLs on newly encountered word pairs. Manipulating presentation of previously studied word pairs varied the likelihood of their covert retrieval: Cue-only formatting promoted covert retrieval of episodically related target words, while cue-target formatting prevented such retrieval. Results are discussed in terms of cue-utilization theory.
Email: Daniel Kimball, dkimball@ou.edu

4:30-4:45 (107)
Metacognitively Mediated Processes Yield Results That Mirror the Effects of Conformity Pressures. ASHER KORIAT, *University of Haifa*. — Research has documented strong effects of group consensus on the judgments of individual members. In particular, majority views are expressed more quickly and are endorsed with greater confidence than minority views, with the majority-minority difference increasing with the size of the majority. These results have been assumed to stem from conformity pressures: Agreement with the group enhances subjective certainty, and disagreement causes hesitancy and inhibition in venturing a deviant opinion. However, the results to be reported suggest that the majority-minority differences can arise from the process underlying metacognitive judgments independent of any social influence. Nevertheless, these differences can have behavioral implications similar to the differences that are due to conformity pressures.
Email: Asher Koriat, akoriat@research.haifa.ac.il

4:50-5:05 (108)
Hyper'correction' of Already-Correct Knowledge? JANET METCALFE, *Columbia University*. — Four experiments investigate whether the correction of misinformation is cognitively indistinguishable from misinforming people at the expense of previously-held correct beliefs. In experiments similar to the 'hypercorrection' paradigm (in which people remember the corrections to high confidence errors better than to low confidence errors) people are asked to give answers to general information questions along with their confidence in the correctness of their answers. They then are given feedback. The change in the current experiments is that sometimes the feedback is not correct. In Experiment 1, for example, when people make a mistake they are given the correct answers as feedback, but when they are right they are given a good but incorrect answer to remember. The 4 experiments refine the counterbalancing, and participants' certainty about the correctness of the feedback. In all 4 experiments when an error was followed by corrective feedback hypercorrection of the high confidence errors was found. In no experiment was hyper'correction' found for already correct answers. It is

concluded that correction of misinformation is cognitively distinguishable from misinforming people at the expense of correct beliefs.
Email: Janet Metcalfe, jm348@columbia.edu

5:10-5:25 (109)
Methodological Issues Concerning Feeling-of-Knowing Accuracy. BENNETT SCHWARTZ, *Florida International University*, AYSECAN BODUROGLU and ALI TEKCAN, *Bogazici University*. — Critical to understanding metacognition is determining when judgments accurately predict performance. Extraneous factors, such as selection bias, can cloud this determination. In traditional feeling-of-knowing procedures, participants make judgments on unrecalled items only. However, some researchers elicit feeling-of-knowing judgments on all items. In the traditional method, selection bias may cause a restricted range when recalled items are eliminated, lowering accuracy. However, when feeling-of-knowing judgments are made on all items, participants may use recall as a basis for judgments, leading to higher judgments for recalled items, but causing a floor effect for judgments for unrecalled items. We present data from 71 conditions across 24 studies. When feeling-of-knowing judgments are made on all items, accuracy is higher than when feeling-of-knowing judgments are made on unrecalled items. When we look at the subset of unrecalled items within studies in which judgments were collected on all items, we find lower accuracy than for traditional judgments.
Email: Bennett Schwartz, schwartb@fiu.edu

Priming
Shoreline, Friday Afternoon, 3:30-5:30
Chaired by Davide Crepaldi, University of Milano Bicocca

3:30-3:45 (110)
Acoustic and Visual Masked Priming Are Both Sensitive to Morphology. DAVIDE CREPALDI and ROBERTO BOTTINI, *University of Milano Bicocca*. — An established fact in the masked priming literature is morphological priming, which attests how internal word structure is a critical factor during early stages in visual word identification (e.g., Rastle et al., 2000). Curiously, this is not mirrored at all in the auditory word identification literature, where morphological priming is considered to be inconsistent when primes are kept outside participants' awareness (Kouider and Dupoux, 2005). In the present study, we put this asymmetry at test by comparing auditory and visual masked morphological priming on the same material. Prime visibility/audibility was also assessed through a d–prime analysis. Results show that morphological primes (e.g., dealer for deal) facilitate target identification in both modalities. Although average d–prime was slightly higher with the acoustic material, it clearly showed that participants were not aware of the primes, either visual or acoustic. These data suggest the existence of general language identification mechanisms that operate independently of modality.
Email: Davide Crepaldi, davide.crepaldi1@unimib.it

3:50-4:05 (111)

Processing Differences Across Regular and Irregular Inflections Revealed Through ERPs. KATHLEEN RASTLE, *Royal Holloway, University of London*, AURELIU LAVRIC and HEIKE ELCHLEPP, *University of Exeter*, DAVIDE CREPALDI, *University of Milano Bicocca*. — Research suggests that printed words are recognized in terms of their constituent morphemes, but researchers have tended to consider derivations and inflections in separate theoretical debates. We investigated brain potentials in response to regular and irregular inflections in the context of masked priming. Significant behavioural masked priming effects were observed for regular and irregular inflections but were greater for regular inflections. Critically, ERP data suggested that these priming effects had different time courses. Priming for regular but not irregular inflections emerged in a time window reflecting processing up to 250 ms post target onset. Further, while priming for regular and irregular inflections was observed in a time window reflecting processing 400-600 ms post target onset, these effects arose earlier and were of greater magnitude for the regular inflections. These data support a 'form-then-meaning' characterisation of visual word recognition developed in respect of derivational morphology and raise challenges for alternative approaches.
Email: Kathleen Rastle, kathy.rastle@rhul.ac.uk

4:10-4:25 (112)

Individual Differences in Masked Semantic Priming: The Role of Lexical Quality. SALLY ANDREWS and VIOLET XIA, *University of Sydney*. — We recently reported that individual differences in spelling and vocabulary modulate masked morphological priming (Andrews & Lo, 2013). An orthographic profile of higher spelling than vocabulary was associated with morphographic decomposition; while the reverse semantic profile predicted early semantic activation. The present study used a masked priming semantic categorization task to extend these findings. 'Animal' categorization responses were compared for exemplars and non-exemplars primed by category congruent primes that were high (eg hawk-EAGLE; pistol-RIFLE) or low (eg mole-EAGLE; boots-RIFLE) in semantic overlap. High average proficiency in spelling and vocabulary predicted stronger congruence priming. This was restricted to high overlap primes for exemplars but extended to both prime types for non-exemplars. Priming was also significantly modulated by the difference between spelling and vocabulary. The semantic profile was associated with an additional boost in priming for high overlap primes that was completely absent in those with the orthographic profile. These results confirm our earlier evidence of individual differences in the balance between orthographic and semantic processing in early retrieval.
Email: Sally Andrews, sally.andrews@sydney.edu.au

4:30-4:45 (113)

Stroop, Priming and Attentional Control. SACHIKO KINOSHITA and MELISSA AJI, *Macquarie University*. — In the classic Stroop task, the stimulus is a colored word (e.g., the word "GREEN" presented in red) and participants respond to the color. It is well-established that the "interference effect" – the difference between the incongruent condition (e.g., the word GREEN presented in red) and neutral condition (e.g., a row of Xs presented in red) – is small for fast responses and increases as responses slow. Spieler, Balota & Faust (2000, JEP:HPP) showed that for spatially separated Stroop stimuli (where the word appears above/below a color patch) however, the RT distribution pattern changes to a constant effect across the RT range. Here we report that temporally separated Stroop stimuli, i.e., where a word prime is presented before a color patch, also show a distributional shift pattern, both when the prime is clearly visible and when it is backward-masked. The results are discussed in terms of source confusion and attention control.
Email: Sachiko Kinoshita, sachiko.kinoshita@mq.edu.au

4:50-5:05 (114)

Capable Primes Cabbage Only When You Are Looking for Vegetables. KENNETH FORSTER and SHILOH DRAKE, *University of Arizona*. — A fundamental assumption of interactive-activation models of visual word recognition is that activation is passed from one level to the next without waiting for resolution. This means that a letter string should momentarily activate the semantic properties of every word that it resembles. One line of evidence that supports this prediction is that in a semantic categorization experiment, a masked nonword prime that is similar to an exemplar will interfere with the response to a nonexemplar (e.g., spoder–LION with INSECT as category). Although one would not expect the same congruence effect if the prime was a word that resembled an exemplar (due to competition between word units), a similar congruence effect is nevertheless obtained. The critical issue is whether this effect only occurs in a semantic categorization task. Using a semantic relatedness task ("are these two words related in any way?") it is shown that a "No" response is slower when the first word is an exemplar of a category (e.g., lettuce) and the second is a neighbor of another member of that category (e.g., capable), but this effect completely disappears when the order of the two words is reversed.
Email: Kenneth Forster, kforster@u.arizona.edu

5:10-5:25 (115)

It Takes Time to Prime: Semantic Priming in the Ocular Lexical Decision Task. PETER GORDON, *University of North Carolina*. — We evaluate the contributions of response mode and task goals to semantic priming by replacing the manual response mode typically used in lexical decision tasks (LDT) with an eye-movement response through a sequence of three words. These ocular LDs were much shorter than manual LDs for the same words in the English Lexicon Project (ELP), yet showed a stronger relationship with word frequency as well as a robust effect of semantic priming. Ex-Gaussian distribution fits revealed priming was most pronounced in the slow tail of the distribution. This pattern shows differential use of the prime information, which is more heavily recruited in cases where the LD is more effortful. Compared to manual LDs, which have not shown differences in the size of the priming

effect across the RT distribution, the highly practiced nature of forward saccades renders ocular LDs a more sensitive measure of this task-related influence on word recognition.
Email: Peter Gordon, pcg@email.unc.edu

Ad Hoc Cognition
Regency A-C, Friday Afternoon, 4:10-5:30
Chaired by Gary Lupyan, University of Wisconsin-Madison

4:10-4:25 (116)
Ad Hoc Cognition: A Framework for Cognitive Science. DANIEL CASASANTO, *University of Chicago*. — To explain how people think and communicate, cognitive scientists posit a repository of concepts, categories, and word meanings (CC&Ms) that are stable across time and shared across individuals. But perhaps this stability is an illusion. Perhaps all CC&Ms are constructed ad hoc each time we use them. According to the Ad Hoc Cognition framework, all words are infinitely polysemous, all communication is "good enough," and no idea is ever the same twice. This framework builds upon previous suggestions that some CC&Ms are created ad hoc, but rejects the notion that these are exceptions: Even the most stable-seeming CC&Ms are constructed ad hoc, and their construction is always context-dependent. A central goal of cognitive science, then, should be to understand the fleeting, idiosyncratic patterns of neurocognitive activity that constitute our thoughts, rather than to discern the nature and origin of stable, universal, context-independent CC&Ms, which only exist as theoretical abstractions.
Email: Daniel Casasanto, casasanto@alum.mit.edu

4:30-4:45 (117)
A Word is Worth (More Than) a Thousand Pictures. JEFFREY ELMAN, *Cognitive Science*. — I suggest that rather than thinking of words as having meaning, words are cues to meaning. Of course, this does not solve the question of what meaning is cued, but it does open the door to thinking of meaning in different ways. In this talk, I outline a framework in which event representations play a central role in meaning. Events, in this framework, may be thought of a kind of ad hoc category in which participants, contexts, and activities are bound together by causal relationships. I speculate that, extending Barsalou's notion of ad hoc categories as goal derived, all categories may ultimately be functionally motivated. The talk will include presentation of a computational model of event representations, as well as data from language comprehension tasks using eye-tracking involving both typical and atypical populations.
Email: Jeffrey Elman, jelman@ucsd.edu

4:50-5:05 (118)
Semantics Without Borders. MICHAEL SPIVEY, *University of California, Merced*. — Every time a concept is activated it is realized with a slightly different shading in its meaning, with a slightly different emphasis on certain semantic features. In fact, when a conceptual representation is implemented by a distributed pattern of activation across thousands of neurons (e.g., a population code), it would be impossible for those neurons to ever repeat their exact pattern of firing rates from one instance to the next. When these population codes are treated mathematically as locations in a state space, it becomes clear that each concept is a region in that state space, and that the fringes of any given concept overlap with the fringes of many other concepts. By placing borders, or partitions, between these regions, one can assign labels to these concepts (e.g., symbolic dynamics). However, these conceptual labels may be more of a descriptive convenience than actual causal components. I will discuss the relationship between classical representationalism and symbolic dynamics, and how they contrast with continuous representational dynamics.
Email: Michael Spivey, spivey@ucmerced.edu

5:10-5:25 (119)
Words Do Not Map Onto Concepts; Words Help Create Them. GARY LUPYAN, *University of Wisconsin-Madison*. — The claim that all concepts are ad hoc mental representations that are dynamically assembled rather than accessed for a given task appears to run into an immediate challenge. If concepts are so experience-and task-dependent, what is it that words map onto? I will argue that words do not map onto concepts. Rather, they help create them. Words carve joints into nature, and create islands of apparent stability. I will describe a series of experiments showing that not only do words directly affect how putatively nonverbal cognitive and perceptual processes unfold, but mental representations cued by verbal labels are more categorical and stable than they would be in the absence of linguistic input. This function of language turns out to emerge naturally from thinking of cognition and perception in terms of predictive coding with words providing high-level hypotheses otherwise unavailable to the organism.
Email: Gary Lupyan, lupyan@wisc.edu

Visual Search
Beacon A, Friday Afternoon, 3:30-5:30
Chaired by Stefanie I. Becker, University of Queensland

3:30-3:45 (120)
Mirror Blindness: Our Failure to Recognize the Target in Search for Mirror-Reversed Shapes. STEFANIE BECKER, DUSTIN VENINI and JAMES D. RETELL, *The University of Queensland*, JEREMY M. WOLFE, *Brigham and Women's Hospital/Harvard Medical School*. — Search for mirror-reversed items is especially difficult and takes much longer than finding targets that are flipped horizontally or show other differences in orientation. It has generally been assumed that these difficulties are rooted in the difficulty to find the target. The present study monitored the observer's eye movements during search and found no evidence for this view: Mirror-reversed targets were selected as early as other targets. However, observers frequently failed to notice that they were fixating on the target and continued searching. The failure to recognize the target could be observed even when the target was always kept constant and only the irrelevant distractors varied across trials. Mirror blindness was attenuated only when both the target and the distractors were kept constant across all trials. These findings show that the composition

of distractors can strongly affect object identification, and demonstrate that object recognition is to some extent context-dependent.

Email: Stefanie I. Becker, s.becker@psy.uq.edu.au

3:50-4:05 (121)
The (Minimal) Role of Familiarity in Hybrid Visual and Memory Search. JEREMY WOLFE, *Brigham and Women's Hospital/Harvard Medical School*, TRAFTON DREW, *Harvard Medical School*, SAGE E. P. BOETTCHER, *Brigham and Women's Hospital*. — In "hybrid" search, observers look through visual displays for any of several targets held in memory. If distinctive objects are used as targets, it is not difficult to search for 100 or more targets at the same time. How is this done? Obviously, 100 objects are not simultaneously in residence in limited-capacity visual working memory. One possibility is that observers simply look for targets that are distinguished from distractors by their familiarity – a popular idea in memory models. In one experiment, we arranged for target and distractor items to be presented equally often over a block of trials. This had minimal impact on speed or accuracy of the search. In other experiments, we included distractors that were markedly more common than any target. These distractors were mistaken for targets no more frequently than novel distractors. The success of hybrid search is not driven by a familiarity signal.

Email: Jeremy M. Wolfe, jwolfe@partners.org

4:10-4:25 (122)
Dealing With Distraction During the Attentional Blink. JOHN MCDONALD, JOHN M. GASPAR, HAYLEY E. P. LAGROIX and VINCENT DI LOLLO, *Simon Fraser University*, PIERRE JOLICOEUR, *University De Montreal*. — Perceptual suppression of distracting stimuli in visual search appears to be indexed by an ERP component called the Distractor Positivity (PD). To assess whether the PD relies on top-down control, we used an attentional blink (AB) paradigm in which identification of the second of two targets (T2) is impaired when it comes within about 500 ms after the first (T1). In our experiment, T1 was a digit, and T2 was an 10-element circular search array containing a target and a salient distractor. T2 was presented at a lag of either 200 or 800 ms after T1 (within – or outside – the period of the AB, respectively). A PD was in evidence at the long lag, when attentional resources were again available, but not at the short lag, while the system was busy processing T1. We conclude that perceptual suppression – as indexed by the PD – is contingent on top-down control.

Email: John McDonald, jmcd@sfu.ca

4:30-4:45 (123)
Top-Down Guidance Can Select Color in Singleton Search, Especially With Slow Responses. ZHE CHEN, *University of Canterbury*, KYLE CAVE, *University of Massachusetts*. — In search, bottom-up attentional effects allow singletons to be found quickly. It is unclear how much top-down mechanisms contribute to singleton search when the relevant feature dimension is known. A cue indicating the relevant feature dimension can speed search, but Theeuwes, Reimann, & Mortier (2006) attributed these effects to nonattentional

factors. They found no evidence of top-down guidance by verbal cues when using a compound search task in which participants first searched for a color or shape singleton and then reported the orientation of a line segment within the singleton. However, their neutral cue trials were blocked separately from the valid and invalid cue trials, so that participants who had neutral cues first may have learned to ignore the cues. In new experiments, the different cue conditions were randomly intermixed, and the top-down effects returned for color targets. The cuing effect is stronger for participants who respond slowly, suggesting that the top-down influence takes time to develop during a trial.

Email: Zhe Chen, zhe.chen@canterbury.ac.nz

4:50-5:05 (124)
What Can 1,000,000,000 Trials Tell Us About Visual Search? STEPHEN MITROFF, ADAM T. BIGGS, STEPHEN H. ADAMO, EMMA WU DOWD, JONATHAN WINKLE and KAIT CLARK, *Duke University*. — In 1998, Jeremy Wolfe collated data from 2500 experimental sessions and 1 million trials to provide key insights into visual search (Wolfe, 1998). This is an example of using big data to reveal new effects and to test theories in a way that is beyond the scope of typical datasets. Through the mobile app Airport Scanner (www.airportscannergame.com), we have amassed visual search data from 70 million experimental sessions and nearly 2 billion trials (so far). In Airport Scanner, players act as baggage screeners and search for illegal items amongst legal distractors. The game interface offers a smorgasbord of variables for vision scientists: hundreds of different targets and distractors, variable numbers of items in each bag, go/no-go trials, etc. With access to output that includes response time and accuracy data along with descriptive information (type of bag, which targets/distractors were present, etc.), we can ask and answer a wide variety of questions that would be near impossible to address in a standard laboratory setting. In this presentation, we will discuss several research topics we have examined to date. We will also discuss how this, and other forms of big data, can be used to advance psychological science.

Email: Stephen Mitroff, mitroff@duke.edu

5:10-5:25 (125)
Comparing the Prevalence Effect in the Laboratory and the Field: A Meta-analysis. TODD HOROWITZ, *National Cancer Institute*. — Many socially critical visual search tasks, such as baggage screening or mammography, are also low-prevalence search tasks, where targets are rare. Laboratory visual search experiments suggest that low prevalence leads to a robust criterion shift that leads observers to miss targets more often, without impairing overall sensitivity. Can we generalize to professional radiologists in the field? I summarize data from three study types: cognitive laboratory studies; laboratory studies of radiologists; and analyses of large-scale field studies. Prevalence ranged from .00032 to .83. In laboratory studies, sensitivity tends to increase with prevalence (mean slope = 1.07), while criterion becomes more liberal (mean slope = - 0.33). For field studies, sensitivity shows small, non-significant declines as prevalence increases

(mean slope = -1.20), but criterion becomes substantially more conservative (mean slope = 1.91). These discrepancies point to important gap in our understanding of the prevalence effect in complex applied search tasks.
Email: Todd Horowitz, todd.horowitz@nih.gov

Judgment and Decision Making I
Seaview A & B, Friday Afternoon, 3:30-5:30
Chaired by Petko Kusev, Kingston University
London/City University London

3:30-3:45 (126)
Uncertainty and Morality of Utilitarian Judgments. PETKO KUSEV, *Kingston University London/City University London*, PAUL VAN SCHAIK, *Teesside University*, SHROOQ ALZAHRANI, *City University London*, SAMANTHA LONIGRO, *Kingston University London*, SVITLANA KUVALDINA, *University of Information Technology and Management Rzeszow*. — Is it acceptable and moral to sacrifice a few people's lives to save many others? Research on moral dilemmas has shown that respondents judge personal moral actions as less appropriate than equivalent impersonal moral actions. Accordingly, theorists (e.g., Greene et al., 2001) have argued that judgments of appropriateness in personal moral dilemmas are (i) more emotionally salient than impersonal moral dilemmas, and (ii) more cognitively demanding, as respondents spend relatively more time judging the appropriateness of personal moral actions. In contrast, our research shows that level of uncertainty rather than personal involvement influence judgments of appropriateness. Information about moral actions and consequences eliminates uncertainty, and boosts the visibility of utilitarian moral actions; accordingly, respondents judge utilitarian moral actions as increasingly appropriate. Our findings highlight a need to investigate how variation in uncertainty produces variation in utilitarian judgments.
Email: Petko Kusev, p.kusev@kingston.ac.uk

3:50-4:05 (127)
How You Make Moral Judgments: You're More Rational Than You Think. DALE COHEN and MINWOO AHN, *University of North Carolina, Wilmington*. — Historically, researchers have debated whether moral judgment is primarily the product of a controlled utilitarian process or an automatic intuitive process. Recently, a dual-process theory of moral judgment (Greene et al., 2001) has proposed that both of these processes are active in moral judgment, but are often in conflict with one and other. We argue that the conclusions of previous research are based on untested, and invalid, assumptions. Here, we present a computational utilitarian model of moral judgment that makes point predictions for both RT and accuracy. We test this model in two experiments. The utilitarian model accounts for over 90% of the variance in the data, suggesting that controlled and intuitive processes are not in competition.
Email: Dale Cohen, cohend@uncw.edu

4:10-4:25 (128)
Killing the Fat Man or el Hombre Gordo: Why Are People More Utilitarian in a Foreign Language? JOANNA COREY, *Universitat Pompeu Fabra*, BOAZ KEYSAR and SAYURI HAYAKAWA, *University of Chicago*, MELINA APARICI, *Universitat Autònoma de Barcelona*, ALICE FOUCART and ALBERT COSTA, *Universitat Pompeu Fabra* (Presented by Boaz Keysar). — Would you kill one man to save five? Most people would not, as deep moral rules against killing win out over utilitarian considerations. We propose that language plays a crucial role in this decision, because one's native tongue provides emotional intimacy that renders killing the man particularly aversive. We discovered that when people face the dilemma in a foreign language, they are dramatically more utilitarian. We report this discovery, demonstrate the role of emotional distance, and rule out alternative explanations. This shows that a native tongue is essential to the pattern of moral choice that is presumably language-free. Using a foreign language fundamentally changes such moral choices. Theories of morality, then, should account for how the language used to represent a situation alters our sense of right and wrong. This discovery also has important practical implications for policy makers and for billions of people who regularly use a foreign language.
Email: Boaz Keysar, boaz@uchicago.edu

4:30-4:45 (129)
Individual Differences and Fitting Methods for the Two-Choice Diffusion Model. ROGER RATCLIFF, *The Ohio State University*. — Methods of fitting the diffusion model to data were examined. For two experiments, individual differences, practice effects, and the effects of numbers of observations were examined. These also provided ranges in the parameter values across individuals for simulation studies. We examined how well several diffusion-model fitting packages and methods recovered individual differences with and without contaminants and as a function of the number of observations. In a second study, 64 sets of simulated data from each of 48 sets of parameter values and different numbers of observations were fit and biases and standard deviations in recovered model parameters were compared across methods. Finally, a standard chi-square method and a hierarchical Bayesian method were compared. The results from these studies can be used for selecting fitting methods and for understanding the strengths and weaknesses of diffusion model analyses in examining individual differences in clinical, neuropsychological, and educational testing.
Email: Roger Ratcliff, ratcliff.22@osu.edu

4:50-5:05 (130)
Psychology of Ownership: Typology of Experience and Dynamics of Valuation. X.T. WANG, *University of South Dakota*, LAY SEE ONG, *Singapore Management University*, JOLENE H. TAN, *Max Planck Institute for Human Development*. — We examined how ownership experience affects the valuation of a good. We hypothesize that the sense of ownership is a psychological derivative of resource acquisition and allocation. We predict a valuation order of constant ownership or no-ownership < transactional (interchanging)

ownership < sudden transition in ownership. One hundred and sixty six participants played a product acquisition game that resulted in gains and losses of actual products (e.g., a pen, a mug, or a flashlight) with different outcome sequences. After each game, the participant priced the target object either as willingness-to-pay, if the last outcome was a loss, or willingness-to-accept, if the last outcome was a gain. As predicted, ownership experience eliminated loss aversion and diminishing marginal valuation. The valuation of an object was highest after experiencing a sudden change in ownership from losses to a final gain or from gains to a final loss, followed by interchanging ownership, and was lowest following a stable (patrimonial) ownership or constant no-ownership. The results suggest that some key decision phenomena such as loss aversion and diminishing marginal utility are better understood as results of specific ownership experience.
Email: X.T. Wang, xtwang@usd.edu

5:10-5:25 (131)

The Impact of Shifting Delay Ranges on Temporal Discounting. MARY KAY STEVENSON, WENDY AMADOR, LEESHA MONY and STEPHEN HANNAH, *California State University East Bay*. — This study describes the impact of shifting the temporal context of gains and losses when they are presented alone and combined. Using a judgment task, temporal discounting was measured for gains and losses. For two groups the gains were shifted to longer delays in the first condition and shorter delays in the second condition. For two additional groups, the payments were shifted to shorter delays or longer delays. Discounting differed for gains and losses regardless of whether they were presented alone or in the same stimulus indicating that they are processed independently. However, shifting the delay range for gains influenced discounting of losses when they were presented together but not when they were presented alone. Shifting the time range for gains affected the discounting of losses when they were presented together. These results are related to a general theory of discounting.
Email: Mary Kay Stevenson, marykayste@gmail.com

Memory: Reward and Motivation
Regency D-F, H, Saturday Morning, 8:00-9:40
Chaired by Steven Most, University of New South Wales

8:00-8:15 (132)

A Retrograde Memory Boost from Five Minutes of Exercise.
STEVEN MOST and BRIANA KENNEDY, *University of New South Wales*, EDGAR A. PETRAS, *University of Maryland, Baltimore*. — Memories consolidate over time, with one consequence being that what we experience after learning can influence what we remember. Across three experiments, participants who engaged in 5 minutes of low-impact aerobic exercise immediately after learning showed better recall for paired associations than did participants who engaged in a non-exercise control activity. In Experiments 1 and 2, this benefit was apparent in a direct comparison between exercise and non-exercise groups. In Experiment 3, it was reflected in a positive correlation between memory performance and exercise-induced change in heart rate. Consistently, such memorial benefits emerged only among female participants. In Experiment 1, half the participants alternatively engaged in an equivalent period of exercise prior to learning, with no benefits for retention of the learned material, suggesting that the memorial benefits of exercise-induced arousal reflects a specific impact on post-learning processes such as memory consolidation.
Email: Steven Most, s.most@unsw.edu.au

8:20-8:35 (133)

Stress Selectively Affects Long-Term Retention of Reactivated, But Not Non-Reactivated Parts of a Memory.
ALMUT HUPBACH and JOELLE DORSKIND, *Lehigh University*. — When long-term memories are reactivated, they can re-enter a transient plastic state. The present study compared the effects of stress on reactivated and non-reactivated components of a declarative memory in a within-subject design. We presented animal-object image pairs, and instructed participants to memorize the object images. Forty-eight hours later, we presented half of the animal images again in an unrelated task to reactivate the associated object images. Participants were then exposed to cold pressor stress or a warm water control condition. Forty-eight hours later, we assessed memory for the object images. Reactivation boosted memory performance in the control condition. Crucially, this memory-enhancing effect of reactivation was completely abolished by cold pressor stress. Importantly, stress selectively impacted only the reactivated items while leaving memory for the non-reactivated items unaffected. The present study shows that it is possible to selectively reactivate and modulate specific parts of a declarative memory.
Email: Almut Hupbach, hupbach@lehigh.edu

8:40-8:55 (134)

Distracted by Cues for Suppressed Memories. PAULA HERTEL, JEFFREY HAYES and ALEXANDRA BARRIONUEVO, *Trinity University*, NILLY MOR, *Hebrew University*. — To examine possible distraction by cues for suppressed thoughts, we used the think/no-think (TNT) paradigm with a flanker task inserted between the TNT phase and the recall test. Respond cues in TNT were emotionally positive words; baseline and suppression cues were negative homographs. Mainly neutral targets in the flanker task were judged for emotional valence, with flankers varying in emotional valence. TNT Suppression cues used as flankers delayed responding to the targets, compared to baseline cues and new negative homographs. As predicted, this flanker effect obtained only when the TNT phase employed direct-suppression instructions, not when substitutes had been provided to aid suppression and change the cues' meaning. Moreover, in the unaided condition, the flanker effect was positively correlated with the suppression effect on free recall.
Email: Paula Hertel, phertel@trinity.edu

9:00-9:15 (135)

Item Value Primarily Enhances Recollection in Recognition Memory. JOSEPH HENNESSEE, MICHAEL COHEN, ALAN CASTEL, and BARBARA KNOWLTON, *University of California, Los Angeles* (Presented by Barbara Knowlton). — People are confronted with a wealth of information, some of it important to remember and some not. Here, 64 subjects studied words that were associated with either high or low point values. Subjects received the corresponding points at test for recognized words, and lost points for false alarms. For each word at test, they decided whether or not they remembered the moment they had studied it. If they were unable to recollect the moment the item had been presented, they rated the item on a 6-point scale, with 6 being "sure old" and 1 being "sure new". The results showed more hits for items associated with high values at study. This effect was driven by recollected items; confidence ratings for non-recollected items were not affected by value. Subjects may engage in deeper semantic processing of high-value items. In contrast, value does not appear to have a strong effect on subsequent familiarity.
Email: Barbara Knowlton, knowlton@psych.ucla.edu

9:20-9:35 (136)

How Does Success Impact the Subjective Value of Learning and Test Experiences? BRIDGID FINN, *Educational Testing Service*. — Remembered utility is the retrospective evaluation about the pleasure and pain associated with a past experience. It can influence choices about repeating or avoiding similar situations in the future. A set of experiments explored the remembered utility of effortful learning and test episodes and how it impacted future study and test choices. The studies mimicked Kahneman et al.'s, (1993) cold-pressor study, but used a tough learning or test experience in place of submerging one's hand in painfully cold ice water. In the learning series, students studied a short and an extended list of difficult vocabulary words. The short list was made of 30 difficult words. The extended list used 30 difficult words plus 10 moderately difficult words. Students made retrospective evaluations about the lists and chose which kind of list (short or extended) they wanted for their next list. The test series used a similar procedure. Results showed that a tough study or test episode extended by a more moderate interval was preferred to an unextended interval. Future study and test

choices reflected this preference. The findings suggest that the means of acquiring or demonstrating knowledge has value in learning and test experiences.
Email: Bridgid Finn, bfinn@ets.org

Eyewitness Identification
Regency A-C, Saturday Morning, 8:00-9:20
Chaired by Curt Carlson, Texas A&M University-Commerce

8:00-8:15 (137)

An Evaluation of Lineup Presentation, Weapon Presence, and a Distinctive Feature Using ROC Analysis. CURT CARLSON and MARIA CARLSON, *Texas A&M University - Commerce*. — We conducted an experiment (N = 2675) including both laboratory and online participants to test hypotheses regarding important system and estimator variables for eyewitness identification. Simultaneous lineups were compared to sequential lineups with the suspect presented early versus late because there is evidence that suspect position could be an important factor determining a simultaneous versus sequential advantage in guilty-innocent suspect discriminability. We also manipulated whether or not the perpetrator held a weapon or had a distinctive feature on his face, to re-evaluate recent evidence that these factors interact. Overall, the simultaneous lineup yielded higher discriminability than the sequential lineup, and there was no effect of sequential position. Discriminability was higher when the perpetrator had no weapon, but only when no distinctive feature was present. We conclude with a discussion of the importance of exploring interactions between system and estimator variables using Receiver Operating Characteristic (ROC) analysis.
Email: Curt Carlson, curt.carlson@tamuc.edu

8:20-8:35 (138)

Misinterpreting Eyewitness Expressions of Confidence: The Justification Effect. CHAD DODSON and DAVID DOBOLYI, *University of Virginia*. — When eyewitnesses provide a verbal expression of confidence about a lineup identification, such as "I'm pretty sure it's him," how well do others understand the intended meaning of this statement of confidence? And, how is this perception of the meaning influenced by justifications of the level of confidence, such as when eyewitnesses say, "I remember his chin"? The answers to these questions are unknown as there is no research on how others interpret the intended meaning of eyewitness confidence. We show that an additional justification of confidence, relative to seeing a confidence statement alone, increases variability and misunderstanding in others' estimation of the meaning of the expression of confidence. Moreover, this justification-induced increase in variability and misunderstanding primarily occurs when the justification refers to an observable facial feature and not when it refers to an unobservable quality (e.g., He is very familiar). The data support a Perceived-Diagnosticity account of assessing eyewitness confidence.
Email: Chad Dodson, cdodson@virginia.edu

8:40-8:55 (139)

A Direct Comparison of US vs. UK Standardized Lineup Procedures. LAURA MICKES and TRAVIS SEALE-CARLISLE, *Royal Holloway, University of London*, JOHN WIXTED, *University of California, San Diego*. — A major goal of eyewitness identification research is to find factors that increase discriminability (i.e., the ability to discriminate innocent from guilty suspects). In a step toward achieving this goal, the current standard procedural practices of two countries were investigated. The lineup procedures of the US were directly compared to the lineup procedures of the UK using receiver operating characteristic (ROC) analysis. Some notable differences between the two procedures include: nominal lineup size (6-person vs. 9-person), procedural format (simultaneous vs. sequential), and presentation format of lineup members (photos vs. videos). Participants watched a brief video of a mock crime and were tested on either lineup procedure. ROC analysis revealed discriminability was significantly better when tested with the standard US lineup procedure. The results support the diagnostic-feature-detection hypothesis (Wixted & Mickes, 2014), which states that the more eyewitnesses are cued into diagnostic features (and ignore nondiagnostic features), the better the discriminability.
Email: Laura Mickes, Laura.Mickes@rhul.ac.uk

9:00-9:15 (140)

Description Benefits for Faces on Recognition Memory: Effects of Study Repetition and Knowledge of Description Condition. TODD JONES, KEALAGH ROBINSON and BRENNA C. STEEL, *Victoria University of Wellington*. — Studies have shown that giving short verbal descriptions of faces in a study phase leads to superior recognition memory performance relative to a no-description (view only) control condition. In a series of experiments on this description benefit, some faces were repeated during the study phase. Study repetition and description benefits were obtained, with faces in a repeated description condition producing the best performance. The benefit appeared to be influenced by whether participants were informed that a face was to be described or viewed before the face was presented, so informed and uninformed conditions were directly compared in a within-participants design. The primary difference was that performance for view only conditions was lower when participants knew beforehand that a face was only to be viewed. For all experiments, participants' ability to retrieve descriptions that they had given during the study phase was examined.
Email: Todd Jones, todd.jones@vuw.ac.nz

Psycholinguistics II
Seaview A & B, Saturday Morning, 8:00-10:00
Chaired by Adrian Staub, University of Massachusetts

8:00-8:15 (141)

Co-Registration of Eye Movements and EEG Demonstrates Dissociation of Predictability and Frequency Effects in Reading. ADRIAN STAUB, *University of Massachusetts*, FRANZISKA KRETZSCHMAR and MATTHIAS SCHLESEWSKY, *Johannes Gutenberg University Mainz,*

Germany. — Lexical predictability and frequency both influence eye fixation durations in reading, typically in an additive manner. Predictability also influences the N400 in ERP studies, but frequency appears to do so only when a word is presented without substantial preceding sentence context. In the present study, subjects (N = 38) read sentences with target words for which predictability and frequency were varied factorially. Eye movements and EEG were simultaneously recorded. Predictability influenced the amplitude of the N400, time-locked to the onset of the first fixation on the target word. However, there was no apparent effect of word frequency in the EEG record. As expected, significant, additive effects of the two factors appeared in fixation duration measures. We conclude that the discrepancy between methods is real, with only eye movements showing sensitivity to word frequency in sentence reading. Moreover, the discrepancy cannot be attributed to the use of RSVP format in previous ERP studies. We discuss implications for the interpretation of the N400, and for the relationship between predictability and frequency effects in language comprehension.
Email: Adrian Staub, astaub@psych.umass.edu

8:20-8:35 (142)

Linguistic Sound Patterns and Their Speech Vessel. IRIS BERENT, *Northeastern University*, ANNA-KATHARINE BREM, *Beth-Israel Deaconess Medical Center, Harvard Medical School,* XU ZHAO, *Northeastern University,* ERICA SELIGSON, *Beth-Israel Deaconess Medical Center, Harvard Medical School,* HONG PAN, EMILY STERN and JANE EPSTEIN, *Brigham and Women's Hospital, Harvard Medical School,* ALBERT GALABURDA and ALVARO PASCUAL-LEON, *Beth-Israel Deaconess Medical Center, Harvard Medical School.* — Across languages, syllables like blog are preferred to lbog, and similar preferences are evident in the behavior of individual speakers. Of interest is whether those preferences reflect abstract linguistic rules, or motor demands associated with speech production. To address this question, here we gauge the sensitivity of English speakers to the universal syllable hierarchy (e.g., blif≻bnif≻bdif≻lbif) while undergoing transcranial magnetic stimulation (TMS) over the cortical motor representation of the left orbicularis oris (OO). In line with the motor account, TMS impaired participants' global sensitivity to the number of syllables, and a subsequent fMRI experiment confirmed that the cortical stimulation site was sensitive to the syllable hierarchy. Contrary to the motor account, however, ill-formed syllables were least likely to engage the lip motor area and least impaired by TMS. Results suggest that speech perception automatically triggers motor action, but this effect is not causally linked to the computation of linguistic structure.
Email: Iris Berent, i.berent@neu.edu

8:40-8:55 (143)

About a Dog That Walks a Man Who Barks. Semantic, not Positional, Distances Between Words Affect Processing Difficulty for Complex Sentences With Relative Clauses. FENNA POLETIEK, *Leiden University*, JUN LAI, *Tilburg University.* — Linearly organized structures in language are supposed to be easy, while hierarchical information is difficult to process. Traditional accounts attribute the difficulty of processing hierarchical sentences (the dog the man walks, barks) to the long positional distances between dependencies (Gibson, 1998). Alternately, linear structures (the man walks the dog that barks) are assumed easier to process. In a sentence comprehension study, structure (i.e., positional distance between dependencies) was manipulated (hierarchical versus linear), and congruency between the semantic and the positional dependencies, being either congruent as in the dog the man walks, barks, neutral, as in the dog the man sees, walks, or incongruent as in the man the dog walks, barks (barks being syntactically dependent on man, but semantically on dog). The data show that structure did not, whilst semantic-syntactic congruency did strongly affect comprehension, suggesting a striking new perspective on the cognitive versus formal complexity of human language.
Email: Fenna Poletiek, poletiek@fsw.leidenuniv.nl

9:00-9:15 (144)

Model-Based Analyses of Low-Literacy Adults' Reading Difficulties. GAIL MCKOON, *The Ohio State University.* — In educational research, an individual's reading difficulties are usually assessed with a broad battery of tests, with several tests for each hypothesized construct (e.g., working memory, vocabulary, reading speed). The scores for the tests of each construct are averaged to provide a measure of an individual's ability for that construct. In contrast, we attempt to understand the basic processes responsible for performance using a model-based approach. To compare word recognition abilities between low-literacy adults and college students, we applied the diffusion model to the response time distributions and accuracy from a lexical decision task. For words that were difficult for the low-literacy adults (less than 80% correct), drift rates from the model were correlated 0.67 with a linear combination of scores from the WAIS-IQ vocabulary test and a nonword naming test (TOWR-nonword). Other reading tests did not improve the correlation and cross-validation showed it was reliable.
Email: Gail McKoon, mckoon.1@osu.edu

9:20-9:35 (145)

Evidence Against Separate Processing of Idiomatic and Compositional Phrases. HAJNAL JOLSVAI, STEWART M. MCCAULEY and MORTEN CHRISTIANSEN, *Cornell University* (Presented by Morten Christiansen). — The standard words and rules" account suggests that idioms are accessed directly from memory and thus processed faster than compositional phrases, which are presumed to be generated "on the fly." However, we provide evidence that idiomatic and compositional phrases are processed in the same way, both representing form-meaning pairs in line with Construction Grammar theories. Processing latencies for idioms (e.g. play the field), meaningful compositional phrases (e.g., nothing to wear), and less meaningful fragments (e.g., without the primary) were compared. The three types of 3-word sequences were matched for whole- and sub-string frequency and were normed for plausibility, meaningfulness, and idiomaticity. Reaction times for the idioms and meaningful compositional phrases were statistically indistinguishable, while responses to the less meaningful fragments were significantly slower. Meaningfulness norming scores emerged as the best predictor

of reaction times, whereas idiomaticity ratings bore no relationship to the speed with which subjects responded to multiword sequences.
Email: Morten Christiansen, christiansen@cornell.edu

9:40-9:55 (146)
The (Non)interaction of Verb Argument and Prosodic Information During L1 and L2 Comprehension: An Auditory ERP Study. CARRIE N. JACKSON, *Pennsylvania State University*, CHELSEA EDDINGTON and NATASHA TOKOWICZ, *University of Pittsburgh*, JANET G. VAN HELL, *Pennsylvania State University, Radboud University*, SONJA A. KOTZ, *University of Manchester*. — Language comprehension involves simultaneously processing multiple linguistic cues, a difficult task for L2 speakers. We examined how native English and German-English bilinguals integrate prosodic and syntactic information in an ERP experiment. Target items contained a di-transitive or simple transitive verb followed by two noun phrases (e.g., The man gave/saw the pretty woman the purple flower…), inducing a verb argument violation at the final noun in simple transitive sentences. Spliced sentences contained sentence-final prosody on the second noun phrase (the pretty woman), inducing conflict between prosodic and verb argument information in di-transitive sentences. L1 and L2 speakers showed an N400 effect on verb argument violations and a closure-positive shift for sentence-final prosody in isolation. Only L1 and highly-proficient L2 speakers showed ERP responses that suggested cue resolution on di-transitive sentences with conflicting prosody, highlighting how L2 processing difficulties can stem from cue integration, rather than an inability to process individual cues.
Email: Carrie N. Jackson, cnj1@psu.edu

Working Memory I
Beacon A, Saturday Morning, 8:00-10:00
Chaired by Chris Donkin, University of New South Wales

8:00-8:15 (147)
Slots and Resource Models of Visual Working Memory: Bayesian Model Comparison. CHRIS DONKIN, *University of New South Wales*. — Whether the capacity of visual working memory is better characterized as a set of discrete slots or as a continuous resource is a lively debate. One paradigm used to inform this question is the change detection task, where patterns of hit and false alarm rates are used to select between mathematical models of slots and resources. I will present the results of five change detection experiments. Hierarchical Bayesian methods are used to estimate parameters of slots and resource models for these data. Importance sampling is used to generate Bayes Factors to compare the models, and the balance of evidence favors the slots model. However, further inspection reveals that this benefit is due to the lack of parsimony in the resource model that is commonly implemented. I will present a more parsimonious version of a resource model, and finish by showing the impact of using a more constrained model on our understanding of working memory capacity.
Email: Chris Donkin, christopher.donkin@gmail.com

8:20-8:35 (148)
Chunking on the Fly in Working Memory and its Relationship to Intelligence. FABIEN MATHY, *Université de Nice*, MUSTAPHA CHEKAF, *Universite de Franche-Comte*, NICOLAS GAUVRIT, *Universite d'Artois*. — Chunking on the fly in working memory can be observed while measuring the compressibility of information likely to allow the formation of chunks. A novel metric of algorithmic complexity for short strings was used to measure the compressibility of each sequence of stimuli in an immediate-serial-recall task resembling the Simon electronic game. In this new task, working memory capacity allowed the span to vary depending on the sum of compressible information. This particular paradigm was thought to examine the processing and storage components together in association. The hypothesis was that the processing component plays a more major role when dedicated to the to-be-remembered items, instead of when it is directed away to a concurrent task. The report of two experiments (N = 293) shows the relationship of the Simon span task to both simple and complex span tasks, and we show that this new task is likely to better predict intelligence.
Email: Fabien Mathy, fabien.mathy@unice.fr

8:40-8:55 (149)
Tracing Thoughts Through the Probe-Span Task: Microanalytic Evidence That People Mentally Refresh Items in Working Memory. EVIE VERGAUWE (2014 Member Select-Speaker Award Recipient), *University of Missouri-Columbia*, EMILY ROEMER, *University of Rochester*, NELSON COWAN, *University of Missouri*. — People appear to refresh recently-presented information rapidly to keep it active in working memory (WM) but the process has been mysterious. Previous studies have shown only that memory performance increases as a function of the unoccupied time available to refresh. Rather than examining the effect of refreshing on the final outcome (recall performance), we aimed to pinpoint refreshing by examining the status of the items in WM during inter-item intervals, when refreshing is assumed to take place. In our new probe-span task, using response latencies, access to items in WM was probed at different time points during the inter-item periods available for refreshing. At 200 ms after an item presentation we observed relatively poor access to prior items, followed by drastic list-wide improvement in access as the time reached 400 ms, allowing refreshing. This is the first direct behavioral evidence for refreshing, and the first microanalysis of its time course.
Email: Evie Vergauwe, vergauwee@missouri.edu

9:00-9:15 (150)
Emotional Stimuli Capture Executive Attention. VALERIE CAMOS, *Universite de Fribourg*, TOBIAS BROSCH, DAVID SANDER and PIERRE BARROUILLET, *Université de Genève*. — Emotional stimuli automatically capture visual attention. This orienting response involves attentional mechanisms often distinguished from controlled attention. The present study showed that emotional stimuli capture also executive attention. It is known that maintenance of verbal information in working memory relies either on refreshing that requires executive attention or on a non-attentional subvocal rehearsal.

In a complex span task, participants maintained letters while judging the parity of digits. This secondary task was performed aloud to impede rehearsal and favour the use of refreshing. Between digits, to-be-ignored pictures were inserted. In the neutral condition, all pictures were emotionally neutral, while half of them were negatively valenced in the emotional condition. Although their performance in the secondary task did not vary across conditions, participants recalled fewer letters in the emotional than in the neutral condition. This effect disappeared in a second experiment when participants performed the parity judgement silently, maintaining memoranda through rehearsal.
Email: Valerie Camos, valerie.camos@unifr.ch

9:20-9:35 (151)
Creativity, Sentence Comprehension and the Brain: Lessons From Amnesic H.M. DONALD MACKAY, *University of California, Los Angeles*. — This talk presents evidence for strong and previously unsuspected links between the hippocampal region (HR) and the ability to accurately comprehend novel phrases and propositions. The evidence comes from 11 studies with H.M., an amnesic with HR damage but virtually no neocortical damage. Tested was the comprehension of metaphors, ambiguous words, ambiguous sentences, and thematic roles (who-did-what-to-whom in sentences), and comprehension when reading sentences aloud and making judgments of grammaticality. The results identified two types of comprehension process: fast comprehension processes without HR involvement for understanding the meanings of familiar words and phrases, and creative comprehension processes with HR involvement for computing the thematic relations between words and phrases and for integrating familiar word meanings with their sentence context to form useful internal representations of novel phrases and propositions. I discuss the similarities between the creative processes for comprehending sentences and creativity in other domains, e.g., problem solving.
Email: Donald MacKay, mackay@ucla.edu

9:40-9:55 (152)
Evidence for a Synaptic Theory of Working Memory: An fMRI/EEG/TMS Study. NATHAN ROSE, JOSHUA J. LAROCQUE, ADAM C. RIGGALL, OLIVIA GOSSERIES and BRADLEY R. POSTLE, *University of Wisconsin-Madison*. — How are items maintained in WM but outside focal attention (FA)? In this study, we employed a two-step procedure: Participants initially performed a single-item delayed-recognition task with words, faces, or directions of motion in an fMRI scanner, and multivariate pattern analysis (MVPA) was used to identify category-selective regions for transcranial magnetic stimulation (TMS). Next, we simultaneously recorded EEG and applied TMS while participants performed a two-item delayed-recognition task with retro-cues indicating which item to maintain in FA ("attended memory item", AMI). MVPA of delay-period EEG data replicated previous demonstrations of active maintenance of AMIs, but not of unattended memory items (UMI). However, the application of TMS to the brain region associated with the UMI produced a brief recovery of MVPA

evidence for its active representation. This result is consistent with the idea that UMIs are held in a distributed pattern of synaptic weights, rather than an active trace.
Email: Nathan Rose, nsrose@wisc.edu

Metamemory/Metacognition II
Beacon B, Saturday Morning, 8:00-9:40
Chaired by Richard Carlson, Pennsylvania State University

8:00-8:15 (153)
Are You Sure the Library Is That Way? An Investigation of Spatial Metamemory. CHRISTOPHER A. STEVENS and RICHARD CARLSON, *Pennsylvania State University* (Presented by Richard Carlson). — Very little research exists on how people monitor the use of their spatial knowledge. In the present studies, participants made judgments of relative direction by pointing at target buildings in well-known or just-learned environments, using given headings. Confidence in pointing judgments might be influenced by confidence in landmark knowledge and by awareness of factors that affect inference difficulty. Several such factors were manipulated, including viewpoint alignment, perceptual information, and target direction in egocentric space. The manipulated factors affected both performance and confidence. However, the effect on confidence was smaller than the effect on performance, resulting in an overconfidence bias for more difficult conditions. Calibration scores were also worse in these conditions. By contrast, landmark confidence was strongly correlated with pointing confidence. Therefore, the data suggest that although both landmark confidence and inference difficulty affect confidence ratings, inference difficulty is not weighed heavily enough to adequately track performance.
Email: Richard Carlson, racarlson@psu.edu

8:20-8:35 (154)
Efficiency and Labor-in-Vain in Problem Solving Under Time Pressure. RAKEFET ACKERMAN, *Technion - Israel Institute of Technology*. — The metacognitive literature is rich in investigations of study time regulation, while little is known about regulation of time investment in problem solving. Memorization studies suggest that under time pressure people use adaptive strategies—lower their target level and waive the most challenging items. However, they also work by items' presentation order, which is inefficient regulation. The present study examined the parallel regulatory behavior when solving compound remote associates with and without time pressure. Overall, despite lowering the target level, time pressure promoted efficiency, while loose timeframe, in comparison, induced labor-in-vain. However, participants under time pressure also showed labor-in-vain, by investing longer in the initial problems than in later ones, with equivalent outcomes. Finally, despite acknowledging failure to solve challenging problems, the participants did not waive them. This labor-in-vain replicated even when the most challenging problems were

marked, and when receiving explicit explanation encouraging waiving the challenging problems. Methods for improving problem solving efficiency are called for.
Email: Rakefet Ackerman, ackerman@ie.technion.ac.il

8:40-8:55 (155)
Overconfidence and Personality in College: Effects of an Intervention. ANIQUE DE BRUIN, ELLEN M. KOK, JILL LOBBESTAEL and ANDRIES DE GRIP, *Maastricht University*. — When predicting exam grades (Dunning et al., 2003) or judging key term definitions (Rawson & Dunlosky, 2007) students are often overconfident. Unexplored factors relate to how judgment accuracy varies during a course, and how overconfidence relates to personality factors as optimism and narcissism. 244 college students predicted their exam grade at the start and end of a course, and completed questionnaires on narcissism and optimism. Moreover, in a 2x2 design, students were provided an exercise to demonstrate their overconfidence (judging their key term definitions) and a strategy to reduce it (identifying correct idea units; Dunlosky et al., 2011). 53.7% of students were overconfident at the start of the course; 38% were at the end of the course. 71.4% of the students who failed the exam had expected to pass it. Narcissism was weakly related to overconfidence. Results revealed a main effect of strategy on exam grade; the strategy condition scored higher; and a marginally significant interaction between strategy and exercise on judgment accuracy; the control group overestimated exam grade, while the rest slightly underestimated it. Overconfidence on exams seems at least partly sensitive to relatively simple interventions.
Email: Anique De Bruin, anique.debruin@maastrichtuniversity.nl

9:00-9:15 (156)
Double Effects of Working Memory Capacity on Mind Wandering During Meditation. MATTHEW J. VOSS and RANXIAO FRANCES WANG, *University of Illinois Urbana–Champaign* (Presented by Ranxiao Frances Wang). — Mind wandering is the well known phenomenon of having intrusive thoughts during an ongoing task due to the failure of attention and executive control. However its subcomponents are not well understood. The current study examined how people's working memory capacity affects both the initiation and the termination of mind wandering during meditation. Participants received an Ospan task and practiced mindfulness meditation while pressing a key whenever they realized they had an intrusive thought (self-reported mind wandering), or being probed randomly at time intervals ranging from 5-40 seconds (probe-caught mind wandering). There was a positive correlation between working memory capacity and the probe-caught mind wandering rate but not the self-caught mind wandering rate. These data suggest that people with high working memory capacity can both stay in meditation longer and recover from mind wandering faster. Implications on theories of mind wandering and research paradigms will be discussed.
Email: Ranxiao Frances Wang, francesw@cyrus.psych.illinois.edu

9:20-9:35 (157)
The Ideal Placement of Practice Quiz Questions. YANA WEINSTEIN, *University of Massachusetts - Lowell*, LUDMILA NUNES and JEFFREY KARPICKE, *Purdue University*. — Retrieval practice improves retention of information – but when should retrieval occur during learning? In Experiment 1, participants viewed slides about APA style and took the final test after one week. In Experiment 2, participants read texts about historic facts, provided judgments of learning, and took an immediate final test. In Experiment 3, students in a Cognitive Psychology class were tested on their memory for multiple lectures. In all experiments, practice quiz questions appeared after short segments (interleaved), or at the end of a study period (massed). Results from the three experiments demonstrate an advantage for interleaved quizzing during study, but an absence of this advantage on the final test. Interestingly, subjects provided higher judgments of learning for interleaved than massed questions.
Email: Yana Weinstein, Yana_Weinstein@uml.edu

Animal Learning and Cognition
Shoreline, Saturday Morning, 8:00-10:00
Chaired by Michael Brown, Villanova University

8:00-8:15 (158)
Control of Spatial Choice by Personal Information and Social Information. MICHAEL BROWN and MARIE SAXON, *Villanova University*. — Rats were tested in a spatial choice task in which partial information about the location of food was available from the outcome of the rat's previous choices. More precise information was sometimes available either about the location of food (Experiment 1) or about which locations contained more vs. less preferred food (Experiment 2). This additional information required observing the choices being made by a model rat that was making choices to the baited locations (or baited with the preferred food). The results showed that both personal information (from the outcome of the rat's own choices) and social information controlled choices and indicates flexible, adaptive use of these two sources of spatial information.
Email: Michael Brown, michael.brown@villanova.edu

8:20-8:35 (159)
Serial Pattern Learning in Pigeons: Rule-Based or Associative? AARON BLAISDELL and DENNIS GARLICK, *University of California, Los Angeles*, STEPHEN B. FOUNTAIN, *Kent State University*. — Pigeons were presented with 8 disks arranged in a circular array on a touchscreen, and pecking to an illuminated disk could lead to reward. Correct responding consisted of serial patterns involving "run" chunks of three elements (123 234, etc.). Some pigeons experienced a violation of the chunk rule in the final chunk. Unlike rats, pigeons made fewer errors on violation chunks than Run chunks, suggesting the use of low-level cues to guide choices. Removal of low level cues and increasing the number of illuminated disks resulted in more errors on the violation chunk. This corresponds to performance shown by rats, and suggests that pigeons can abstract sequence structure. Pigeons

were also able to abstract structure from a "trill" pattern (121 232 etc.), but showed difficulty learning instance-specific rules, preferring general responses. This suggests that working memory is not as highly developed in the pigeon as in some other animals.
Email: Aaron Blaisdell, blaisdell@psych.ucla.edu

8:40-8:55 (160)

Delayed Gratification in a Grey Parrot. IRENE PEPPERBERG, *Harvard University*, ADRIENNE KOEPKE, *Hunter College, CUNY*, SUZANNE L. GRAY, *Harvard University*. — Delay of gratification—forgoing immediate reward to gain either better quality or quantity rewards—has been used as a metric for temporal discounting, self-control, and the ability to plan for the future in both humans (particularly children) and nonhumans. The task itself can be parsed several ways, such that subjects can be required to wait not only for a better or larger reward, but also such that rewards can be either in view or hidden during the delay interval. Whatever the task, nonhuman subjects have generally succeeded in delays of only a few minutes. We demonstrate that a Grey parrot (Psittacus erithacus), trained in the use of English speech, could respond to the instruction "wait" for up to 15 minutes, in a task notably similar to that used with young children, to receive a better quality reward, whether or not it—and the experimenter—were or were not in view.
Email: Irene Pepperberg, impepper@media.mit.edu

9:00-9:15 (161)

The Domain Specificity of Self-Control: Caching and Intertemporal Choice in Pinyon Jays. JEFFREY STEVENS, BRYCE A. KENNEDY, DINA MORALES and MARIANNA BURKS, *University of Nebraska-Lincoln*. — When choosing between a piece of cake now versus a slimmer waistline in the future, many of us have difficulty with self-control. Food-hoarding species, however, regularly cache food for later, sometimes waiting months before retrieving their caches. It remains unclear whether these long-term preferences generalize outside of the caching domain. We hypothesized that the ability to save for the future is a general tendency that cuts across different situations. To test this hypothesis, we measured and experimentally manipulated caching to evaluate its relationship with operant measures of self-control. We found no correlation between caching and self-control at the individual level, and experimentally increasing caching did not influence self-control. Yet, exploratory analysis suggests that caching rates may correlate with self-control choices on a daily basis rather than at the individual level. Thus, shorter-term fluctuations in motivation may influence both caching and self-control.
Email: Jeffrey Stevens, jeffrey.r.stevens@gmail.com

9:20-9:35 (162)

Go When You Know: Confidence Movements by Language-Trained Chimpanzees During Computerized Testing. MICHAEL BERAN, THEODORE EVANS and AUDREY PARRISH, *Georgia State University*, BONNIE PERDUE, *Agnes Scott College*. — Metacognition includes the capacity for indicating that one knows the answer to a question even before external confirmation of the correctness of that answer. We assessed whether two language-trained chimpanzees (Pan troglodytes) could indicate confidence in their responses to a computerized symbolic matching-to-sample test before being given any feedback about those responses. Both chimpanzees had learned to associate lexigram symbols with real world items and could match lexigrams to photographs of those known items. For trials with sample photographs of items with known lexigram names, the chimpanzees moved away from the test area to another location where food reward was later dispensed for any correct responses. This movement happened even before any feedback about the correctness or incorrectness of their matching responses was given. In contrast, when presented with photographs with no association with lexigrams, the chimpanzees did not move to the reward location even though some responses were scored as correct. This pattern of differential movement may reflect confidence judgments by chimpanzees during item naming.
Email: Michael Beran, mjberan@yahoo.com

9:40-9:55 (163)

Dolphin Echolocation Is Not Seeing With Sound. HEIDI HARLEY, *New College of Florida*, WENDI FELLNER and BARBARA A. LOSCH, *The Seas, Epcot®, Walt Disney World® Resorts*. — Dolphin echolocation is often described as "seeing with sound", although vision and audition vary substantially in direct access to spatial information. We studied spatial representation based on echoic information. Dolphins matched 3-object stimulus sets of unfamiliar objects varying only in shape and made from the same PVC parts (controlled); different PVC parts (uncontrolled); or non-PVC junk (junk). Sets were presented for 5 18-trial sessions echoically only and also visually only. Performance accuracy varied across set type and condition: echoic controlled (12 sets, M=45%) < echoic uncontrolled (12 sets, M=50%) < visual controlled (M=67%) < visual uncontrolled (M=76%). Echoic performance ranged: 32% - 86% across sets; visual performance ranged: 50% - 100%. In contrast, performance with junk sets differed: echoic (2 sets, M=81%) > visual (2 sets, M=58%). Shape is difficult via echolocation but accessible through vision. Dolphins integrate information about objects across modalities; they likely gain most shape information through vision.
Email: Heidi Harley, harley@ncf.edu

Speech Perception
Beacon B, Saturday Morning, 10:00-12:00
Chaired by Tessa Bent, Indiana University

10:00-10:15 (164)

Foreign-Accent Detection in the Presence of Multiple Linguistic Varieties. TESSA BENT, KELSEY MARKS and ERIKO ATAGI, *Indiana University*. — Listeners can distinguish between native and nonnative talkers with stimuli as short as one phoneme (Flege, 1984; Park, 2013). However, previous studies only included two accents: one foreign accent and one native accent close to the listeners' dialect. In the current study, listeners' foreign-accent detection was assessed with words produced in four foreign accents (German-, Spanish-,

Swahili-, and Thai-accented English) and four native accents (Midland, Southern, Scottish, and New Zealand). On each trial, listeners identified the speaker as native or nonnative. Although listeners were overall sensitive to the difference between native and nonnative accents, they were at chance for the German and Scottish accents. These two accents were closest to the native-nonnative boundary according to the results of a previous task that ranked numerous accents on their distance from standard American English. The current results suggest that both native and nonnative accents can occupy a fuzzy boundary between the native - nonnative categories.
Email: Tessa Bent, tbent@indiana.edu

10:20-10:35 (165)

Lexical Feedback and Perceptual Learning of Foreign-Accented Speech. ANGELA COOPER and ANN BRADLOW, *Northwestern University* (Presented by Ann Bradlow). — Lexical knowledge can influence listeners' interpretation of unusual or ambiguous speech sounds. The current study examined the effect of lexical feedback on the perceptual learning of foreign-accented English. American English listeners transcribed English sentences in noise produced by a single Mandarin-accented English talker. After each transcription, listeners received feedback in one of three formats: 1) a native-accented production of the same sentence with no background noise, followed by a repetition of the foreign-accented sentence in noise, 2) a native-accented production of an unrelated sentence, followed by a repetition of the foreign-accented sentence in noise, or 3) a repetition of the accented sentence in noise with no intervening "model". Listeners who received feedback where the native-accented sentence matched the accented sentence showed significantly greater improvement over trials relative to listeners in the other two conditions. These findings highlight the facilitative role of lexical feedback in the adaptation to foreign-accented speech.
Email: Ann Bradlow, abradlow@northwestern.edu

10:40-10:55 (166)

No Role for Orthography in Recognizing Connected Speech. HOLGER MITTERER, *University of Malta*, EVA REINISCH, *LMU Munich*. — It is claimed that learning to read influences speech perception. Evidence for this claim, however, stems from studies with single-word presentation, while speech outside the laboratory tends to be connected. We investigated the role of orthography in connected-speech perception by measuring the impact of common speech-sound deletions on speech perception. The German glottal stop (/ʔ/) has no orthographic representation and, if orthography influences speech perception, its deletion should have less impact on perception than deletion of German /h/ and Maltese /ʔ/, which are written as "h" and "q", respectively. Deletion costs were measured with visual-world eye-tracking: Participants had to click on a target picture among distractors while hearing a sentence containing a full or reduced target word (e.g., "(h)elmet"). Reduction costs were similar for all

three segments (German and Maltese /ʔ/ and German /h/). The role of orthography in speech perception thus seems severely reduced in connected speech.
Email: Holger Mitterer, holger.mitterer@um.edu.mt

11:00-11:15 (167)

Speech Sound Encoding in the Brain Measured Using Fast Diffuse Optical Imaging. JOSEPH TOSCANO (2014 Member Select-Speaker Award Recipient), NATHANIEL ANDERSON, SUSAN GARNSEY, MONICA FABIANI and GABRIELE GRATTON, *University of Illinois, Urbana-Champaign*. — A central question in speech perception concerns the nature of the representations listeners use to recognize speech: Is perception based on continuous acoustic cues or discrete linguistic categories? We used fast diffuse optical neuroimaging, which provides high temporal and spatial resolution simultaneously, to address this question by measuring neural responses to speech sounds varying in voice onset time (VOT) along a /b/-/p/ continuum. We found that left posterior STG tracks continuous changes in VOT, with a linear trend across the continuum at 96 ms post-stimulus. Less than 50 ms later, in left IFG, we see evidence of category-level processing (greater activation for VOTs near the category boundary). Moreover, the temporal windows during which we observe cue- and category-level effects are highly overlapping, indicating that cue encoding is ongoing even as categorization begins. The results demonstrate that listeners encode continuous cues and rapidly categorize sounds, while maintaining sensitivity to within-category differences.
Email: Joseph Toscano, jtoscano@illinois.edu

11:20-11:35 (168)

Segmental Aspects of Susceptibility to Temporal Distortion in the Perception of Speech. ROBERT REMEZ, *Barnard College*, EMILY F. THOMAS, ANDREA M. WYCOFF, AISLINN T. CRANK and REBECCA E. GIGLIO, *Barnard College, Columbia University*. — Sensitivity to the spectral modulation of speech is disrupted by temporal distortion. The availability of natural vocal timbre confers only a small perceptual benefit, assayed via measures of intelligibility, when temporal distortion is imposed on sampled speech. This outcome suggests a primary role of modulation sensitivity in the perception of linguistic properties of speech. New studies with natural samples and sine-wave replicas of spoken sentences imposed restrictions on phoneme composition in order to sharpen the analysis of time-critical acoustic properties, however abstract, in speech perception. Relying on a transcription task and graded variation in the span of temporal distortion, these tests replicated prior findings with unrestricted variation in phoneme composition. The tests, blocked by class of phoneme restriction, also spotlighted the unique fragility of obstruent consonants to temporal distortion. Implications for a causal account of perceptual organization and analysis will be discussed. [Supported by NIDCD.]
Email: Robert E. Remez, remez@columbia.edu

11:40-11:55 (169)

How Much Processing Time Is Needed to Drive Perceptual Recalibration of Speech? ARTHUR SAMUEL, *Stony Brook University and the Basque Center on Cognition, Brain, and Language.* — Listeners use lexical information to retune their perceptual categories: If a segment is ambiguous (e.g., possibly either "s" or "sh"), lexical context (e.g. "demoli_") will both shift immediate perception and also shift the listener's category boundary to include the lexically-cued sound. Recent work [Zhang & Samuel, JEP:HP&P, 40, 200-217] has shown that this category retuning occurs even if the listener is engaged in a demanding second task. In the current study, rather than requiring listeners to do a competing task, we created conditions intended to interrupt processing of the lexical items that would otherwise drive perceptual retuning. Across listeners, the time before interruption was varied between 200 and 1200 msec. No category retuning occurred unless about 1 second of processing time was available. Collectively, the results demonstrate that perceptual retuning requires cognitive resources, but listeners are adept at time-sharing when the conditions allow it.
Email: Arthur Samuel, a.samuel@bcbl.eu

Perception and Action
Seaview A & B, Saturday Morning, 10:20-12:00
Chaired by Hagit Magen, Hebrew University of Jerusalem

10:20-10:35 (170)

The Accessory Simon Effect Within and Across Visual Dimensions. HAGIT MAGEN, *Hebrew University of Jerusalem.* — Interference tasks are often used to study response selection processes. Previous studies with the flanker and Stroop tasks demonstrated that response selection processes operate independently within visual dimensions. The present study investigated whether the modularity assumption can account for results from the Simon task as well. Four accessory Simon tasks were used. In the within-dimension tasks, targets and distractors were all colors or all words, whereas in the cross-dimension tasks, the targets and distractors belonged to different dimensions. The results showed that the dimensional relation between the targets and distractors had a large impact on the Simon effect. A typical effect was obtained in the cross-dimension tasks, while a reversed Simon effect was obtained in the within-dimension tasks. These data demonstrate that different processes occur in the accessory Simon task within and across dimensions, and provide further support for the modular architecture of response selection processes in the visual system.
Email: Hagit Magen, msmagen@mscc.huji.ac.il

10:40-10:55 (171)

The Influence of Control and Intentional Dynamics on Spatial Perception. J. SCOTT JORDAN and DEVIN GILL, *Illinois State University*, RACHEL DUPUIS, *University of Paris Descartes.* — The present experiments investigated the impact of intentional movement dynamics (School & Tremoulet, 2000) on the perceived vanishing point of a moving stimulus. Previous experiments with non-intentional stimulus dynamics (i.e., the stimulus moved at a constant velocity horizontally across the computer screen) revealed that the perceived vanishing point is located beyond the actual vanishing point in the direction of stimulus motion. Further, if the stimulus appears to move across a surface, or between two surfaces (i.e., implied friction), the magnitude of the forward displacement (FD) decreases as implied friction increases (Hubbard, 1995). The present experiments produced intentional dynamics by having participants (versus the computer) control the movements of the stimulus back and forth across the computer screen. Participants who observed participant-controlled stimulus movements reversed the implied friction effect for FD. Participants who controlled stimulus movements themselves also reversed the implied friction effect, and also expressed less FD than observers.
Email: J. Scott Jordan, jsjorda@ilstu.edu

11:00-11:15 (172)

Is Pointing Pointless? Why Pointing Gestures to Distal Referents Are Misleading. OLIVER HERBORT and WILFRIED KUNDE, *Julius-Maximilians-Universität Würzburg.* — Gestures are a vital aspect of human communication. However, pointing gestures toward distal referents are frequently misunderstood. We tested the hypothesis that this misunderstanding arises because production and interpretation of pointing gestures follow different rules. In an experiment, participants were asked to point to objects at various distances and to judge where another person is pointing. When asked to point, participants aligned the index finger with their eyes and the referent. When asked to judge where someone else is pointing, participants aligned their estimate of the referent with the extrapolation of the pointer's arm. As salient visual cues, which differed for pointers and observers, determined gesture production and interpretation, pointing gestures were systematically misinterpreted. Moreover, interindividual differences in the production and interpretation of pointing gestures were uncorrelated, suggesting that motor processes do not contribute to the interpretation of pointing gestures.
Email: Oliver Herbort, oliver.herbort@psychologie.uni-wuerzburg.de

11:20-11:35 (173)

What Makes an Event: Temporal Integration of Stimuli or Actions? LISA FOURNIER and JONATHAN GALLIMORE, *Washington State University.* — We examined whether forming a single action event in an active observer is contingent on the temporal presentation of the stimuli (i.e., the temporal availability of the action information associated with these stimuli), the learned temporal execution of the actions associated with the stimuli, or both. A partial-repetition paradigm was used to assess the boundaries of an event. The temporal properties of the stimuli (simultaneous or serial presentation) and temporal properties of the intended actions associated with these stimuli (one, temporally integrated response or two temporally separate responses) were manipulated. Results showed that the temporal features of action execution, not the temporal presentation of the stimuli, determined whether one or more events were constructed.

This suggests that the action representation, or "task goal," served as the "glue" in forming an event in an active observer. These findings emphasize the importance of action planning in event construction in an active observer.
Email: Lisa Fournier, lfournier@wsu.edu

11:40-11:55 (174)

Metacognition and Performance Evaluation for Joint Actions. ROBRECHT VAN DER WEL, *Rutgers University*. — Joint actions constitute a ubiquitous class of actions, but surprisingly little is known about how people derive a sense of agency and evaluate performance quality for such actions. Here, I examined the influence of prior intentions, actor roles, and objective performance quality on the subjective experience of joint actions. Dyads moved a dot to the target of their choice out of a set of targets. By having each participant control the dot movements in only one dimension (orthogonal to their partner) and by varying the target locations, participants took on different roles. By chance, they could have a congruent or incongruent intention prior to the movements. In a decider-follower scenario, where one actor decided on the target, the sense of agency and performance evaluation depended on whether a prior intention was instantiated, regardless of which actor in the pair controlled the target choice. When participants had conflicting intentions, both the dominant and the nondominant participant showed a marked reduction in the perceived quality of the performance. The nondominant actor also reported a strongly reduced sense of agency. Implications for theories on the sense of agency and for applied settings are discussed.
Email: Robrecht van der Wel, r.vanderwel@rutgers.edu

Cognitive Skill Acquisition
Shoreline, Saturday Morning, 10:20-12:00
Chaired by Thomas Redick, Purdue University

10:20-10:35 (175)

Does Working Memory Training Improve Intelligence? A Meta-Analytic Update. THOMAS REDICK, *Purdue University*, MONICA MELBY-LERVÅG, *University of Oslo*, ANDREA GROVAK, *Purdue University*, CHARLES HULME, *University College of London and University of Oslo*. — In recent years, there has been great interest in the efficacy of working memory training. A meta-analysis (Melby-Lervåg & Hulme, 2013) found that although working memory training led to significant short-term improvements on memory tests similar to those practiced during training, there was virtually no evidence for improvements on transfer to tests of intellectual ability and scholastic achievement. Our updated meta-analysis included over 100 independent comparisons of effects from working memory training on nonverbal abilities, and despite roughly four times as many comparisons as Melby-Lervåg and Hulme (2013), the major conclusions are almost identical. There was a small immediate effect of working memory training on tests of intelligence, but no long-term effect. Additional analyses indicated significantly smaller

transfer when the training group was compared to an active-control group instead of a passive-control group. Short- and long-term transfer effects on tests of verbal and mathematical ability were either weak or non-significant.
Email: Thomas Redick, tredick@purdue.edu

10:40-10:55 (176)

The Role of Working Memory in the Formation and Retention of Chunks in Long-Term Memory: The Case of Typewriting. MOTONORI YAMAGUCHI, *Edge Hill University*, GORDON LOGAN, *Vanderbilt University*. — Processing units are larger in skilled performance than in unskilled performance. For instance, skilled typists can type words as chunks, whereas novice typists "hunt-and-peck" each letter. Chunking depends on knowledge of words: skilled typists have to process each letter when typing unfamiliar letter-strings (nonwords). The present study investigated how chunks are acquired in skilled typewriting. Skilled typists typed words and nonwords while performing a concurrent memory task. Memory error was larger when typing nonwords than when typing words, indicating more memory chunks in working memory for nonwords than for words. Memory error decreased when the same nonwords appeared for six consecutive trials but not when the nonwords did not repeat immediately. After immediate repetitions, decreased error rate was maintained when the same nonwords appeared after 120 intervening trials. Results imply that chunks are formed in working memory and transferred to long-term memory, as opposed to being formed in long-term memory.
Email: Motonori Yamaguchi, cog.yamaguchi@gmail.com

11:00-11:15 (177)

Improved Dual-Task Performance After Practice Due to Efficient Task Instantiation. TILO STROBACH and TORSTEN SCHUBERT, *Humboldt University Berlin*. — Practice of two simultaneous dual tasks results in an improvement of dual-task performance. The present study investigates the underlying cognitive mechanisms responsible for this improvement: The efficient instantiation of information of two component tasks in working memory at the beginning of each dual-task trial. This instantiation is the consequence of dual-task practice, but it is not the consequence of separate practice of two tasks in single tasks. While previous studies did not provide evidence for an efficient instantiation after dual-task practice with complex tasks, we analyzed dual-task performance with rather less complex tasks at the end of dual-task and single-task practice. Under conditions of these less complex tasks, we found advantageous dual-task performance after dual-task in contrast to single-task practice. These results are consistent with the assumption that improved dual-task performance after dual-task practice is the consequence of an efficient instantiation of information of two component tasks in working memory.
Email: Tilo Strobach, tilo.strobach@hu-berlin.de

11:20-11:35 (178)

The Non-Ironic Effects of Prohibitive Instruction on Gender Stereotyped Motor Tasks. TRAVIS SEYMOUR and SARA GOODMAN, *University of California, Santa Cruz*. — Wegner and colleagues (1998) reported that prohibition in instructions led to an ironic effect: increasing participants' likelihood of making the prohibited error rather than reducing it. This ironic effect was only observed for female participants performing a golfing task (males overcompensated), but was potentially dependent on cohort-bound stereotype threat. We investigated the necessary conditions for elicitation of the ironic effect in motor control. Regardless of prohibition type, overcompensation rather than ironic effects were demonstrated for both women and men in performing a golfing task. The influence of gender stereotype threat was investigated as a potential contributor to the ironic effect. Regardless of whether subsequent tasks were biased against men or women, no ironic effects were produced. Rather, overcompensation effects were qualitatively similar between genders and differed only in magnitude. We conclude that though prohibition initially leads to extreme overcompensation, over time it is effective in producing the desired non-ironic outcomes.
Email: Travis Seymour, nogard@ucsc.edu

11:40-11:55 (179)

Cognitive Plasticity in Experienced Video Game Players After Training in Novel Game Genres. MICHAEL PATTERSON, HAN JING YANG and QINYUEN WONG, *Nanyang Technological University*. — To test how previous video game experience modulates cognitive plasticity when playing new video games, three groups, non-gamers, action gamers, and other gamers (without action game experience), were instructed to play one of three video games: a hidden object game, an action game, or a physics-based puzzle game for twenty hours over four weeks. Participants were tested before and after training on measures of visual attention, perception, and executive function. The training video games were chosen based on the degree they resembled habitually played games. We predicted action gamers would only show post-training changes after non-action game training, while non-gamers should show changes after all three games. The results largely matched expectations and demonstrated that even habitual gamers can benefit from playing video games different in style from what they usually play. Previous video game experience modulated pre-test performance with other gamers and action gamers showing differences compared to non-gamers.
Email: Michael Patterson, mdpatterson@ntu.edu.sg

Event Cognition
Regency D-F, H, Saturday Morning, 10:00-12:00
Chaired by Jeffrey M. Zacks, Washington University in St. Louis

10:00-10:15 (180)

Effects of Penetrating Traumatic Brain Injury on Event Segmentation. JEFFREY M. ZACKS, *Washington University in St. Louis*, CHRISTOPHER KURBY, *Grand Valley State University*, CLAUDIA S. LANDAZABAL, *Washington University in St. Louis*, FRANK KRUEGER, *George Mason University*, JORDAN GRAFMAN, *Northwestern University*. — Event segmentation is an ongoing component of perception that is predictive of subsequent memory. Little is known about how online comprehension mechanisms such as event segmentation are affected by brain injury. Here, we assessed 180 combat veterans who have participated in the Vietnam Head Injury Study since the 1980s on measures of event segmentation and event memory. Participants with lesions to dorsolateral prefrontal cortex were impaired on segmenting activity into both fine-grained and coarse-grained events. Participants with lesions to ventromedial prefrontal cortex or right superior posterior cortex were impaired on coarse-grained segmentation. These results indicate that some brain injuries can impair brain mechanisms of event segmentation.
Email: Jeffrey M. Zacks, jzacks@wustl.edu

10:20-10:35 (181)

An fMRI Investigation of the Effects of Narrative Transportation on Attention and Memory. MATTHEW BEZDEK, *Georgia Institute of Technology*, RICHARD GERRIG and WILLIAM G. WENZEL, *SUNY at Stony Brook*, ERIC SCHUMACHER, *Georgia Institute of Technology* (Presented by Eric Schumacher). — According to one theory of narrative transportation, engaging narratives can command attentional processing and suppress processing of peripheral environmental stimuli (Gerrig, 1993). Across two experiments, we have investigated moment-by-moment changes in neural markers of transportation, using suspenseful film excerpts and functional magnetic resonance imaging. We have found a consistent pattern of brain networks that show increased or decreased blood-oxygen-level dependent signal at moments of increasing narrative suspense. These include decreases in peripheral visual processing regions and the default-mode network, as well as increases in lateral occipitotemporal cortex and the ventral attention network. We have also found evidence that moments of increased suspense are better recalled on post-viewing surprise memory tests. Together these results illustrate how narrative transportation influences neural processing on a moment-by-moment basis, and affects subsequent memory for aspects of the narrative experience.
Email: Eric Schumacher, eschu@gatech.edu

10:40-10:55 (182)

Event Segmentation and Seven Types of Narrative Discontinuity in Popular Movies. JAMES CUTTING, *Cornell University*. — Using a sample of 24 movies I investigated narrative shifts in location, characters, and time that do and do not align with viewer segmentations of events (scenes and

subscenes) in popular movies. Taken independently these dimensions create eight categories, one of nonchange and seven of change. Data show that the more dimensions that are changed the more viewers agree on their judgments of narrative shifts, although the nonadditive variations across the seven change types are large and systematic. Dissolves aid segmentation but over the last 70 years they have been used less and less by filmmakers, except for two infrequent shift types. Locations and characters are strongly yoked in visual narratives, jointly accounting for most narrative shifts. There are also interactions of shift types over the 70-year span and across genres, as well as differences that affect the scale of the establishing shot in a new scene.
Email: James Cutting, jec7@cornell.edu

11:00-11:15 (183)
Using Hollywood Movies to Explore Human Long-Term Memory for Audio-Visual Scenes. MARKUS HUFF and TINO G. K. MEITZ, *University of Tuebingen*, HAUKE MEYERHOFF, *Knowledge Media Research Center, Tuebingen, Germany*. — Working memory plays an important role for processing dynamic information and finally storing it in long-term memory. Recently, we showed that long-term memory for audio-visual dynamic scenes (short excerpts from Hollywood movies) emerges from integration processes. Memory was superior in case the audio-visual information was congruent (i.e. from the same movie) when compared to a condition with incongruent audio-visual information (i.e. audio and video information was combined from two different movies). In further experiments, we explored how audio-visual integration interacts with event perception. Based on current event perception theories we hypothesized that dynamic scenes depicting a change (e.g., a new character enters the room) trigger updating processes in working memory finally leading to better long-term memory when compared to scenes without a change. We observed such an advantage for visual scenes, however, memory performance for audio-visual scenes was unaffected by changes in the event model. This suggests that additional auditory information influence basic event perception processes by presumably neutralizing effects of distinct visual event boundaries.
Email: Markus Huff, markus.huff@uni-tuebingen.de

11:20-11:35 (184)
Causal Relations in Language Influence Perception of Causality in Visual Stimuli. ELSI KAISER, DAVID CHENG-HUAN LI and IRIS CHUOYING OUYANG, *University of Southern California*. — Causality is fundamental to cognition. Some claim perceptual (visual) causality is encapsulated/modular; others argue for nonmodularity. New work supports nonmodularity (Woods et al. 2012), but the mechanism is unclear: top-down learning or perceptual adaptation? We tested whether exposure to causal vs. non-causal LINGUISTIC primes influences causality ratings of VISUAL launching events. In a priming paradigm, people were eye-tracked while reading sentences (primes) and rating the causality of Michotte-type launching events. Linguistic primes (normed) were causal (e.g. The baby started crying and the babysitter hurried to get milk) or non-causal (e.g. The

bank teller answered the woman's questions and the guard watched the video monitors). Eye-movements show that exposure to causal sentences makes people more conservative in rating launching events. This supports nonmodularity, and suggests the underlying mechanisms do not rely on perceptual adaptation, but involve a domain-general representation of causality. This is the first demonstration of language influencing perceptual causality.
Email: Elsi Kaiser, emkaiser@usc.edu

11:40-11:55 (185)
The Multiscale Nature of Context. SIMON DENNIS, *University of Newcastle*, VISHNU SREEKUMAR, *Ohio State University*. — People naturally divide their experience into contexts and use these representations to organize perception, memory and communication (Zacks & Tversky, 2001; Zacks, Tversky & Iyer, 2001). In a series of studies, we used text corpora (proxy for reading experience; Doxas, Dennis & Oliver, 2010), images extending over temporal scales of two weeks collected continuously using smartphones worn in a pouch around the neck (proxy for visual experience; Sreekumar, et al., 2014) and an email corpus extending over five years (proxy for personal discourse; current study) to analyze real world context extending across a wide range of spatiotemporal scales. We apply dynamical systems analysis techniques to reveal a strikingly similar two-regime structure in the structure and dynamics of reading experience, visual experience and personal discourse.
Email: Simon Dennis, simon.dennis@gmail.com

Automatic Processing
Beacon A, Saturday Morning, 10:20-12:00
Chaired by Julie Bugg, Washington University in St. Louis

10:20-10:35 (186)
Contextual Modulation of Task-Rule Congruency Effects: The Role of Proactive and Reactive Control. JULIE BUGG and TODD BRAVER, *Washington University in St. Louis*. — Bottom-up as well as top-down effects can influence task-switching performance. Bottom-up activation of task rules (S-R mappings) is evidenced by the task-rule congruency effect (TRCE): response time slowing for incongruent stimuli activating competing task rules, relative to congruent stimuli activating response compatible task rules. The current experiments examined modulation of the TRCE by manipulating proportion congruence during cued task switching, in both a list-wide and context-specific manner. Participants made odd/even or vowel/consonant judgments in response to congruent (e.g., A1) and incongruent (e.g., A2) stimuli. The TRCE was significantly attenuated when the list was mostly incongruent, and this effect transferred to inter-mixed 50% congruent stimuli. The TRCE was also selectively influenced by spatial context, i.e., reduced interference for stimuli appearing in a mostly incongruent location relative to a mostly congruent location. These findings provide support for the role of proactive and reactive control in the bottom-up activation of irrelevant task rules.
Email: Julie Bugg, jbugg@artsci.wustl.edu

10:40-10:55 (187)

Evidence for Graded Central Processing Resources in a Sequential Movement Task. WILLEM BASTIAAN VERWEY, *University of Twente*, ELGER ABRAHAMSE and MARIT RUITENBERG, *Ghent University*. — We examined slowing of the individual key presses of a familiar keying sequence by four different versions of a concurrent tone counting task. This was done to determine whether the same cognitive processor that has previously been assumed by the dual processor model (DPM) to initiate familiar keying sequences and assist in their execution, is involved also in the central processes of a very different task (viz. identifying tones and counting target tones). The present results confirm this hypothesis. They suggest also that in this particular situation the central processing resources underlying the cognitive processor can be distributed across the central processes of different tasks in a graded manner, rather than that they continue to behave like a single, central processor that serially switches between the central processes of the concurrently performed tasks.
Email: Willem Bastiaan Verwey, w.b.verwey@utwente.nl

11:00-11:15 (188)

Can Irrelevant Activation Also Be Suppressed in the Flanker Task? RONALD HUBNER and LISA TÖBEL, *Universität Konstanz*. — For the flanker task the congruency effect in the latencies usually increases with response time. In contrast, for the Simon task the effect often decreases and can even become negative, which has been attributed to suppression of irrelevant response activation. Does this difference indicate the involvement of qualitatively different processes in the two tasks? To answer this question, we tested if a decreasing congruency effect can also be produced for the flanker task. Because a characteristic of the Simon task is that irrelevant information activates associated responses very quickly, we mimicked this situation for the flanker task by presenting flankers before the target. Data analyses revealed a steeply decreasing congruency effect clearly indicating suppression of irrelevant activation. Altogether, our results show that the same basic mechanisms are involved in processing the flanker and the Simon task, even though to different degrees, depending on the specific condition.
Email: Ronald Hübner, ronald.huebner@uni-konstanz.de

11:20-11:35 (189)

From Distractor to Intrusive Thought. IRA HYMAN, KAYLEIGH CUTSHAW, SYDNEY DREVER, MADELINE JALBERT and JOSEPH BLYTHE, *Western Washington University*. — The effect of background distractors on cognitive performance is very well known. Distractors, such as background music, decrease performance on many cognitive tasks. But what happens to the distractors? The cognitive impact on the distractors has not been studied. We propose that distractors may quickly become intrusive thoughts on subsequent tasks. This proposal is based on individuals working to suppress awareness of background distractors during the original cognitive tasks. Since suppression may result in rebound effects, the previous distractors may rebound into awareness on subsequent tasks when they are no longer present. We have documented this effect first with background music. When music is played in the background during a cognitive task, it is more likely to occupy awareness on a subsequent than if people were focused on the music. We have also investigated the effect for cell phone thoughts following a task in which cell phones were distractors. The overall impact of distractors on awareness may continue past the time when the distractors are actually present.
Email: Ira Hyman, ira.hyman@wwu.edu

11:40-11:55 (190)

Spatial Attention to Pointing Gestures and Arrows: Contributions of Cue Selection and Distractor Suppression. BENNETT BERTENTHAL and SAMUEL HARDING, *Indiana University*. — Although recent research on the social brain suggests that spatial orienting is privileged for social stimuli, behavioral evidence with a spatial cueing paradigm has been elusive. We hypothesized that the difficulty in finding differential responding to social and non-social stimuli was due to the design of this paradigm which eliminated the need for observers to first select a deictic stimulus before orienting in the direction of the target. In the current research, we modified the paradigm by adding two flanking stimuli positioned laterally to the left and right of a pointing hand or arrow so that the cue would have to be selected before shifting attention in a specific direction. The response time results revealed that the pointing hand flankers interfered with the arrow cue, but not vice versa. These results suggest that the processing advantage associated with social stimuli is related to cue selection and suppression of distractors.
Email: Bennett Bertenthal, bbertent@indiana.edu

SYMPOSIUM III: Memory, Sleep, and Dreams
Regency A-C, Saturday Morning, 9:50-12:00
Organized by Richard Schweickert, Purdue University

9:50-10:05 (191)

The Role of Systematicity in the Consolidation of Linguistic Knowledge. GARETH GASKELL and JELENA MIRKOVIĆ, *University of York, UK*. — Many theories of sleep-associated memory consolidation suggest that declarative and procedural memories recruit different components of sleep during the consolidation process. However, until now, less attention has been placed on divisions within declarative memory. Here we examine the role of one key variable, namely systematicity. Two experiments manipulated the systematicity of artificial language mappings between form and meaning, using grammatical gender (Experiment 1) and number (Experiment 2). Participants learned the languages and then spent time awake or asleep. Rather than boosting performance overall, the effect of sleep depended on the level of systematicity in the newly learnt mapping. More systematic mappings showed little or no benefit of sleep, whereas more arbitrary mappings revealed better performance after sleep than after wake. We interpret these results in the context of a connectionist complementary systems account of memory consolidation in which systematicity dictates the level of initial involvement of the hippocampus.
Email: Gareth Gaskell, g.gaskell@psych.york.ac.uk

10:10-10:25 (192)

Fast Mapping Integrates Information Into Existing Memory Networks. MARC N. COUTANCHE, *Yale University*, SHARON L. THOMPSON-SCHILL, *University of Pennsylvania.* — Successful learning involves integrating new material into existing memory networks, typically through a slow consolidation process, which can benefit from sleep. Recent results suggested that a 'fast mapping' (FM) learning procedure could bypass hippocampal consolidation, which has led to the proposal that FM may incorporate information directly into cortical networks. We report two experiments into whether FM enables rapid lexical integration. In experiment 1, we introduced participants to sixteen unfamiliar animals and names through either FM or explicit encoding (EE), and tested subjects on the day of training, and again after sleep. Learning through EE produced strong declarative memories, although without immediate lexical competition (as expected from slow-consolidation models). Learning through FM, however, led to almost immediate lexical competition (without strong declarative memory; a double dissociation). In experiment 2, we replicated this effect and found that the presence of a known animal plays an important role in this rapid integration.
Email: Marc N. Coutanche, coumarc@psych.upenn.edu

10:30-10:45 (193)

Sleep and False Memory: Friend or Foe? KIMBERLY M. FENN, *Michigan State University*, STEVEN J. FRENDA, *University of California, Irvine,* MARIA S. ZARAGOZA, *Kent State University,* ELIZABETH F. LOFTUS, *University of California, Irvine,* SHARI R. BERKOWITZ, *California State University, Dominquez Hills.* — Despite strong evidence that sleep strengthens veridical memory, the role of sleep in the formation of false memory remains unresolved. For example, one study found that sleep decreased false memory whereas another found that it increased false memory. The experiments differed in the type of test (recognition vs. recall, respectively) but were otherwise similar. Furthermore, studies investigating the effect of sleep deprivation on false memory are also equivocal. In some work, deprivation increased false memory but several studies found no effect of deprivation. One weakness to this literature is that all studies have used the DRM paradigm to test false memory. We will discuss ongoing work investigating the role of sleep and sleep deprivation in the formation of false memory using the misinformation paradigm. Specifically, both sleep and sleep deprivation can have contrasting effects on false memory, in some situations decreasing memory distortion and in others, increasing memory distortion.
Email: Kimberly M. Fenn, kfenn@msu.edu

10:50-11:05 (194)

Sleep and Motor Learning: Is There Room for Consolidation? TIMOTHY RICKARD AND STEVEN PAN, *University of California, San Diego.* — Motor skill performance improves after a night of sleep, a phenomenon that is widely attributed to sleep-specific consolidation. We report results of a quantitative meta-analysis in which the explanatory power of several alternative and previously hypothesized accounts was explored. Four factors were identified as highly predictive of the post-sleep gain: the degree of data averaging in the calculation of pre-post gain scores, the degree of reactive inhibition over the course of training, time of testing, and training duration. After adjusting for those factors, there is no evidence that sleep enhances motor learning. Further, relatively better performance after sleep than after wakefulness was observed for only one of four experimental designs, and that design is uniquely subject to a time of testing confound. We discuss challenges for the field, make recommendations for improved experimental design, and suggest a new approach to data analysis that eliminates confounds due to data averaging.
Email: Timothy Rickard , trickard@ucsd.edu

11:10-11:25 (195)

Sleep-Based Emotional Memory Consolidation: The Role of Physiological Tagging of Memories During Encoding. JESSICA PAYNE, *University of Notre Dame.* — Negative objects are typically better remembered than the neutral backgrounds on which they are placed, while neutral objects and backgrounds are remembered equivalently. This preferential reinforcement of negative objects within scenes is known as the emotional memory trade-off effect, and it has been shown to increase following periods of sleep. Here we examined the sleep stage correlates of this selective benefit to emotional objects, and whether elevated levels of cortisol and physiological reactivity (measured by heart-rate deceleration, HRD, and GSR) to images at encoding would predict subsequent memory for these objects. Memory for emotional objects was associated with REM sleep, and cortisol levels and degree of HRD and GSR response to negative scenes at encoding predicted subsequent memory for negative objects, but only if participants slept. These results suggest that cortisol and visceral reactions to negative pictures at encoding 'tag' these memories as important to process during subsequent sleep.
Email: Jessica Payne, Jessica.Payne.70@nd.edu

11:30-11:45 (196)

Associative Memory Networks and the Systematic Occurrence of People in Dreams. RICHARD SCHWEICKERT, HYE JOO HAN, and ZHUANGZHUANG XI, *Purdue University*, CHARLES VIAU-QUESNEL, *Université du Québec à Trois-Rivières.* — During Rapid Eye Movement (REM) sleep, the stage from which most dreams are reported, primary sensory cortices are less active than while awake. Any systematic patterns found in dream content must arise from the dreamer's memory. A fruitful strategy is to examine the most salient entities reported from dreams, people. To look for systematic patterns in appearances of people, social networks were constructed by linking any two characters who occurred in the same dream. Such dream social networks were constructed for five individuals, each with reports of hundreds of dreams. Important social network parameters were found to vary systematically, and not as predicted from comparable randomly connected networks. The dream social networks are similar in many ways to word association networks. Although

dream social networks are systematic, they differ from waking life social networks. We attribute the difference to remote associations being followed in REM sleep.
Email: Richard Schweickert, swike@psych.purdue.edu

11:50-12:00 (197)
General Questions. RICHARD SCHWEICKERT, *Purdue University.*

Reward, Motivation, and Decision Making
Regency D-F, H, Saturday Afternoon, 1:30-3:10
Chaired by Christian Luhmann, Stony Brook University

1:30-1:45 (198)

Direct and Indirect Influence of Altruistic Behavior in a Social Network. PEI-PEI LIU, VASILIY C. SAFIN, BARRY YANG, and CHRISTIAN LUHMANN, *Stony Brook University, SUNY* (Presented by Christian Luhmann). — Prior research suggests that recipients of generosity behave more generously themselves (a direct social influence). However, there is conflicting evidence about the existence of indirect influence (i.e., whether interacting with a recipient of generosity causes one to behave more generously). The current study investigated how far selfish and generous behavior can be transmitted through social networks and the relevant cognitive mechanisms. Participants played a sequence of public goods games comprising a chain network. This network is advantageous because it permits only a single, unambiguous path of influence. Furthermore, we experimentally manipulated the behavior of the first link in the chain (either generous or selfish). Results revealed the presence of direct social influence, but no evidence for indirect influence. Results also revealed that selfish behavior exerted a substantially greater influence than generous behavior. Finally, expectations about future partners' behavior mediated the observed social influence, suggesting an adaptive basis for such influence.
Email: Christian Luhmann, christian.luhmann@stonybrook.edu

1:50-2:05 (199)

Prospect Theory Reflects Selective Allocation of Attention. THORSTEN PACHUR, MICHAEL SCHULTE-MECKLENBECK and RALPH HERTWIG, *Max Planck Institute for Human Development*. — Cumulative prospect theory (CPT; Tversky & Kahneman, 1992), arguably the most prominent model of decision making under risk, has been almost completely detached from cognitive decision research, that focuses on measuring predecisional cognitive processing. We highlight that key explanatory constructs in CPT, such as probability sensitivity and loss aversion, are amenable to an information-processing interpretation in terms of selective attention allocation. In a process-tracing study, we monitored people's information search while they chose between monetary lotteries and estimated CPT parameters from each participant's choices using a Bayesian hierarchical approach. Individual differences reflected in CPT's probability sensitivity, outcome sensitivity, and loss aversion parameters were associated with individual differences in selective attention during information search—such as the relative attention to probabilities versus outcomes and the relative attention to negative versus positive outcomes. Our results reveal an underappreciated value of CPT to reflect aspects of cognitive processing and point to mechanisms underlying key constructs of CPT in terms of selective attention allocation.
Email: Thorsten Pachur, pachur@mpib-berlin.mpg.de

2:10-2:25 (200)

Visual Attention and Reward. JAN THEEUWES and MICHEL F. FAILING, *Vrije University*. — It is well known that salient events have the ability to summon attention in an exogenous way. Recent studies have shown that attentional capture is not solely determined by salience alone but is affected by previous experience of rewards and punishment. Here we show that nonsalient events that are associated with monetary reward have the ability to capture attention. Spatial attentional capture is demonstrated in a spatial cueing paradigm in which we show performance costs and benefits in attentional orienting towards a nonsalient cue that acquired value through reward learning. Non-spatial attentional capture is demonstrated in an RVSP task in which stimuli associated with high monetary reward cause more interference than stimuli associated low monetary reward. Finally, we show that also stimuli that merely signal the presence of reward have to ability to summon attention. The present study adds to the growing evidence that stimuli associated or signaling reward have the ability to exogenously capture spatial and non-spatial attention independent of task-set, goals and salience.
Email: Jan Theeuwes, j.theeuwes@psy.vu.nl

2:30-2:45 (201)

The Buyer's Curse: Pricing Decisions Indicate a Cognitive Asymmetry Between Buyers and Sellers. ELDAD YECHIAM, *Technion - Israel Institute of Technology*, THORSTEN PACHUR, *Max Planck Institute for Human Development*, TAHER ABOFOL, *Technion - Israel Institute of Technology*. — Previous work comparing pricing decisions by buyers and sellers has primarily focused on discrepancies in valuation between the two perspectives. We examined whether this phenomenon, known as the endowment effect, is also accompanied by buyer-seller differences in evaluative accuracy. If, as has been proposed, sellers stand to accrue a more substantial loss than buyers, then their pricing decisions should be more sensitive to actual value differences between objects. In Study 1 we reanalyzed two published datasets in which participants priced monetary lotteries as sellers or buyers. Sellers indicated prices that were better aligned with the ranking of the lotteries' expected value in 6 out of 7 studied conditions. The discrepancy in accuracy disappeared in a condition with an extended deliberation time of 15 seconds. In Study 2 a new experiment showed that these results emerge when selling and buying conditions are presented in a blocked but not in a mixed format. The results are consistent with an attentional resource-based account of asymmetries between buyers and sellers.
Email: Eldad Yechiam, yeldad@tx.technion.ac.il

2:50-3:05 (202)

Conditional Control of Spatial Information Provided by a Landmark. KEN LEISING, JOSHUA E. WOLF and CHAD M. RUPRECHT, *Texas Christian University*. — The best spatial cues are those that reliably predict a location across time, provide consistent spatial information (i.e., stable) regarding location, and are temporally or spatially proximal to a desired location. We investigated whether these factors were also critical within conditional discriminations involving

landmarks. Undergraduate students and pigeons were trained to respond at a target location (+) signaled by a landmark (e.g., LM A), only if the landmark was preceded by a colored display (e.g., X→A+). The direction of the target relative to the landmark (A) was conditional on the colored display (X or Y) which preceded it (+←YA, XA→+). The stability of LM A was varied across two experiments to determine its effects on response magnitude and spatial accuracy during transfer tests with novel configurations of stimuli (e.g., XB). We found hierarchical accounts best explained differences in magnitude, whereas spatial accuracy was best explained via spatial learning models.

Email: Kenneth Leising, k.j.leising@tcu.edu

Recall I
Seaview A & B, Saturday Afternoon, 1:30-3:30
*Chaired by Neil Mulligan, University of
North Carolina at Chapel Hill*

1:30-1:45 (203)
Negative and Positive Testing Effects in Terms of Item-Specific and Relational Information. NEIL MULLIGAN, *University of North Carolina at Chapel Hill*, DANIEL PETERSON, *Knox College*. — Though retrieving information typically results in improved memory on a subsequent test (the testing effect), Peterson and Mulligan (2013) outlined the conditions under which retrieval can result in poorer memory relative to restudy, a phenomenon dubbed the negative testing effect. Across four experiments, we follow up on this original demonstration showing: (1) The basic phenomenon is replicable, (2) the breadth of results fit well within the item-specific–relational framework, (3) alternative explanations do not accommodate the results reported here and in the original study, and (4) the testing effect shares important similarities with the generation effect and other similar memory phenomena.

Email: Neil Mulligan, nmulligan@unc.edu

1:50-2:05 (204)
Forgetting the Presidents. HENRY L. ROEDIGER, III and K. ANDREW DESOTO, *Washington University in St. Louis*. — Someday George W. Bush and Barack Obama will be remembered as poorly as Millard Fillmore and Chester Arthur are today. How rapidly are well known people forgotten from collective/historical memory? We analyzed data collected from college students over a 40-year period, as well as from an online sample of adults of varying ages, to arrive at estimates of forgetting from collective memory. We find regular serial position effects in recall of presidents and use these data in two ways to estimate rates of forgetting. We can predict when presidents will drop to baseline levels of knowledge (Lyndon Johnson will be about as well known as Millard Fillmore in 2165) and which presidents will live on in historical memory (John F. Kennedy is likely to be remembered better than most presidents). The study of collective or historical memory is a new enterprise for psychologists and can be subjected to empirical examination.

Email: Henry L. Roediger, III, roediger@wustl.edu

2:10-2:25 (205)
Assessing the Inhibition and Context Accounts of Retrieval-Induced Forgetting. JULIA S. SOARES, CODY W. POLACK and RALPH R. MILLER, *SUNY - Binghamton* (Presented by Ralph Miller). — Retrieval-induced forgetting (RIF) refers to impaired recall of previously studied items resulting from retrieval of other studied items from the same category, relative to recall of studied items from categories in which no item was retrieved. The inhibition account of RIF (Anderson & Spellman, 1995) was assessed by our manipulating the orthographic similarity (and hence competition during retrieval practice) of practiced and non-practiced items within a category. The context account of RIF (Jonker, Seli, & MacLeod, 2013) was assessed by increasing the similarity of the contexts of Study and Retrieval Practice, which the model predicts will decrease RIF, and the similarity of the contexts of Retrieval Practice and Test, which the model predicts will promote RIF. Although RIF was observed, manipulations expected to modify RIF according to each account not only failed to do so, but produced opposite tendencies. Constraints on these accounts will be discussed.

Email: Ralph Miller, rmiller@binghamton.edu

2:30-2:45 (206)
Retrieval Can Fixate Transient Access Strengths in Long-Term Memories. MIHALY RACSMANY, *Budapest University of Technology and Economics*, ATTILA KERESZTES, *Max Planck Institute for Human Development, Berlin, Germany*. — Retrieval can enhance learning, but it might also induce forgetting on related memories. Previous research has shown that only selective retrieval – not selective restudying – of target items in a memory set leads to decreased accessibility of related items belonging to the same set (see Storm, 2011). In two experiments, we investigated the long-term effects of practicing selective retrieval or selective study on relative recall probabilities within a memory set. Subjects studied category-exemplar associations, some of which were then either restudied or retested. Each studied items were probed on a delayed final category-cued recall test. Using short (5 minutes) and long (5 and 10 days) retention delays between selective practice and final recall, we found that selective retrieval fixated the strength ratios (ratio of retrieved practiced/unpracticed items) within practiced category sets. Contrary to retrieval, selective study changed strength ratios only for a short time interval, whereas longer delays reset strength ratios in comparison to baseline sets. These results can be interpreted in a theoretical framework describing retrieval function as an act of pattern fixation in memory sets.

Email: Mihaly Racsmany, racsmany@cogsci.bme.hu

2:50-3:05 (207)
The Curious Case of Orthographic Distinctiveness: Disruption of Organizational Processing. MARK MCDANIEL, MICHAEL CAHILL and JULIE BUGG, *Washington University in St. Louis*. — We investigated the effects of orthographic distinctiveness on encoding and recall of categorized word lists. One assumption is that categorically-structured lists prompt encoding of related features of the items and de-emphasize distinct features of each item. In line

with this assumption, recall of categorically-structured lists is advantaged by increasing the distinctiveness of individual words. Thus, orthographic distinctiveness (OD) would be expected to enhance recall of categorically-structured lists. However, OD disrupts encoding and use of temporal order information in recall, raising the possibility that OD might interfere with categorical processing and attenuate recall of categorized lists. Two experiments revealed that categorized lists were more poorly recalled when composed of OD words than when composed of orthographically common words. This disruption was eliminated when words were presented entirely in capital letters. These results are novel in demonstrating that OD, unlike other distinctive processing, disrupts organizational processes in memory.
Email: Mark McDaniel, mmcdanie@artsci.wustl.edu

3:10-3:25 (208)

Assessing Fluent Expert Memory Access and Search in Competitive Crossword Players: The Dual Versus Single Route Hypothesis. SHANE MUELLER and KEJKAEW THANASUAN, *Michigan Technological University*. — Crossword play requires memory along two routes (semantic and orthographic) that provide complementary cues and constraints. The process can be understood as a memory search problem in which candidates are generated via memory retrieval, and then checked against the constraints to determine whether the candidate is satisfactory. It remains an open question whether this memory search can happen simultaneously along both routes, or must happen for orthographic and semantic routes separately. We report the results of experimentation and a computational model that show the best explanation, for both novices and experts, is that memory search occurs with one type of cue at a time. This suggests that compound cues are typically not used to search memory in crossword play. Furthermore, these results, together with a computational model of crossword play, indicate that expert players may be especially adept at memory access via semantic (clue-answer) associations. This suggests an association-based account of knowledge expertise wherein recognitional decisions are constrained mainly be fluent memory retrieval rather than a more traditional decision process involving the ability to compare and weigh between options.
Email: Shane Mueller, shanem@mtu.edu

Attention: Features and Objects I
Beacon A, Saturday Afternoon, 1:30-3:10
Chaired by Jonathan Flombaum, Johns Hopkins University

1:30-1:45 (209)

Models of Multiple Object Tracking Without Capacity or Resource Limits. JONATHAN FLOMBAUM, *Johns Hopkins University*. — Central constructs in perceptual and cognitive psychology over the last several decades are capacity and resource limitations. The multiple object tracking paradigm became influential, at least in part, because of how saliently it evidences limits. Human observers just cannot track many objects at once, especially at high speeds. This talk will entertain the possibility that these limits are computational, not resource- or capacity-dependent. The main focus will be on the challenge of identifying correspondences between items from one encounter to the next. Given noisy estimates of several object positions at one moment in time, and an unlabeled bag of noisy observations at the next moment, an observer must make inferences about which observations correspond to which prior estimates. I will discuss computational models that execute these inferences and that include basic psychophysical constraints such as eccentricity-dependent noise. The models do an excellent job of capturing human performance in a variety of contexts without any explicit capacity limits or commodity-like resource constraints.
Email: Jonathan Flombaum, flombaum@jhu.edu

1:50-2:05 (210)

Feature-Based Attention Results in Active Suppression of Similar Features Throughout the Visual Field. VIOLA STÖRMER and GEORGE ALVAREZ, *Harvard University*. — It is known that focusing attention on a particular feature facilitates processing of all objects in the visual field with that feature. Here we show that such feature-based attention not only facilitates processing, but also actively inhibits processing of similar features globally across the visual field. We combined behavior and electrophysiological recordings in human observers to measure this inhibitory surround in feature space. We found that sensory signals of an attended color (e.g., red) were enhanced while sensory signals of colors similar to the target color (e.g., orange) were suppressed relative to colors more distinct from the target color (e.g., yellow). These findings suggest that feature-based attention comprises an excitatory peak surrounded by a narrow inhibitory zone in color space. This selection profile is akin to what has been reported for location-based attention and suggests that such center-surround mechanisms are an overarching principle across different domains in the human brain.
Email: Viola Störmer, vstormer@fas.harvard.edu

2:10-2:25 (211)

Feature Amnesia: Attending to a Feature of a Specific Object Does Not Guarantee That It Can Be Reported. BRAD WYBLE and HUI CHEN, *Pennsylvania State University*. — It is by now well known that the visual system fails to process all of the information present in a complex scene, as exemplified by inattentional and change blindness. However it is often tacitly assumed that attended information that reaches a full level of awareness will be reportable. We tested this assumption in a series of experiments that used the surprise-test paradigm of Rock et al. (1992) to determine whether a feature (e.g. color) that participants used to localize a target could be reported immediately afterwards. The conclusion of four experiments was that even though participants had been fully aware of an attended feature of a specific object, they were at or near chance in reporting that feature immediately afterwards if they did not expect to have to report it. These results suggest that attentional control settings differentiate between feature dimensions for target selection and for memory.
Email: Brad Wyble, bwyble@gmail.com

2:30-2:45 (212)

Birds Use Vertices to Discriminate 2D Shape. MUHAMMAD QADRI and ROBERT COOK, *Tufts University* (Presented by Robert Cook). — All vision systems, human, animal, and computer, have to parse the visual world. Vertices and edges have been proposed as important theoretical features for this function. Previous research with pigeons had suggested that their visual system relies more heavily on edges than humans. To examine this question further, using a genetic algorithm that varied size, position, and other stimulus properties to optimize the stimuli, pigeons and starlings were trained in a two-sample two-alternative forced-choice task to discriminate triangles from squares. Subsequent tests with contour-deleted items revealed that pigeons and starlings relied on the vertices more than edges in making their discrimination. These results are consistent with those found in humans and suggest that all three species process shape in a fundamentally similar way. Previous comparative difference between pigeons and humans likely resulted from procedural issues.
Email: Robert Cook, robert.cook@tufts.edu

2:50-3:05 (213)

Were Verbal Stimuli All to Blame? In Search for the Locus of No Retention-Interval Cueing Benefit. MICHI MATSUKURA and SHAUN VECERA, *University of Iowa.* — Despite 40 years of the belief that attention cannot influence visual memory once an iconic image of the to-be-remembered items faded away (Sperling, 1960), the finding that attention can select an item already stored in visual short-term/working memory (VSTM/VWM) is now widely accepted (Griffin & Nobre, 2003). However, why the original iconic memory study failed to find a cueing benefit during VSTM maintenance still remains unknown. While some studies assume that this lack of the cueing benefit is attributed to use of alphanumeric stimuli, differences between the original partial report procedure and the retention-interval cueing paradigm are not limited to stimulus type. In the present study, we investigated whether lack of the retention-interval cueing benefit derived from (1) visual-verbal recoding, (2) attentional selection demands, or (3) memory task specificity (recognition vs. recall). The results indicated that lack of the retention-interval cueing benefit is not solely attributable to visual-verbal recoding.
Email: Michi Matsukura, michi-matsukura@uiowa.edu

Reading
Beacon B, Saturday Afternoon, 1:30-3:30
Chaired by Simon Liversedge, University of Southampton

1:30-1:45 (214)

Reading Sentences With Words of the Same Length. SIMON LIVERSEDGE, DENIS DRIEGHE and MICHAEL G. CUTTER, *University of Southampton.* — We investigated the effect of removing word length variability within sentences on eye movements during reading. We hypothesised that this manipulation might result in more efficient saccadic targeting, and consequently word identification. Participants read sentences comprised entirely of three-, four- or five-letter words, and sentences with a combination of these lengths. Our manipulation affected saccadic targeting. When participants read sentences comprised entirely of three-letter words they became more accurate at making short saccades relative to in the non-uniform condition. When participants read uniform sentences of five-letter words they became more accurate at making long saccades relative to in the non-uniform condition. This suggests that the range bias established by McConkie et al. (1988) rapidly adapts to current word length context. Furthermore, our manipulation had significant inhibitory effects on reading times, with words of each length receiving longer fixations in uniform than non-uniform sentences. Potential explanations will be discussed.
Email: Simon Liversedge, s.p.liversedge@soton.ac.uk

1:50-2:05 (215)

The Development of Reading Skill: Exploratory Analyses Using the E-Z Reader Model. ERIK REICHLE, *University of Pittsburgh*, LYUBA MANCHEVA, ANNE GUERIN-DUGUE, BENOIT LEMAIRE and SYLVIANE VALDOIS, *University of Grenoble Alpes.* — Previous simulations using E-Z Reader suggest that the changes that occur in readers' eye movements with the development of reading skill reflect increasingly proficient lexical processing (Reichle et al., 2013). We examined this hypothesis more carefully by using the E-Z Reader model to simulate eye-movement data from a large sample of native French speaking adults and children (having a range of reading skill) reading a passage of text. The best-fitting parameter values obtained from these simulations replicate previous simulation results suggesting that differences in the overall rate of lexical processing contribute to differences in reading skill. In addition, with the simulations of individual children, the best-fitting parameter values correlated with psychometric measures of orthographic and phonological knowledge, but not comprehension of the text. The theoretical implications of these findings for normal and impaired reading skill development will be discussed.
Email: Erik Reichle, reichle@soton.ac.uk

2:10-2:25 (216)

Toward a New Theory of Reading: Independent and Joint Effects of Context, Parafoveal Preview, and Foveal Information. ELIZABETH SCHOTTER (2014 Member Select-Speaker Award Recipient), *University of California, San Diego.* — Three experiments investigated how (1) expectations from context, (2) parafoveal preview, and (3) foveal target information independently or jointly influence silent reading. The strength of expectations based on contextual constraint was manipulated and the gaze-contingent boundary paradigm (Rayner, 1975) was used to create various target-preview relationships: identical, synonym, antonym, associated, plausible, or random. Across all experiments, increased contextual constraint facilitated early processing of both the expected target word and any preview that was associated with the context. Later processing showed an inhibitory consequence for all but the identical preview. These data challenge the traditional view of reading—that preview and target information are always and immediately integrated—but support an alternative theory—that early reading is risky if there is enough information to assume the word will

be recognizable (based on preview and context) and later reading slows or goes back to salvage comprehension when this hedged bet was incorrect.
Email: Elizabeth Schotter, eschotter@ucsd.edu

2:30-2:45 (217)

Where Do Chinese Readers Move Their Eyes During Reading? XINGSHAN LI, *Chinese Academy of Sciences*. — In English reading, readers' eyes typically land on a fixed location on a word, which is halfway between the beginning and the middle of the word. English readers could do so because there are spaces between words so that English readers could perceive word boundary information based on low-level visual information. In contrast, in Chinese reading, there are no inter-word spaces between words. In this situation, how do Chinese readers decide where to move their eyes? In one of the studies, we showed that the landing position was not affected by the length of the target word, suggesting that Chinese readers do not target at any specific position within a word when they move their eyes. In another study, we showed that the length of saccades leaving an "easy" word was longer than leaving a "difficult" word. Based on these findings, we propose a processing-based strategy for saccade target selection in Chinese reading. According to this strategy, readers identify as many characters as possible on each fixation. As a consequence, the easier the processing of the fixated word, the longer the outgoing saccade.
Email: Xingshan Li, lixs@psych.ac.cn

2:50-3:05 (218)

Reading for Comprehension Versus Skim Reading on the Web: How Skim Reading Is Informed by Hyperlinks. DENIS DRIEGHE, MARK J. WEAL and GEMMA FITZSIMMONS, *University of Southampton*. — Studies of reading have focused on reading behaviour when participants read a single, mono-coloured sentence for comprehension. However, everyday reading behaviour such as reading hypertext on Webpages entails people reading or skim reading passages of text containing links in a colour, different from the main text. We recorded participants' eye movement behaviour and asked them to read for comprehension or skim read modified pages from Wikipedia. Target words were embedded in the pages that were either hyperlinked or not, and were either a high- or a low-frequency word. When skim reading, participants read faster and skipped more words, even though comprehension was comparable across the tasks. Linked words were skipped less often than unlinked words when skimming, revealing that participants used the coloured words as 'anchor' points for scanning strategies. Frequency effects were observed in all conditions except for the unlinked words in the skimming task, indicating reduced lexical processing.
Email: Denis Drieghe, d.drieghe@soton.ac.uk

3:10-3:25 (219)

The Contribution of the Exner's Area During Reading: A Neuronavigated TMS Study. CHOTIGA PATTAMADILOK, *Laboratoire Parole et Langage*, AURÉLIE PONZ and MIREILLE BONNARD, *Institut de Neurosciences des Systèmes*. — The Exner's area has been considered to play a central role in handwriting gestures. Its activation was reported in studies that compared handwriting to other language or motor activities and lesions within this area lead to dysgraphias or agraphias. However, some studies also showed that the area is activated during reading. Here, we investigated whether the Exner's area truly contributes to fluent reading or it is merely activated by the presence of written characters without any functional role. To do so, Transcranial Magnetic Stimulation was applied on this area while participants performed a lexical decision task. The result showed that for both handwritten and printed characters, only pseudowords were affected by the stimulation. The disruptive effect of TMS occurred as early as 60ms post-stimulus onset. The finding suggests that the Exner's area contributes to reading especially when the stimuli are processed serially but not when a global procedure is used.
Email: Chotiga Pattamadilok, chotiga.pattamadilok@lpl-aix.fr

Perceptual Processes
Shoreline, Saturday Afternoon, 1:30-3:30
Chaired by Jared Medina, University of Delaware

1:30-1:45 (220)

Mirror-Touch Synesthesia: Effects of Body Position on Percept Localization. JARED MEDINA, *University of Delaware*. — Individuals with mirror-touch synesthesia (MTS) report feeling touch on their own body when seeing someone else being touched. Thirty-five individuals with MTS were shown videos in which a hand, positioned palm up or palm down, was touched on the index finger, ring finger, or not touched. To examine the effect of body position on the frequency and perceived location of MTS percepts, we manipulated the congruency of video and participants' hand posture. Mirror-touch percepts were more frequent in the congruent versus incongruent condition. Furthermore, an error analysis revealed two subtypes of MTS. In one group, percepts were experienced on the same surface and finger as in the video in congruent and incongruent conditions. In a second group, percept location was constrained by the participants' own hand position, with percepts consistently experienced on the side facing up. These results provide evidence for the influence of the body schema on mirror-touch percepts.
Email: Jared Medina, jmedina@psych.udel.edu

1:50-2:05 (221)

The Perceptual Detection Model. RICHARD CHECHILE, *Tufts University*. — Chechile (2013) argued that multinomial processing tree (MPT) models have an advantage over the signal detection (SD) approach to recognition memory because recognition memory tests result in stochastic mixtures. A case is made here that perceptual detection also frequently involves a mixture of processes that are well rePresented by

a MPT model. The new MPT model is called the Perceptual Detection (PD) model, and it is an adaptation of the Chechile (2004) 6P memory model. The key properties of the model are developed, and applied to the case of a radiologist examining CT scans. The PD model brings out novel features that were absent from the standard SD analysis.

Email: Richard Chechile, richard.chechile@tufts.edu

2:10-2:25 (222)
Increased Alpha Band Activity Indexes Inhibitory Competition Across a Border During Figure Assignment. MARY PETERSON and JOSEPH L. SANGUINETTI, *University of Arizona*, LOGAN T. TRUJILLO and DAVID M. SCHNYER, *University of Texas, Austin*, JOHN J.B. ALLEN, *University of Arizona*. — Increased EEG alpha band activity may index inhibition of task-irrelevant information. Here, we test whether increased alpha activity indexes inhibitory competition for figural status. In 3 experiments, participants judged silhouettes as "real-world" or "novel" objects. Real-world silhouettes depicted namable objects. Novel silhouettes depicted novel objects on the inside, figure-side, of their borders. There were 2 types of novel silhouettes: High-competition (HC) novel silhouettes, where real-world objects suggested on the outside of the borders competed with the inside for figural status; and low competition (LC) novel silhouettes where little competition occurred. In Experiments 1-2 alpha power was greater for HC than LC, $p < .05$; repetition lag (many items) had no effect. In Experiment 3, with short lags (4-7 items, ~10s), alpha power was reduced for 2nd versus 1st presentation of HC only, $p < .05$, suggesting that persisting inhibition of the object suggested on the groundside reduced competition on second presentation. Therefore, EEG alpha band activity increases with increased inhibitory competition for figure assignment. These results are consistent with the view that alpha indexes inhibition.

Email: Mary Peterson, mapeters@u.arizona.edu

2:30-2:45 (223)
Sensitivity to Nonaccidental Properties in Two-Line Configurations. JOHAN WAGEMANS, CHARLOTTE SLEURS and JONAS KUBILIUS, *University of Leuven (KU Leuven)*. — Why do some pairs of short line segments look special and others random? Minimal Model Theory (MMT) holds that two-line configurations are more special if there are fewer degrees of freedom left to change their relative position and orientation. Another theory emphasizes the role of nonaccidental properties (NAPs) that allow 3D shape recovery. Predictions from both theories were tested in three experiments with displays consisting of four two-line configurations, three identical and one different, which had to be located. The odd one out differed from the others by a change in angle or position (e.g., from T- to L- or X-junction) in two experiments. In Experiment 3, metric changes were directly compared to changes in NAPs such as collinearity,

cotermination, and parallelism. Overall, changes in NAPs were detected faster than metric changes, while position and orientation changes in junctions were not always as predicted by MMT.

Email: Johan Wagemans, johan.wagemans@psy.kuleuven.be

2:50-3:05 (224)
Aesthetic Preferences for Spatial Compositions: Evaluating the Rule of Thirds. STEPHEN PALMER, JAN FLATLEY-FELDMAN, YURIKA S. HARA and WILLIAM S. GRISCOM, *University of California, Berkeley*. — The Rule of Thirds posits that, regardless of the image content, the best positions for a focal object within an image lie along the vertical and horizontal third-lines, yielding the best compositions when the object is located at one of their four intersections and the worst compositions when it is at the frame's center. Our results strongly contradict all of these predictions. Forward-facing objects produced a powerful center bias, whereas left-facing and right-facing objects produced an inward bias, being preferred off-center but only when there is more space in front than behind the object. We hypothesized that these biases might arise simply from a bias toward centered placement of an object's affordance space: its perceived functional surrounding space that includes room for its interactions with observers and other objects (e.g., extending farther in front than behind for most objects). An empirical test was consistent with this possibility: 2AFC judgments of affordance-space structure were highly consistent with 2AFC judgments of aesthetic preference in composition for corresponding pictures of the same objects ($r = $ ~.80) and much less consistent with the predictions of the Rule of Thirds.

Email: Stephen Palmer, sepalmer@gmail.com

3:10-3:25 (225)
Visual Cues Effects on Temperature Perception. CARRIE ANNE BALCER, ANDREW SHIRTZ, TAYLOR ROLISON and MOUNIA ZIAT, *Northern Michigan University* (Presented by Mounia Ziat). — The purpose of this study is to understand multisensory integration between the color and the temperature of an object when a conflict arises. It was hypothesized that when the information of color and temperature stimuli are incongruent (blue-warm or red-cold), reaction times (RTs) will be slower than when they are congruent (blue-cold or red-warm). We utilized the Oculus Rift, a head-mounted display to create a virtual environment that allowed us to control color cues of cup's temperature and a Peltier thermo-device to provide tactile temperature stimuli. The results confirmed our initial expectation, as suggested by longer RTs for incongruent stimuli. The results also showed that participants rated cold temperature sensations warmer when presented simultaneously with a visual red color cue and warm temperature sensations cooler when presented simultaneously with a visual blue color cue.

Email: Mounia Ziat, mziat@nmu.edu

SYMPOSIUM IV: New Ideas About Memory Development
Regency A-C, Saturday Afternoon, 1:30-3:40
Organized by Rebecca L. Gómez, University of Arizona,
and Nora S. Newcombe, Temple University

1:30-1:40 (226)
Introduction. REBECCA L. GÓMEZ, *University of Arizona*

1:40-2:00 (227)
A Puzzle in Memory Development: Similar Outcomes Driven by Different Memory Processes. REBECCA L. GÓMEZ, *University of Arizona.* — Generalization requires extracting relevant cues across training instances while ignoring irrelevant ones. We investigate memory in young children who are unable to generalize at learning, but who generalize after a delay. Children saw stimuli with strongly supported cues relevant to generalization and weakly supported variations across trials. Sleep promoted generalization in 12-month-old infants and retarded generalization in 2.5-year-old toddlers who performed better after a delay containing wake. These seemingly contradictory findings make sense in light of developing memory structures. In infancy an immature trisynaptic circuit precludes hippocampal sharp wave ripples and neural replay, favoring generalization based on a downscaling process that retains stronger memories over weaker ones. Later in development when hippocampal connectivity may begin to support neural replay, high levels of slow wave sleep may consolidate relevant and irrelevant information equally, leaving children with little basis for generalization. During wake children forget weaker, irrelevant memories permitting generalization.
Email: Rebecca L. Gómez, rgomez@email.arizona.edu

2:05-2:25 (228)
Relations Between Episodic Memory and Spatial Memory Development. NORA NEWCOMBE, *Temple University.* — Episodic memory involves binding together what-where-when associations. Spatial memory arguably involves exactly the same associations, and both kinds of memory are supported by the hippocampus and associated neural structures. So, are there correlations at the individual difference level between the two kinds of memory? Can charting the development of one kind of memory give us information about the developmental trajectory of the other? This paper suggests that the answer to both questions is "yes." It also argues that children's episodic memory undergoes an early qualitative change, followed by continuing increments in the use of contextual cues throughout the preschool period.
Email: Nora S. Newcombe, newcombe@temple.edu

2:30-2:50 (229)
Remembering Things In, and Out of, Context Across Typical and Atypical Development. JAMIE EDGIN, *University of Arizona.* — Context effects on object recognition show a u-shaped developmental trajectory (Edgin et al, 2014). Specifically, these effects are present in preschool children, disappear in mid-childhood, and reappear after age 13 years, with well-replicated effects in adults. Context effects in young children likely reflect unitized binding, flexibility emerges around 24-48 months (depending on task demands), and then in adolescence into adulthood there is increasing ability to encode and retrieve complex representations (objects in scenes). Individuals with memory disorders show lapses in these transitions. Those with autism show no context effects, and no increase in scene recognition into the adult years, suggesting they never reach the final stages of development. In contrast, individuals with Down syndrome, an intellectual disability affecting hippocampus, show clear context effects, much like young children. Therefore, the association of objects in context, often thought to reflect hippocampal binding, must be mediated by different neural systems across development.
Email: Jamie Edgin, jedgin@email.arizona.edu

2:55-3:15 (230)
Development of Flexible Retrieval. SIMONA GHETTI, DANA DEMASTER, AND CHRISTINE COUGHLIN, *University of California, Davis.* — Episodic memories are arguably most useful if they can be retrieved in the absence of the original encoding context and through a variety of retrieval cues; this retrieval flexibility has been found to improve with age. The goal of the present study was to examine hippocampal contribution to the development of flexible episodic retrieval. FMRI data were collected 8-year-olds, 11-year-olds, and adults (N=56) during an associative memory task that required participants to retrieve pairs of pictures that either appeared in the same location or a different location as during encoding. Recognition of different-location pairs required more flexible retrieval than recognition of same-location trials. Developmental differences were found such that adults, but not children, recruited the hippocampus more strongly for correct different-location trials compared to correct same-location trials; the opposite was true for children. Overall, these results implicate hippocampal development as a source of developmental change in flexible retrieval.
Email: Simona Ghetti, sghetti@ucdavis.edu

3:20-3:40 (231)
Discussion and Questions. NORA NEWCOMBE, *Temple University.*
Email: Nora Newcombe, newcombe@temple.edu

Vision II
Beacon A, Saturday Afternoon, 3:30-5:30
Chaired by Jessica Witt, Colorado State University

3:30-3:45 (232)
Integrating Action-Based and Visual Information: Bayesian Model of Action-Specific Effects on Spatial Perception. *JESSICA WITT, *Colorado State University.* — The action-specific account of perception emphasizes the role of action in perception. The claim is that perceivers see the spatial layout of the environment in terms of their ability to perform the intended action. For example, when trying to block balls moving at various speeds, the balls look to be moving slower when the paddle used to block them is bigger and thus more effective at blocking (Witt & Sugovic, 2010, 2012, 2013). Yet to be determined is how action-based information exerts its

influence. According to Bayesian theory, if two sources of information (such as action-based and visual information) are integrated, one source will exert a greater influence as uncertainty related to the other source increases. A Bayesian model was designed that predicted a bigger effect of a person's ability to block a ball on perceived speed of the ball as visual uncertainty increased. The model's predictions showed a good fit to human data. The results suggest that a mechanism underlying action-specific effects is one of direct integration between visual and action-based information.
Email: Jessica Witt, jessica.witt@colostate.edu

3:50-4:05 (233)

Target-Distractor Competition in the Oculomotor System Is Spatiotopic. ARTEM BELOPOLSKY, *Vrije Universiteit*, DONATAS JONIKAITIS, *Ludwig-Maximilians Universität Munich*. — In natural scenes multiple visual stimuli compete for selection, however, each saccade displaces the stimulus representations in retinotopicaly organized visual and oculomotor maps. In the present study we used saccade curvature to investigate whether oculomotor competition across eye movements is represented in retinotopic or spatiotopic coordinates. Participants performed a sequence of saccades and we induced oculomotor competition by briefly presenting a task-irrelevant distractor at different times during the saccade sequence. Despite the intervening saccade, the second saccade curved away from a spatial representation of the distractor that was presented before the first saccade. Furthermore, saccade curvature away increased with salience of distractor that was presented before the first saccade. The results suggest that spatiotopic representations of target-distractor competition are crucial for successful interaction with objects of interest despite the intervening eye movements.
Email: Artem Belopolsky, a.belopolsky@psy.vu.nl

4:10-4:25 (234)

The Development of Categorization: Attention and Category Representation. VLADIMIR SLOUTSKY and WEI (SOPHIA) DENG, *Ohio State University*. — The current study examined the role of attention in category learning category representation. In Experiment 1, 4-year-olds, 6-year-olds, and adults were trained with either a classification task or an inference task and then tested with categorization and recognition tasks. Adults and 6-year-olds exhibited an important asymmetry: they relied on a single deterministic feature during classification, but not during inference training. In contrast, regardless of the type of training, 4-year-olds relied on multiple probabilistic features. In Experiment 2, 4-year-olds were presented with classification training and their attention was explicitly directed to the deterministic feature. Under this condition, their categorization performance was similar to that of older participants in Experiment 1, yet their memory performance pointed to a similarity-based representation, which was similar to 4-year-olds in Experiment 1. These results are discussed in relation to theories of categorization and the development of selective attention in the development of category learning.
Email: Vladimir Sloutsky, sloutsky.1@osu.edu

4:30-4:45 (235)

The Role of Motion, Flicker, and Abrupt Onset in Attention Capture. ADRIAN VON MUEHLENEN, *University of Warwick*, MEERA MARY SUNNY, *IIT Gandhinagar*. — Previous research has shown that motion per se does not capture attention, however, the onset of motion does. The explanation for this motion-onset effect was that continuous motion as such is far too common in our natural environment to be informative of behaviourally urgent events. But, the onset of motion can be important for the categorization of objects as being animate as opposed to inanimate, which, in evolutionary terms might be vital for the detection of prey and predators. In my talk I will argue that the motion-onset effect critically depends on motion jerkiness – that is, the rate at which the moving stimulus is refreshed. I will present a series of experiments showing that this attention effect by jerky motion is solely due to one initial abrupt displacement. I will further argue that this effect of abrupt displacements is the same as the effect of abrupt onsets. I will speculate that the primary cause of this effect is not an advantage for the displaced/onset item, but a disadvantage for all other items, due to forward masking by their preceding figure-8 placeholders.
Email: Adrian Von Muehlenen, a.vonmuhlenen@warwick.ac.uk

4:50-5:05 (236)

Visual and Haptic Shape Recognition Memory. J. FARLEY NORMAN, JACOB R. CHEESEMAN, HIDEKO F. NORMAN, CONNOR E. ROGERS, MICHAEL W. BAXTER and OLIVIA C. ADKINS, *Western Kentucky University*. — Little is known about memory for solid (3-D) shape, especially for unfamiliar naturally-shaped objects. In the current experiment, participants haptically explored or viewed a set of six bell peppers (Capsicum annuum) either once, four times, or seven times. On each study trial, the participants either viewed or haptically explored a particular bell pepper for 15 seconds. The participants' recognition memory was tested immediately. Twelve bell peppers were then presented (visually or haptically); the participants judged whether each one was either old (previously presented during the study phase) or new. Recognition performance was similar for vision and haptics when each of the original bell peppers was studied once. However, when the original bell peppers were studied multiple times (4 or 7 times), the participants' visual recognition performance was higher (by 33.7 percent) than that obtained for haptics. Visual solid shape memory thus appears to be superior to haptic shape memory.
Email: J. Farley Norman, farley.norman@wku.edu

5:10-5:25 (237)

Multiple Levels of Crowding. RUTH KIMCHI and YOSSEF PIRKNER, *University of Haifa*. — The identification of a peripheral object in the presence of flankers is impaired, although the same object can be readily identified in isolation – a phenomenon known as crowding. We examined whether crowding can occur at multiple levels, specifically, at the object whole and the object parts levels. The target object was a disconnected configuration (square or diamond) made of elements grouped by collinearity, closure, and symmetry.

Target identification was measured at varying eccentricities. The flankers surrounding the target were similar to the target object parts or the target object whole. The results showed that flankers impaired target identification at larger eccentricities and there was no effect of flankers at the fovea, indicating crowding. However, the detrimental effect of object whole flankers was evident at smaller eccentricity and was greater than the effect of object parts. These results suggest that crowding occurs at both the object whole and the object parts levels, but crowding at the object parts level is weaker and has smaller spatial extend than crowding at the object whole level.
Email: Ruth Kimchi, rkimchi@research.haifa.ac.il

<center>

Working Memory II
Beacon B, Saturday Afternoon, 3:50-5:30
Chaired by Jeffrey Rouder, University of Missouri

</center>

3:50-4:05 (238)
Evidence for a Guessing in Working-Memory Judgments. JEFFREY ROUDER, JONATHAN THIELE and NELSON COWAN, *University of Missouri-Columbia.* — We explore whether visual working memory is mediated by a discrete-slot model, in which items are either in memory or not, or by a resource model, in which the memory for an item reflects the share of latent resources devoted to it. One finding concordant with the discrete-slot model is that in a production paradigm, responses are seemingly a mixture of stimulus-driven responses and guesses (Zhang & Luck, 2008, Psy. Sci). Alternative accounts from the resource theorists is that guessing-like behavior comes from responses to distractor items (Bays et al., 2009, J. Vis) or to items that did not receive many resources (van den Berg et al., 2014, Psy Rev). We use a production paradigm with items that vary in an angular displacement dimension. If guessing occurs, it has a different distribution than either responding to distractors or to responding to targets with a low proportion of resources. We show that the guessing signature remains and cannot be due to these resource-based alternatives. We also show a novel finding: On some trials participants remember the angular disparity finely on a continuous scale, and on others they remember it categorically as left or right.
Email: Jeffrey Rouder, rouderj@missouri.edu

4:10-4:25 (239)
How Many Items Changed? NELSON COWAN, JOHN SCOTT SAULTS and CHRISTOPHER L. BLUME, *University of Missouri-Columbia.* — In many studies of visual working memory, an array is presented and is followed by a probe that is either identical to one array item, or differs from all of them. In contrast, when people compare two objects or scenes, it is often possible for multiple elements to differ between the two. To begin to approach this kind of ubiquitous real-world situation, we presented on each trial an array of N colored squares to be remembered (N=5 or 7), followed by a second array resembling the first except that 1, 2….N items had changed to new colors that were not present in the first array. The task was to indicate the number of items that had changed to a new color. I will explain a formula designed to estimate the number of items held in working memory in this situation. Also, on some trials, participants were first asked a metamemory question, specifically how many of the colors they thought they had in working memory. The results show limited awareness of the contents of working memory. The findings will be discussed in terms of the deployment of the human focus of attention in working memory tasks.
Email: Nelson Cowan, cowann@missouri.edu

4:30-4:45 (240)
Repetitions Boost Visual Working Memory Capacity Via Strategic, Domain-General Rehearsal. CANDICE MOREY, *University of Edinburgh*, YONQI CONG and YIXIA ZHENG, *Rijksuniversiteit Groningen*, MINDI PRICE, *College of Idaho*, RICHARD MOREY, *Rijksuniversiteit Groningen.* — Repetitions in a visual scene boost working memory capacity for its elements. This may occur because improved perceptual organization reduces load or because the repetitions capture attention. These explanations provide unique predictions about capacity: efficient organization should boost capacity overall, whereas allocating attention selectively towards the repeated items should boost capacity only for tests of those particular items. We manipulated the occurrence of color repetitions and also whether a repeated item was probed. Some participants engaged in articulatory suppression while others counted backwards by threes. Estimated memory capacity was always higher when repeated items were tested, and under full attention conditions this bonus spilled over to the unique colors too. Analyses of gazes showed that with full attention, participants tended to glance earlier at repeated colors during the stimulus presentation but prioritized rehearsal of singletons during the retention interval. This pattern of results suggests that the repetition-based bonus occurs because efficient perceptual organization of the display is enhanced by strategic attention allocation when attention is available.
Email: Candice Morey, cmorey@staffmail.ed.ac.uk

4:50-5:05 (241)
Memory Retrieval Profile of the DRM False Memory in the Sternberg Paradigm: The Role of Distractors. JERWEN JOU, SARAH C. SILVA and CLARISSA GARCIA, *University of Texas - Pan American.* — This is a follow-up study of our 2013 Psychonomic presentation which showed that the retrieval time for the critical lures decreased with the increase of memory-set size (MSS), and that both the studied critical words and list words yielded an arched RT/MSS function. These are anomalies in the Sternberg paradigm. We attributed them to the semantically unrelated distractors in the DRM test. In this experiment, we used semantically related distractors. As expected, the RT functions of the critical lures and the studied list words displayed the normal monotonic increase trend as a function of MSS. The different shapes of the functions can be explained by an item- and a category-based retrieval process.
Email: Jerwen Jou, jjou@utpa.edu

5:10-5:25 (242)

Effects of Motor Congruence on Visual Working Memory.
RENE ZEELENBERG, *Erasmus University Rotterdam*,
MICHEL QUAK, *Ghent University*, DIANE PECHER,
Erasmus University. — Grounded cognition theories suggest
that memory shares processing resources with perception and
action. The motor system could be used to help memorize
visual objects. In two experiments we tested the hypothesis
that people use motor affordances to maintain object
representations in working memory. Participants performed
a working memory task on photographs of manipulable
and non-manipulable objects. The manipulable objects were
objects that required either a precision grip (i.e., small items)
or power grip (i.e, large items) to use. A concurrent motor task
that could be congruent or incongruent with the manipulable
objects caused no difference in working memory performance
compared to non-manipulable objects. Moreover, the
precision or power grip motor task did not affect memory
performance on small and large items differently. These
findings suggest that the motor system plays no part in visual
working memory.
Email: Rene Zeelenberg, zeelenberg@fsw.eur.nl

Human Learning and Instruction II
Regency D-F, H, Saturday Afternoon, 3:30-5:30
Chaired by Thomas H. Carr, Michigan State University

3:30-3:45 (243)

**Test-Enhanced Learning in Reading and Remembering
Text: Comprehension Is Crucial.** THOMAS H. CARR and
HILLARY HICKS, *Michigan State University*, AUTUMN B.
HOSTETTER and ROBERT BATSELL, *Kalamazoo College*.
— Taking a practice test after new learning integrates,
consolidates, and preserves what has been learned, making
more of it retrievable for a longer time than does merely
restudying. Such Test-Enhanced Learning (TEL) occurs in a
variety of domains, though most of the evidence comes from
memory for written material, where the occurrence of TEL is
quite systematic. Here we focus on the role of comprehension
in reading and remembering short texts. Using a powerful
manipulation of comprehension and situation modeling
first invented by Bransford and Johnson (1972), we find TEL
effects when readers comprehend and no TEL effects when
they do not comprehend.
Email: Thomas H. Carr, carrt@msu.edu

3:50-4:05 (244)

**Distributed Practice and Retrieval Practice in Primary
School Vocabulary Learning.** GINO CAMP and NICOLE
A.M.C. GOOSSENS, *Open University of the Netherlands*,
PETER VERKOEIJEN, HUIB K. TABBERS and ROLF
ZWAAN, *Erasmus University Rotterdam*. — The beneficial
effects on learning of both distributed practice and retrieval
practice have been extensively investigated in the laboratory,
but to a lesser extent in representative educational contexts.
In four studies we examined whether distributed practice
and retrieval practice enhance primary school vocabulary
learning. The effects of distributed practice and retrieval

practice on vocabulary learning were investigated in the
laboratory, in a simulated classroom setting and in a real-life
classroom setting. The studies were conducted in Grade 2-6
and varied in study materials, types of exercises used, and
context in which the new vocabulary was presented. In the
laboratory and in the simulated classroom setting, benefits
of distributed practice and retrieval practice were found, but
in a real-life classroom setting these effects were absent. It
is discussed to what extent these memory strategies can be
successfully integrated in current primary school vocabulary
lessons.
Email: Gino Camp, gino.camp@ou.nl

4:10-4:25 (245)

**Interleaving Test Trials With New Learning Impairs
Performance by Encouraging Time Borrowing.** JASON
CHAN and SARA D. DAVIS, *Iowa State University*. —
Retrieval often potentiates new learning (Chan, Thomas, &
Bulevich, 2010), but a recent paper demonstrated the opposite
(Finn & Roediger, 2013). In their study, after studying face-
name pairs, subjects either restudied or recalled the names,
and then learned a profession for each face. Surprisingly,
testing of the names impaired learning of the profession
(relative to restudying). In a series of experiments, we
examined whether testing impairs new learning because
participants borrow time from profession learning to focus
on the names following initial testing. We discouraged time
borrowing by providing longer name feedback durations,
incentivizing profession performance, and dividing name
retrieval and profession learning into separate blocks of trials.
These manipulations either eliminated or reversed the testing
impairment on profession learning. These results suggest that
the effects of testing on new learning is influenced by task
demands, and participants flexibly allocate their attentional
resources to maximize performance based on what they
believe to be important.
Email: Jason Chan, ckchan@iastate.edu

4:30-4:45 (246)

Creating Visual Explanations Improves Learning.
BARBARA TVERSKY, *Columbia Teacher's College*,
ELIZA BOBEK, *University of Massachusetts*. — Diagrams
communicate effectively and improve learning and
performance; can creating visual explanations also promote
learning? In two studies, students were taught a STEM
phenonmenon. Half then created visual explanations, half
verbal, followed by a post-test. All did better on the post-test
without additional learning, but those who had created visual
explanations scored higher. Visual explanations map thought
directly and provide checks for completeness and coherence
as well as a platform for inference, notably from structure to
process.
Email: Barbara Tversky, btversky@stanford.edu

4:50-5:05 (247)

Interleaved Practice Improves Mathematics Learning.
DOUG ROHRER, ROBERT F. DEDRICK and SANDRA
STERSHIC, *University of South Florida*. — A typical
mathematics assignment consists of problems of the same

kind (e.g., a dozen problems requiring the quadratic formula). This means that students know which strategy is needed to solve each problem before they read the problem. In an alternative approach known as interleaved practice, problems from the course are rearranged so that each assignment includes a mixture of different kinds of problems. Interleaved practice requires students to choose a strategy on the basis of the problem itself, as they must do when they sit for a comprehensive exam or high-stakes test. In the experiment reported here, 126 seventh-grade students received the same practice problems over a three-month period, but the problems were arranged so that students received interleaved practice or the usual blocked practice. Students then completed a review, followed 1 or 30 days later by an unannounced test. Compared to blocked practice, interleaved practice produced higher scores on both the immediate and delayed tests (Cohen's d = 0.42 and 0.79, respectively).
Email: Doug Rohrer, drohrer@usf.edu

5:10-5:25 (248)

A Cognitive Antidote to Boredom: Motivational Effects of Interspersing Quizzes During Fact Learning. ALICE HEALY, MATT JONES, LAKSHMI LALCHANDANI and LINDSAY ANDERSON TACK, *University of Colorado*. — The position of quizzes was manipulated during fact learning. Subjects learned 8 facts about each of 8 plant categories, with the categories blocked during learning. Quizzes occurred about 4 of the 8 facts from each category, either immediately after studying the facts for that category (standard) or after studying the facts from all 8 categories (postponed). Testing occurred after a 5-minute interpolated task following the learning of all facts and again 2 or 7 days later. The tests included both the facts quizzed initially and the facts not quizzed. Test performance was better in the standard than in the postponed condition, especially for categories learned later in the sequence. This result held even for the facts not quizzed during learning, suggesting that the advantage cannot be due to any direct testing effects. Instead the results support the hypothesis that interspersed quizzes can serve a motivational function as a cognitive antidote to boredom and imply that interrupting learning with quiz questions is desirable because it can enhance learner engagement. These findings have practical implications for the classroom, especially because of the increasing prevalence of frequent and rapid quizzing using clickers.
Email: Alice Healy, alice.healy@colorado.edu

Neural Mechanisms of Cognition
Seaview A & B, Saturday Afternoon, 3:50-5:30
Chaired by Evangelia G. Chrysikou, University of Kansas

3:50-4:05 (249)

Frontoparietal Cortical Networks Support Flexibility in Goal-Directed Object Knowledge Retrieval. EVANGELIA CHRYSIKOU, *University of Kansas*. — Neuroimaging studies exploring the cortical organization of semantic knowledge have revealed distributed networks in ventrotemporal cortex supporting the representation of different properties of object

concepts (e.g., color, shape, mode of manipulation). Moreover, tasks requiring object similarity judgments based on such properties are associated with activity in inferior parietal cortex (the left intraparietal sulcus). Although these regions allow for object knowledge retrieval related to such perceptual properties, the neural mechanisms supporting functional similarity among objects based on abstract object properties (e.g., thematic context or function) and in the context of impromptu goals have not been fully explored. We present evidence from two functional magnetic resonance imaging studies, employing univariate model-based and multivoxel pattern analysis, that demonstrate the contributions of frontopolar and dorsoparietal networks in establishing ad hoc conceptual representations for goal-oriented tasks. We discuss these results in support of dynamic, partially distributed models of semantic memory for object concepts.
Email: Evangelia G. Chrysikou, lilachrysikou@ku.edu

4:10-4:25 (250)

Distractor Templates: Predicting Stimulus Surround Biases Focal-Attentional Selection of High, But Not Intermediate and Low, Salient Targets. THOMAS TÖLLNER (2014 Member Select-Speaker Award Recipient), MARKUS CONCI and HERMANN J. MÜLLER, *Ludwig- Maximilians-Universität München*. — It is well established that we can focally attend to a specific region in visual space without shifting our eyes. The underlying mechanisms that determine how fast we engage our 'attentional spotlight' in visual-search scenarios, however, remain controversial. The dominant view advocated by contemporary decision-making models holds that focal-attentional selections are mediated by templates that bias perceptual decisions exclusively through target-defining feature coding. This notion directly predicts that search times remain unaffected whether or not participants can predict the stimulus surround. Here we tested this hypothesis by manipulating the predictability of distractor contexts during an illusory-figure localization task. We found gradually decreasing internal selection times—correlated with external behavior—with increasing distractor-target similarity. Only for high-salient targets, however, these effects were cortically amplified when participants could reliably predict the stimulus surround. Our findings provide behavioral and electrophysiological evidence that search guidance signals can integrate context information for optimizing distractor-target competition.
Email: Thomas Töllner, thomas.toellner@psy.lmu.de

4:30-4:45 (251)

Building Better Brains: Enhancing Creativity Through Meditation, Exercise, and Brain Stimulation. BERNHARD HOMMEL, LORENZA COLZATO, SHARON ZMIGROD and AYCA SZAPORA, *Leiden University*. — Cognitive interventions often aim at repair, that is, at reducing the deviation from some norm or population mean. In contrast to this approach, we investigate how people can exploit and enhance their mental/neural resources to realize their cognitive potential. The main idea is that this often requires finding just the right balance between cognitive stability and flexibility—two cognitive-control functions that are driven by

prefrontal and striatal dopaminergic systems. I will discuss training techniques that we found to be suitable for targeting and biasing this stability-flexibility balance to improve specific kinds of creativity (convergent thinking, divergent thinking): meditation, physical exercise, and brain stimulation (tDCS). Email: Bernhard Hommel, hommel@fsw.leidenuniv.nl

4:50-5:05 (252)

Memory Retrieval During Recognition and Correct Rejection. MATHIEU B. BRODEUR, *McGill Universtiy*. — New items are often used to control for memory retrieval in experimental settings. However, in everyday life, detecting new items often requires memory retrieval to avoid confounding them with other known similar items. This experiment examined whether the memory retrieval used to correctly detect novelty, the recall-to-reject process, is different from the memory retrieval used to recognize studied items. The EEG of 17 participants was recorded while completing two episodic memory experiments. In one experiment, the new items resembled the studied items (i.e. related condition). They could thus only be correctly rejected following memory retrieval of the studied items with which the new items would be compared. In the other experiment, the new items were unrelated to the studied items and activated no memory retrieval. Results indicated that the brain correlate of memory retrieval of old and new items was significantly different in both experiments, meaning that the recall-to-reject process is different from the memory retrieval of old items. Email: Mathieu B. Brodeur, mathieu.brodeur@douglas.mcgill.ca

5:10-5:25 (253)

A Simple Accumulator Model That Simultaneously Accounts for Behaviour and Spike-Train Data. PETE CASSEY, *University of Newcastle, Australia*, GARREN GAUT, *University of California, Irvine*, MARK STEYVERS, *University of California*, SCOTT BROWN, *University of Newcastle* (Presented by Scott Brown). — Accumulator models of simple decision-making account for behavioural data in great detail. More recently, these models have been linked with neural activity by comparison against firing rates recorded from the neurons of monkeys who were making perceptual decisions. For the most part, the links between neural spiking data and evidence accumulation have been qualitative, comparing ordinal properties of the accumulators with ordinal properties of the neurons. Purcell et al. (2010, Psych. Rev.) went further, using the observed spike trains as the evidence that is accumulated by the cognitive model. We further develop this approach, by coupling a well-validated cognitive model of decision-making with a non-stationary Poisson model of neural activity. The neural and cognitive parts form a single generative model through explicitly linked parameters. Using data reported by Roitman and Shadlen (2002, Jnl. Neuro.), we estimate the marginal posterior distribution simultaneously over the neural, behavioural and linking parameters. Our approach allows for explicit modelling of the differences between neurons, and supports quantitative testing of different linking assumptions via Bayesian model selection methods. Email: Scott Brown, scott.brown@newcastle.edu.au

Associative Learning
Shoreline, Saturday Afternoon, 3:50-5:30
Chaired by Linda Parker, University of Guelph

3:50-4:05 (254)

Contextually-Elicited Conditioned Gaping in Rats: Role of the Endocannabinoid System in the Regulation of Anticipatory Nausea. LINDA PARKER, CHERYL L. LIMEBEER and ERIN M. ROCK, *University of Guelph*. — Although rats are not capable of vomiting, they display the characteristic conditioned gaping reaction when re-exposed to a flavor or a context previously paired with an emetic drug, such as Lithium Chloride. Contextually-elicited conditioned gaping provides a rodent model of anticipatory nausea in human chemothearpy patients. The classic anti-emetic treatments, such as 5-HT3 antagonist, ondansetron, are completely ineffective in suppressing anticipatory nausea in humans and contextually-elicited conditioned gaping reactions in rats. Here we present evidence that the expression of contextually-elicited conditioned gaping reactions can be suppressed by pretreatment with agents which inhibit the enzymes, fatty acid amide hydrolase (FAAH) and monoacyl glycerol lipase (MAGL), that hydrolyze the endocannabinoids, anandamide (AEA) and 2-arachidonyl glycerol (2-AG) respectively. These findings suggest that compounds which boost the action of the endocannabinoid system may be effective in treating this side effect of chemotherapy treatment. Email: Linda Parker, parkerl@uoguelph.ca

4:10-4:25 (255)

Evaluative Conditioning Fails for Subliminally Presented Conditioned Stimuli. CHRISTOPH STAHL and JULIA HAAF, *University of Cologne*. — Theories of attitude acquisition hold that humans acquire preferences via different learning mechanisms, one of them being evaluative conditioning (EC). In EC, an initially neutral stimulus (CS) is evaluated more positively (negatively) after being paired with positive (negative) stimuli (USs). EC plays a central role in current dual-process models of attitudes; it is predicted to operate automatically and in the absence of awareness. Consistent with this claim, a recent meta-analysis suggests EC may operate on subliminally presented CSs. To investigate this possibility, we studied EC with subliminal presentation of CSs and strict subliminality checks (using an immediate AFC task). We present a series of studies (with different presentation conditions, materials, and orienting tasks) in which we compared EC effects for supraliminal vs. subliminal presentation conditions, as well as for identified vs. non-identified CSs. EC effects were obtained for supraliminal and for identified CSs but not for subliminally presented CSs. This suggests that EC is not, in general, independent from awareness of CSs. We discuss moderating variables that may account for the discrepancy between the present findings and the meta-analytical results. Email: Christoph Stahl, christoph.stahl@uni-koeln.de

4:30-4:45 (256)

Super Causal Learning Arising From Cue Interaction.
KOUJI URUSHIHARA, *Health Sciences University of Hokkaido*.
— Superlearning, a supernormal associative learning to a
cue which was paired with an outcome in compound with
a previously established preventative cue, was investigated
in human causal learning experiments. Experiments 1 and
2 demonstrated superlearning effects with appropriate
control conditions. Experiment 3 revealed that superlearning
effect vanished when relatively many cues were used in one
experiment. Experiment 4 demonstrated that when large
number of cues was used, superlearning occurred if testing
of one set of cues was conducted immediately after training,
whereas it did not occur if testing with one set of cues was
separated from training by interposing training and testing of
the other set of cues. Experiment 5 showed that responding to a
superlearning cue was greater than those to control conditions
but was still weaker than that to a training excitor of conditioned
inhibition. These results revealed some weakness of both the
associative and propositional reasoning models.
Email: Kouji Urushihara, uru@pluto.dti.ne.jp

4:50-5:05 (257)

Implicit Learning Is Path Dependent. RANDALL
JAMIESON, *University of Manitoba*. — Researchers have
typically (perhaps tacitly) assumed that implicit learning
is unaffected by the order in which training items are
presented—the assumption of path independence. That
simplifying assumption is wrong. I build the case in three
steps. First, I use artificial grammar experiments to identify
a stable empirical signature of path dependence in implicit
learning. Second, I explain the problems and complications
those data pose for existing theory. Third, I present a
computational model of memory that postdicts our results.
I argue that path dependence could be the empirical bridge
needed to productively integrate and combine concepts and
methods developed by researchers in the putativley distinct
fields of implicit and associative learning.
Email: Randall Jamieson, randy.jamieson@umanitoba.ca

5:10-5:25 (258)

**Familiarity Breeds Neglect: Latent Inhibition-Like Effects
in Rapid Serial Visual Presentation.** EVAN LIVESEY, ANNA
BETHMONT and ROSALIND HUTCHINGS, *University
of Sydney*. — Exposure to visual stimuli results in well-
documented facilitatory and inhibitory effects when those
stimuli are subsequently used in learning or perceptual tasks.
In visual attention research, stimulus familiarity is associated
with faster and more accurate identification in some tasks
and retarded performance in others. Here we examined the
effects of familiarizing stimuli in a simple cognitive task
on later performance in rapid serial search task where two
coloured targets appeared amongst distractors, with the
sequence of stimuli comprising a mix of familiarized and
novel stimuli. Familiarization of target stimuli was associated
with poorer performance in rapid serial visual presentation,
while familiarization of neighbouring distractor stimuli
was associated with enhanced target report. These effects
were not specific to the level of attentional control at test

(manipulated using the attentional blink), were insensitive to
manipulations of memory load during exposure, and survived
a delay between exposure and testing of at least 24 hours. As
will be discussed, the results have implications for models of
controlled stimulus selection.
Email: Evan Livesey, evan.livesey@sydney.edu.au

Business Meeting
Regency A-C, Saturday Afternoon, 5:10 p.m.-6:00 p.m.
*Chaired by Jeremy Wolfe, Brigham and Women's
Hospital/Harvard Medical School*

**Presentation of the 2014 Clifford T. Morgan Best Article
Awards**
COLIN M. MACLEOD, *Chair, Publications Committee,
University of Waterloo*

Recipients:
- ALAN L. F. LEE, *Nanyang Technological University*
- CLINTIN P. DAVIS-STOBER, *University of Missouri*
- BENJAMIN OTTO, *University of Denver*
- PATRICK C. CONNOR, *Dalhousie University*
- DOUGLAS MARKANT, *Max Planck Institute for Human
  Development*
- SUDEEP BHATIA, *University of Warwick*

Business of the Psychonomic Society
JEREMY WOLFE, *Chair, Governing Board, Brigham and
Women's Hospital/Harvard Medical School*

<div align="center">

Recognition
Regency D-F, H, Sunday Morning, 8:00-9:40
Chaired by Jeffrey Starns, University of Massachusetts Amherst

</div>

<div align="center">

8:00-8:15 (261)

</div>

Accommodating Response Time Alters Predicted ROC Functions for Discrete-State and Dual-Process Models. JEFFREY STARNS, *University of Massachusetts Amherst.* — In recognition memory, are decisions informed by continuous memory strength values, a limited number of discrete internal states, or a hybrid of the two? An extensive literature has explored this question using Receiver Operating Characteristic (ROC) functions, and recent work has tested continuous-evidence models by jointly fitting ROC data and response time (RT) distributions. I will present extensions of popular discrete-state and hybrid models – the two-high threshold and dual process models, respectively – that can accommodate both ROC functions and RT distributions from bias-manipulation experiments. The RT versions of these models predict different shapes for the ROC function than non-RT versions; for example, the discrete-state model is no longer constrained to predict linear ROCs. For this reason, RT data are required to determine whether or not observed ROC functions are consistent with a given model. I will show fits to a recognition task and discuss how RT distributions help to discriminate the alternative models.
Email: Jeffrey Starns, jstarns@psych.umass.edu

<div align="center">

8:20-8:35 (262)

</div>

The Vicissitudes of Learning During Retrieval. LEONEL GARCIA-MARQUES, *Alameda da Universidade*, PEDRO MARQUES, *Universidade de Lisboa.* — In two experiments, our participants went through three cycles of study-test trials. In the study category condition, study lists corresponded to exemplars of common categories like fruits and animals and the recognition tests included only unrelated lures (except for two same-category lures). In the test category condition, study lists corresponded to non-related words and the recognition tests include only exemplars of a same category (except for two nonrelated words). In both cases, the level of false alarms for lures that matched the study lists was very high. In a final recognition test, participants of both conditions were told to accept as "old" all the previously presented items (both at study and test) and only reject totally new items. This test included new exemplars that belonged to the three categories and new unrelated items. In both studies, test category participants made fewer category false alarms than participants from the other condition.
Email: Leonel Garcia-Marques, garcia_marques@sapo.pt

<div align="center">

8:40-8:55 (263)

</div>

The Role of Context in Memory Confusion Errors. MICHAEL HUMPHREYS, *University of Queensland.* — Brands in the same brand category are known to be slightly similar. The question addressed is whether memory confusion errors will be enhanced when recogntion memory for these slightly similar brands will be enhanced when memory is tested in a relevant context. Separate groups of subjects studied single brand names, brand adjective pairs, and brand claims. Singleton study items were tested as singletons, paired study items were tested as singletons or in pairs, and brand claim study items were tested as singletons, in pairs, and in brand claims. Test items consisted of old study items, a brand that came from the same brand category as a studied brand but was otherwise dissimilar, and a brand that came from a non studied brand category. The difference between similar and dissimilar lures was enhanced when testing occurred in the context of the brand claim. The implications for our understanding of gist memory and for the application of tradmark laws are discussed.
Email: Michael Humphreys, mh@psy.uq.edu.au

<div align="center">

9:00-9:15 (264)

</div>

Recollection and Unitization in Memory for People's Paths and Manners of Motion. ALAN KERSTEN, JULIE L. EARLES and JOHANNA D. BERGER, *Florida Atlantic University.* — This research tested the theory that manners of motion (e.g., run, skip) are represented conjointly with information about the identities of the actors who carry out those motions, whereas paths of motion (e.g., into the building) are represented separately from identity information, thus requiring an associative process to bind the two types of information in memory. Participants viewed events involving actors moving with different manners of motion along different paths. They were later tested on their ability to discriminate old items from items in which either the path or manner of motion was replaced by one that had been performed by a different actor earlier. Fitting Yonelinas' (1999) dual-process source memory model to ROC functions revealed that participants discriminated old items from novel combinations of actors and manners of motion on the basis of familiarity, consistent with unitized representations of manner of motion and identity information. Discrimination of old items from novel combinations of actors and paths of motion, on the other hand, required recollection of having seen an actor follow the same path earlier, consistent with independent but associated representations of path and identity information.
Email: Alan Kersten, akersten@fau.edu

<div align="center">

9:20-9:35 (265)

</div>

The Slow Forgetting of Emotional Episodic Memories. ANDREW YONELINAS and MAUREEN RITCHEY, *University of California, Davis.* — Emotional events are remembered better than neutral events, and this emotion advantage often becomes particularly pronounced over time. A review of behavioral, lesion and neuroimaging studies of human episodic memory reveals a number of empirical regularities regarding the effects of emotion that present important challenges for emerging models of functional specialization in medial temporal lobe regions. The effects of emotion have often been attributed to a modulatory consolidation process whereby the amygdala facilitates the retention of emotional memories supported by medial temporal lobe regions including the hippocampus. Here we propose that these effects can be better understood by an emotional binding account whereby the amygdala mediates

the recollection of item-emotion bindings that exhibit slower forgetting than hippocampally-dependent retrieval of item-context bindings.
Email: Andrew Yonelinas, apyonelinas@ucdavis.edu

Judgment and Decision Making II
Beacon B, Sunday Morning, 8:00-10:00
Chaired by Ana Franco-Watkins, Auburn University

8:00-8:15 (266)
Attentional Processing and Intertemporal Choice. ANA FRANCO-WATKINS, *Auburn University*, RICHARD MATTSON, *Binghamton University*. — The tendency to discount future prospects in lieu of smaller immediate outcomes is known as temporal discounting. The current work used eye-tracking methodology to examine attentional processing to different elements of choice during an intertemporal choice task. Our findings reveal that those who tend to prefer the immediate option demonstrate attentional biases that were predictive of choice. When losses were at stake, selective attention biases also predicted unique variance in self-report measures of risk-taking, impulsivity, and self-control beyond what was accounted for by k, a typical method for summarizing intertemporal choice data. Overall, our findings suggest that eye-tracking measures of selective attention may allow for a better theoretical understanding of the mechanisms and processes involved in intertemporal choice.
Email: Ana Franco-Watkins, afrancowatkins@auburn.edu

8:20-8:35 (267)
The Interpretation of IPCC Probabilistic Statements Around the World. DAVID BUDESCU and HAN HUI POR, *Fordham University*, STEPHEN BROOMELL, *Carnegie Mellon University*, MICHAEL SMITHSON, *Australian National University*. — The Intergovernmental Panel on Climate Change (IPCC) uses verbal descriptions of uncertainty (e.g., unlikely) to convey imprecision in its forecasts and conclusions. Previous studies showed that the American public misinterprets these probabilistic statements. We report results from a multi-national study involving 25 samples in 24 countries and 17 languages. As predicted, laypeople interpret IPCC statements as conveying probabilities closer to 50% than intended by the IPCC authors. We show that an alternative presentation format supplementing the verbal terms with numerical ranges increases the correspondence between the public's interpretations and the IPCC guidelines, and the terms are better differentiated. These qualitative patterns are remarkably stable across all samples and languages. In fact, interpretations of the terms in various languages are more similar under the new presentation format. These results suggest changing the way the IPCC communicates uncertainty.
Email: David Budescu, budescu@fordham.edu

8:40-8:55 (268)
Eye Movements Reveal Memory Processes During Similarity- and Rule-Based Decision Making. BETTINA VON HELVERSEN, *University of Basel*, AGNES SCHOLZ, *Chemnitz University of Technology*, JORG RIESKAMP, *University of Basel.* — Recent research suggests that when people retrieve information from memory they tend to fixate the location where the information had appeared during encoding. We used this phenomenon to investigate if different pieces of information are activated in memory when people use a rule- or a similarity-based decision strategy. In two studies, participants first memorized multiple pieces of information about job candidates (exemplars). In subsequent test trials they judged the suitability of new candidates that varied in their similarity to the previously learned exemplars. Results showed that when using similarity, but not when using a rule, participants fixated longer on the previous location of exemplars that resembled the new candidates than on the location of dissimilar exemplars. This suggests that people using similarity retrieve previously learned exemplars, whereas people using a rule do not. Furthermore, the results show that eye movements can provide new insights into the memory processes underlying decision-making.
Email: Bettina von Helversen, bettina.vonhelversen@unibas.ch

9:00-9:15 (269)
A Hyperboloid Model of the Discounting of Rewards That Are Both Delayed and Probabilistic. JOEL MYERSON, ARIANA VANDERVELDT and LEONARD GREEN, *Washington University* (Presented by Leonard Green). — An outcome's value is affected both by the delay until its receipt (delay discounting) and by the likelihood of its receipt (probability discounting). Despite being well-described by the same hyperboloid function, delay and probability discounting involve fundamentally different processes. Previous research has focused on the discounting of delayed and probabilistic rewards separately, with little research examining situations in which rewards are both delayed and probabilistic. In the current study, participants made choices between smaller rewards that were both immediate and certain and larger rewards that were both delayed and probabilistic. We found significant interactions between delay and probability, a result inconsistent with an additive model. In contrast, a hyperboloid discounting model in which delay and probability combine multiplicatively provided an excellent fit to the data. These results suggest that the hyperboloid is a good descriptor of decision making in complicated monetary choice situations like those people encounter in everyday life.
Email: Leonard Green, lgreen@wustl.edu

9:20-9:35 (270)
Implications of Disregarding Objective Utilities When Selecting a Medical Test. JONATHAN NELSON, BJÖRN MEDER and CHRISTINE SZALAY, *Max Planck Institute for Human Development*, VINCENZO CRUPI, *University of Turin/Ludwig Maximilian University*, KATYA TENTORI, *University of Trento*. — Consider the task of selecting a binary medical test to determine whether a patient has a disease. Normatively, this requires considering the base rate

of the disease, the true and false positive rate for each test, and the payoffs and costs for correct and incorrect diagnoses. However, it can be difficult for people to appropriately use objective utilities. Can shortcut pure information strategies sometimes identify the objectively most useful test? We explore this through simulation studies and mathematical proofs. We prove that one simple strategy, the likelihood difference heuristic, identifies the objectively most useful test in some conditions. We also characterize the performance of information gain, probability gain, and related pure-information test-selection strategies. If the objective payoff structure and base rate of a disease are even approximately known, it can be possible to identify a purely informational test selection strategy that performs well despite not explicitly calculating objective utilities.
Email: Jonathan Nelson, jonathan.d.nelson@gmail.com

9:40-9:55 (271)

Visual Expertise and Identification. JASON TANGEN, RACHEL SEARSTON and MATTHEW THOMPSON, *University of Queensland*. — Many domains of visual expertise (e.g., radiology, cytology, dermatology) involve experiential knowledge based on many prior instances. Learning about the variability of instances between and within categories serves as a rich source of analogies to permit efficient classification. But how does visual expertise develop in domains of identification (e.g., fingerprint or unfamiliar face matching) where the question of identity is based on a single member? Here, we discuss several experiments designed to gain a better understanding of the source of identification errors, the factors that influence performance, and the nature of expertise in identification. Even though examiners believe that a slow, careful, and highly analytic approach is critical for matching fingerprints, our results from these experiments and others suggest otherwise. These findings indicate that identification experts rely heavily on nonanalytic processing, and they perform accurately when information is sparse—experts can do a lot with a little.
Email: Jason Tangen, jtangen@psy.uq.edu.au

Attention: Features and Objects II
Seaview A & B, Sunday Morning, 8:00-10:00
Chaired by Steven Franconeri, Northwestern University

8:00-8:15 (272)

Four Examples of Translational Visual Cognition. STEVEN FRANCONERI, *Northwestern University*. — We typically study visual cognition within a set of tasks & paradigms designed to distill the real-world problems encountered by the visual system. But over time, those paradigms can lose contact with the original problems that inspired them. I will argue that maintaining closer contact with the visual challenges faced by students, domain scientists, and the public can cross-pollinate our own research. I will present four examples of such links from data visualization, graph & diagram comprehension,

and display animation, to topics such as subitizing, apparent motion, object tracking, ensemble processing, and relational perception.
Email: Steven Franconeri, franconeri@northwestern.edu

8:20-8:35 (273)

The Effects of Reward on Contingent Response Inhibition. CHARLES FOLK, *Villanova University*, BRIAN ANDERSON, *Johns Hopkins University*, REBECCA GARRISON and LEELAND ROGERS, *Villanova University*. — Evidence suggests that automatic processes associated with both "front-end" attention allocation and "back-end" response code inhibition are contingent on top-down set. However, recent work suggests that stimuli associated with reward can modulate front-end attention independent of top-down set. The present studies explored the influence of reward history on back-end response inhibition. Participants completed a training phase in which particular colors were associated with high/ low reward, followed by a test phase consisting of a go-no go flankers task in which responses to a central target were dependent on the target appearing in a particular color. Critically, compatible and incompatible flankers were presented in a color previously associated with high/ low reward. The results show that set-contingent inhibition of flankers (as reflected in reverse compatibility effects with no-go colored flankers) was eliminated for flankers appearing in previously rewarded colors. Implications for theories of reward and attentional control will be discussed.
Email: Charles Folk, charles.folk@villanova.edu

8:40-8:55 (274)

Features Previously Associated With a Unique Response Attract Attention. RACHAEL GWINN and ANDREW LEBER, *The Ohio State University* (Presented by Andrew Leber). — How does the visual system assign objects priority for attentional selection? Classically, research has distinguished between goal-driven and stimulus-driven prioritization, but recent work has highlighted experience-dependent sources, too (e.g., contextual cueing and learned value). We introduce a new source of experience-dependent prioritization, based on response history. Experiments included a training session with a color judgment task: one "unique response" color was mapped to one button press, while five "common response" colors were mapped to another button press. Each color was presented equally often. The test session, 4-7 days later, included a shape judgment, and color was now irrelevant. Here, RTs to shape targets were faster when their color was previously "unique" compared to "common." Additional experiments showed a minimal presence of motor learning transferring to test. Thus, features associated with a unique response gain increased priority, which remains for a long duration, even after these features become task-irrelevant.
Email: Andrew Leber, leber.30@osu.edu

9:00-9:15 (275)

Dual Target Search Is Neither Purely Simultaneous nor Purely Successive. KYLE CAVE, *University of Massachusetts*, TAMARYN MENNEER, *University of Southampton*, MOHAMMAD S. NOMANI, *University of*

Massachusetts, MICHAEL J. STROUD, *Merrimack College*, NICK DONNELLY, *University of Southampton.* — When searching for either of two color targets, do subjects search simultaneously for both targets, or do they first search for one and then the other? To answer this question, we performed new analyses on eyetracking data from Stroud, Menneer, Cave, & Donnelly (2012). Each fixated item was categorized according to whether its color was more similar to one target or the other. Once an item similar to one target has been fixated, the next fixated item is more likely to be similar to that target than the other, showing that at a given moment during search, one target is generally favored over the other. However, the search for one target is not completed before search for the other begins. Instead, there are usually multiple switches from searching for one target to searching for the other during a trial.
Email: Kyle Cave, kcave@psych.umass.edu

9:20-9:35 (276)
Measuring Feature-Based Visual Attention Filters. GEORGE SPERLING, PENG SUN, CHARLES WRIGHT, and CHARLES CHUBB, *University of California, Irvine.* — An attention filter is a top-down instruction-initiated brain process of feature-based attention that allows selected visual information to pass but attenuates unselected information. A centroid-judgment paradigm quickly and precisely measures such human perceptual filters as accurately as photographic color filters. Subjects use a mouse to position a pointer at the centroid—the center of gravity—of a briefly displayed cloud of dots and receive precise feedback. A subset of dots is distinguished by some characteristic, such as a different color, and subjects judge the centroid of only the distinguished subset, e.g., dots of a particular color. The analysis efficiently determines the precise weight to the judged centroid of every dot of every color in the display, i.e., the attention filter for that particular attended color in that context. Attention filters for one of eight equiluminant hues among the 7 others are extremely selective, achieving attended/unattended weight ratios >10:1.
Email: George Sperling, sperling@uci.edu

9:40-9:55 (277)
Probability of Spatially Proximal Distractors Modulates Feature-Driven Capture. CARLY LEONARD and STEVEN LUCK, *University of California, Davis.* — We have previously shown that the magnitude of capture to a distractor that shares a target feature (i.e., contingent capture) is reduced as its distance from the locus of spatial attention increases. Although feature-based attention is often referred to as a global phenomenon, these results suggest a strong interaction with spatial attention. If so, manipulations of spatial attention should modulate the effect of spatial proximity on attentional capture. In the current experiments, we tested this by manipulating non-stimulus related parameters that may change the spatial window of attention. In the main experiment, we manipulated the probability of distractors occurring at different distances relative to the location of a task-relevant rapid serial visual presentation stream. Capture effects were reduced when there was a higher frequency of

proximal distraction. Eye position data was recorded as well to analyze differences in fixation stability across conditions. Overall, these results support the hypothesis that spatial attention is critical in mitigating contingent attentional capture, showing that feature-based attention effects are not purely global.
Email: Carly Leonard, cjleonard@ucdavis.edu

Bilingualism
Regency A-C, Sunday Morning, 8:00-9:40
Chaired by Ana Schwartz, University of Texas at El Paso

8:00-8:15 (278)
Priming Concepts in the Second Language Inhibits Later Conceptual Access During Text Comprehension. ANA SCHWARTZ, JOSEPH NEGRON and KARLY SCHLEICHER, *University of Texas at El Paso.* — According to the Revised Hierarchical model,conceptual links are stronger in the native language due to earlier and/or more frequent exposure to those concepts through L1 words relative to second language (L2) words. This model has not yet been tested in text comprehension. If concepts are more readily accessed via the L1, then priming those concepts in the L1 should improve later comprehension of an L2 text. Highly proficient, English-Spanish bilinguals read texts in their L2. They first read a prime passage that was either related or unrelated to the target text and presented either in the L1 or the L2. Comprehension was measured via performance on follow-up, fill in the blank questions (in the L2) as well as time spent reading critical sentences in the target text. As predicted, performance was superior when related passages were presented in the L1. However, the interaction between the two factors was largely driven by the fact that presenting a related passage in the L2 produced the worse performance, even relative to unrelated passages. We interpret this unexpected interference as reflecting inhibition from existing conceptual links within the L1.
Email: Ana Schwartz, aischwartz@utep.edu

8:20-8:35 (279)
Evidence From Bimodal Bilinguals Indicates "Turning a Language ON" Is Not Costly but "Turning a Language OFF" Is. KAREN EMMOREY and JENNIFER PETRICH, *Lab for Language & Cognitive Neuroscience*, TAMAR H. GOLLAN, *University of California, San Diego.* — Bimodal bilinguals, fluent in a sign and spoken language, can produce code-blends (simultaneous production of a word and a sign). We investigated whether switch costs are observed when switching into or out of a code-blend by requiring ASL-English bilinguals to name pictures in two conditions: switching between speaking and code-blending or between signing and code-blending. Response times (RTs) for code-blend switch trials (the switch from English or ASL alone into a code-blend) were not longer than stay trials for either language, indicating that "turning an additional language on" is not costly. However, RTs for switch trials into English or ASL alone (the switch from a code-blend to one language) were longer than for stay trials, indicating that "turning a language off" (inhibiting one language) is cognitively costly.

Simultaneous activation of two languages may be automatic for bilinguals, but what makes language switching difficult is inhibition of the recently selected language.
Email: Karen Emmorey, kemmorey@mail.sdsu.edu

8:40-8:55 (280)

Early or Late, Balanced or Not, Young Adult Bilinguals Do Not Have Enhanced Executive Functions. KENNETH PAAP and HUNTER A. JOHNSON, *San Francisco State University*, OLIVER SAWI, *University of Connecticut*. — Skeptics have concluded that there is no coherent evidence for bilingual advantages in executive processing. More optimistic researchers believe the advantages may be restricted to specific types of bilinguals. Recent large-scale and lifespan investigations that tested highly fluent bilinguals from communities where the same two languages are spoken by most residents reported no bilingual advantages in any age group or in any of five tasks. The present study takes a complementary approach by examining a sample that is quite homogeneous in terms of current life experiences, but heterogeneous in terms of its exposure to an L2. A composite database of 168 bilinguals is used to explore for differences based on: (1) the age of acquiring a second language, (2) the relative proficiency of a second language, and (3) the number of languages used. Across 12 different measures of executive function, derived from four tasks, there was no consistent evidence supporting the hypotheses that early bilingualism, highly fluent balanced bilingualism, or trilingualism enhances inhibitory control, monitoring, or switching. The significant effects that did occur more often disconfirmed than confirmed these hypotheses.
Email: Kenneth Paap, kenp@sfsu.edu

9:00-9:15 (281)

Aging Impairs Language Control When Switching Como Crazy, But Less When Switching Like a Loco. TAMAR GOLLAN, *University of California, San Diego*, MATT GOLDRICK, *Northwestern University*. — While language intrusion errors (saying el instead of the) are rare in spontaneous speech, they can be induced by asking bilinguals to read aloud mixed-language paragraphs (Kolers, 1967; Gollan, Schotter, Gomez, Murillo, & Rayner, 2014). Twenty young and twenty proficiency-matched older Spanish-English bilinguals completed executive control tests and read aloud paragraphs manipulating switch rate and typicality (whether switches followed or violated normal patterns of spontaneous code switching). Older bilinguals produced more intrusions than young bilinguals, but this effect was concentrated in conditions with frequent and atypical switches. The aging related switching deficit was correlated with deficits in executive control tests. These results suggest that bilinguals rely on executive control to maintain language selection (Kroll & Bialystok, in press), but also imply some language-specific control mechanisms that remain intact in aging (Weissberger, Wierenga, Bondi, & Gollan, 2012).
Email: Tamar Gollan, tgollan@ucsd.edu

9:20-9:35 (282)

Trolley Dilemmas and Ethical Judgments in a Foreign Language. CATHERINE CALDWELL-HARRIS, *Boston University*, SEVIL HOCAOĞLU, *Istanbul University*, STEPHANIE CHANG, *Boston University,* and AYSE AYCICEGI-DINN, *Istanbul University*. — Bilingual speakers frequently report reduced emotionality when using foreign languages. To determine if this influences moral decision making, Turkish students in Istanbul were asked to make yes or no permissibility judgments for 18 trolley-type moral dilemmas and 6 novel dilemmas about unethical behavior. Half of the participants read dilemmas in L1-Turkish and the other half in L2-English, and skin conductance was recorded. Percentages of permissible responses for the footbridge, transplant, and crying baby dilemmas presented in Turkish were 4%, 7%, and 14%, respectively. This is lower than prior studies using American students and thus reflects Muslim students' discomfort with utilitarian reasoning. When responding in English, the percentages increased to 31%, 21%, and 21%, approaching American monolingual norms. For the unethical behavior dilemmas, agreement with selfish decisions was also higher when participants read and responded in English instead of Turkish. Average skin conductance amplitudes were lower in the foreign language condition than in the native language condition for many of the dilemmas, supporting the hypothesis that blunted emotion is a cause of the increase in utilitarian and selfish responding.
Email: Catherine Caldwell-Harris, charris@bu.edu

Letter and Word Processing
Beacon A, Sunday Morning, 8:00-10:00
Chaired by Sascha Schroeder, Max Planck Institute for Human Development

8:00-8:15 (283)

The Developmental Lexicon Project: Visual Word Recognition Across the Lifespan. SASCHA SCHROEDER and PAULINE SCHRÖTER, *Max Planck Institute for Human Development*. — Visual word recognition shows strong developmental trends. However, the mechanisms behind these changes are still unclear and most computational models do not address such factors. One reason for this is that reliable data on developmental differences are still missing. The Developmental Lexicon Project investigates how word recognition processes in German develops across the lifespan. 1152 words were selected in order to investigate changes in length, frequency, and neighborhood effects. 500 students of grades 2, 4, and 6 as well as 40 younger and 40 older adults were assessed using the lexical decision and the naming task. Results showed that length effects decrease exponentially and frequency effects linearly across the lifespan. Neighborhood effects were generally weak and facilitatory for beginning readers but inhibitory from age 10. Overall, our data indicate that the visual word recognition system is getting increasingly more efficient with age and cumulative experience with print. Implications for theories of reading and cognitive development are discussed.
Email: Sascha Schroeder, sascha.schroeder@mpib-berlin.mpg.de

8:20-8:35 (284)

Does Word Repetition Affect Lexical Processing in Repetition Blindness Paradigms? JENNIFER BURT, JACK LEGGETT and JO-MAREE CECCATO, *University of Queensland*. — When a target word appears twice in an RSVP stream the repetition is often missed. Refractoriness accounts suggest a repetition cost even when report of the first target is not required. University students named a backward-masked 72-ms target which was preceded by two lower-case 120-ms letter strings; the first a prime word and the second a filler. With a lower-case target and a random letter string as the filler, an identical prime enhanced target accuracy. When the target was presented in uppercase, accuracy for unrelated targets increased and the priming benefit was lost. When the filler was a word, there was a large cost for the identical prime condition, with filler-word responses often given for an identical target, consistent with a bias against the target because of uncertainty about repetitions. The experiments provide no compelling evidence for lexically-based priming or refractoriness when an item intervenes between prime and target.
Email: Jennifer Burt, j.burt@psy.uq.edu.au

8:40-8:55 (285)

No Identification Without Spatial Attention: Word Processing in the Stroop Task. SERJE ROBIDOUX, *Macquarie University*, DEREK BESNER, *University of Waterloo* (Presented by Derek Besner). — Some theorists assert that word identification can occur in the absence of spatial attention whereas others argue that there is no word identification without spatial attention. We demonstrate that this putative conflict disappears when the attentional demands of color and word processing in the context of the spatial cuing paradigm are better controlled. Conclusion: Broadbent was right.
Email: Derek Besner, dbesner@uwaterloo.ca

9:00-9:15 (286)

Task-Dependent Modulation of Word Processing During Visual Search for Words. NICOLAS VIBERT and CHRISTINE ROS, *University of Poitiers,* JASON L. G. BRAASCH, *University of Memphis,* SANDRINE BELKADI and JEAN-FRANCOIS ROUET, *University of Poitiers*. — According to Kiefer and Martens' (2010) attentional sensitization framework, performing an "induction task" involving either the orthographic or the semantic features of words leads people to preferentially use those same features in subsequent tasks. The present experiment tested whether performing a pre-search task involving either the visual form or the meaning of target words modified the way 10 to 16 years old children and adults subsequently searched for them within word displays. The participants' eye movements were recorded using a TOBII 1750 eye-tracker. Search times decreased with age, but adults were not faster than ninth graders. All participants needed more time to locate target words after performing the semantically-oriented task. More distractor words were fixated, and they were fixated for longer durations. The data suggest that the semantically-oriented pre-search task fostered access to word meanings during the search phase, and that the participants' cognitive system was less tuned to the target word's visual features.
Email: Nicolas Vibert, nicolas.vibert@univ-poitiers.fr

9:20-9:35 (287)

Searching for Individual Differences in Inflectional Priming in One's Native Language. LAURIE FELDMAN and KIT CHO, *SUNY, Albany*, PETAR MILIN, *University of Novi Sad, Serbia*. — In a forward masked visual lexical decision task with native speakers, we compare forward masked morphological facilitation after identity, inflected ED and ING and unrelated primes for regular and irregular verbs. Analyses encompassing not only the relation between prime and target (prime type), but also principle components that capture a rich set of frequency and form-related properties of the target itself reveal significant effects of prime type but no main effect or interactions with regularity. Individual differences in vocabulary failed to predict performance. Spelling proficiency did speed recognition but it interacted with prime type only when targets were complex. Finally, like nonnative speakers, native speakers revealed reduced morphological facilitation for inflected-simple as compared with simple-simple pairs.
Email: Laurie Feldman, lfeldman@albany.edu

9:40-9:55 (288)

Type and Token Frequency in Distributional Learning of Morphological Processes. SARA FINLEY, *Pacific Lutheran University*. — This study tests the role frequency in learning morphology by extending Finley and Newport (2010), who demonstrated that adults can learn morphology without reference to meaning. Participants were exposed to stem+suffix items with High, Medium and Low Frequency suffixes, and tested on either recognition of familiar stem+suffix constituents (comparing grammatical stem+suffix words to 'scrambled' words) or acceptance of novel stems (comparing novel grammatical items to 'scrambled' words). Participants were more likely to accept items containing High Frequency suffixes compared to items containing Low Frequency suffixes. A second experiment addressed the possibility that differences between Low and High Frequency suffixes were due to the token frequency of the suffixes. Items containing High Frequency suffixes were heard nine times; items containing Medium Frequency suffixes were heard five times; items containing Low Frequency suffixes were heard once. Participants were better at recognizing familiar and novel words containing High and Medium Frequency suffixes compared to words containing Low Frequency suffixes. These results support a view in which type frequency plays a greater role in language learning than token frequency.
Email: Sara Finley, finleysr@plu.edu

Autobiographical Memory
Shoreline, Sunday Morning, 8:00-9:40
Chaired by Steven Smith, Texas A&M University

8:00-8:15 (289)

Dropout-Induced Forgetting and Recovery of Autobiographical Memories. JUSTIN D. HANDY and STEVEN SMITH, *Texas A&M University* (Presented by Steven Smith). — Whether or not accurate recovered memories truly exist continues to be a divisive issue. Our studies using the dropout method show that memories of word lists and narrative vignettes can be blocked, or temporarily forgotten if a few targets are mixed with many fillers, and fillers are repeated several times; recovery of these memories can be triggered with appropriate memory cues (e.g., Handy & Smith, 2012). The present study shows that emotionally complex, personally-meaningful autobiographical memories are also susceptible to very large memory blocking and recovery effects with the dropout method. The roles of interference and inhibition in producing these memory blocks were tested by using either re-presentation or retrieval practice of the fillers involved in the forgetting manipulation. Results showed that either re-presentation or retrieval practice of fillers was sufficient to produce forgetting of autobiographical memories in both free and cued recall.
Email: Steven Smith, stevesmith@tamu.edu

8:20-8:35 (290)

Accuracy, Occurrence, and Recollection in Autobiographical Memory. ALAN SCOBORIA, *University of Windsor.* — Various conceptualizations of autobiographical remembering propose roles for multiple distinct metamemorial appraisals. Within and between frameworks, the term 'belief' is used loosely to refer to different constructs. The research reported in this talk distinguishes belief in the occurrence of events from belief in the accuracy of memory representations. Two studies (N=299; N=1,026) are reported in which different procedures were used to elicit autobiographical memories, which participants then rated in terms of autobiographical belief, belief in accuracy, recollection, and other characteristics. Confirmatory factor analytic techniques reveal distinct belief in occurrence, belief in accuracy, event cohesion, and recollection latent variables. Evidence for experimentally produced dissociations between the constructs is presented.
Email: Alan Scoboria, scoboria@uwindsor.ca

8:40-8:55 (291)

Navigating the Road Less Traveled: Hippocampal Contributions to Remote Spatial Memory During Virtual Navigation in Real-World Environments. JASON OZUBKO, *Rotman Research Institute, Baycrest Centre*, JESSICA ROBIN, *University of Toronto*, CHERYL GRADY, *Rotman Research Institute*, R. SHAYNA ROSENBAUM, *York University and Rotman Research Institute*, GORDON WINOCUR, *Rotman Research Institute*, MORRIS MOSCOVITCH, *University of Toronto.* — The hippocampus is known to be important for the acquisition and short-term retention of spatial memories, but its role in long-term representation is debated. Using new software, based on Google Street View, to quickly and easily virtualize real-world environments, we examined the role of the hippocampus in supporting spatial memories while participants navigated in real-world environments in their home city (Toronto) that either varied in terms of familiarity, or had been spatially mirrored. The right hippocampus was activated during turns along less familiar routes, but not along highly familiar routes. However, when highly familiar environments were spatially mirrored, the hippocampus was activated at turns. Activity in the right hippocampus during navigation was related to participants' use of mental maps, but not with their general navigational ability. We conclude that the hippocampus is crucial for navigation in less familiar environments, but not in remotely learned familiar ones unless complex reorganization of spatial representations is required.
Email: Jason Ozubko, jozubko@research.baycrest.org

9:00-9:15 (292)

The Role of Vividness and Vantage Perspective in the Psychological Distance of Positive and Negative Events. STEVE M. J. JANSSEN and DENISE J. PARKER, *Flinders University.* — People who report PTSD symptoms tend to feel psychologically close to negative events, whereas people who report depression symptoms often feel psychologically distant from positive events. Besides event age, psychological distance is affected by factors, such as importance, emotionality and rehearsal. In this study, the role of vividness and vantage perspective in the psychological distance of positive and negative events is examined. Participants recalled a recent positive and a recent negative event and rated these events on vividness, vantage perspective, and psychological distance at two occasions four weeks apart. Vividness and first-person perspective decreased over time and changes in vividness and vantage perspective corresponded with changes in psychological distance. Since vividness and vantage perspective can be manipulated by focussing less or more on the visual details and by taking a different perspective when retelling the event, psychological distance of the events can also be altered in a therapeutic setting.
Email: Steve Janssen, steve.janssen@flinders.edu.au

9:20-9:35 (293)

Adaptive Memory: Is the Evolutionary Account Still Viable? JAMES NAIRNE, *Purdue University*, JOSEFA N.S. PANDEIRADA, *University of Aveiro*, JOSHUA E. VANARSDALL, *Purdue University.* — Given that memory evolved, subject to the constraints of natural selection, our memory systems may be "tuned" to favor the processing of fitness-relevant information. Indeed, processing information for its survival value produces exceptionally strong retention, an effect that has been replicated many times. However, some have questioned the evolutionary interpretation, suggesting instead that survival processing merely engages domain-general processes such as elaborative or distinctive encoding. I will discuss the logic that underlies such arguments and review the relevant empirical evidence for and against evolutionary and so-called "elaborative" accounts of survival processing. To do so effectively, however, requires a primer on the nature of evolutionary arguments.
Email: James Nairne, nairne@psych.purdue.edu

<div align="center">

Discourse Processes
Seaview A & B, Sunday Morning, 10:20-12:00
Chaired by Rick Dale, University of California, Merced

</div>

<div align="center">

10:20-10:35 (294)
</div>

The Effects of Low-Level Distractors on the Dynamics of Conversation. ALEXANDRA PAXTON and RICK DALE, *University of California, Merced* (Presented by Rick Dale). — Recent advances in wearable technology are providing opportunities to explore cognitive phenomena in new, more naturalistic settings. In the current study, we use Google Glass — a glasses-like wearable computer with a small visual display — as an online but relatively unobtrusive method to both monitor and disrupt interaction during naturalistic conversation. Previous research suggests that individuals may compensate for impoverished auditory channels during conversation by increasing levels of movement synchrony (Boker, Rotondo, Xu, & King, 2002). The present research investigates how low-level disruptions to the visual system — delivered by the Google Glass display — affects high-level discourse during two different conversational contexts. Building from our previous research (Paxton & Dale, 2013), we compare naive dyads' levels of interpersonal synchrony during friendly conversations and arguments to further explore influences of contextual pressures on interpersonal interaction.
Email: Rick Dale, rdale@ucmerced.edu

<div align="center">

10:40-10:55 (295)
</div>

Reading Times Increase at Event Boundaries: Fact or Fiction? KYLE PETTIJOHN and GABRIEL RADVANSKY, *University of Notre Dame* (Presented by Gabriel Radvansky). — Many studies of language comprehension have shown that reading times can increase when a shift along any number of event dimensions (shift in space, introduction of a new entity, a new goal, etc.) is encountered. This has traditionally been interpreted as reflecting an increase in the cognitive effort required to update the event model for the described situation. We note that the event boundaries encountered in experimental texts are often unexpected based on the prior text information. As such, these event boundaries may also serve as causal breaks, in addition to the changes along other event dimensions. Here, we explored the extent to which these reading time increases reflect increased cognitive effort due to event model updating along those dimensions, and the extent to which they reflect the processing of a perceived causal break.
Email: Gabriel Radvansky, gradvans@nd.edu

<div align="center">

11:00-11:15 (296)
</div>

Word Frequency Effects in Idioms Vary Based on Idiom Familiarity. KRISTA A. MILLER and GARY E. RANEY, *University of Illinois at Chicago* (Presented by Gary Raney). — We explored whether word frequency effects are altered when words are read as part of idiomatic phrases. Participants read a series of high or low familiarity idiom phrases ending with either high or low frequency target words in contexts that supported either the literal or figurative interpretation of the idiom phrases. Results showed faster reading times for high frequency target words than for low frequency target words (word frequency effects) for idioms presented in literally supportive contexts. In figurative contexts, consistent word frequency effects were found for target words in low familiarity idioms, whereas consistent words frequency effects were found for target words in high familiarity idioms only for measures that include multiple fixations (e.g., gaze duration, total time). Target words in high familiarity idioms were processed faster than target words in low familiarity idioms. Our results show that inclusion of a word in a high familiarity idiom can change the way that word is processed, but only when that idiom phrase is used figuratively.
Email: Gary Raney, graney@uic.edu

<div align="center">

11:20-11:35 (297)
</div>

Linguistic Adaptation Between Mothers and Children in ASD: A Longitudinal Perspective. RICCARDO FUSAROLI and ETHAN WEED, *Aarhus University*, DEBORAH FEIN and LETITIA NAIGLES, *University of Connecticut* (Presented by Letitia Naigles). — We investigate mother-child linguistic adaptation in 66 children, 33 with ASD and 33 TD. We employ a longitudinal corpus (6 visits over 2 years) of naturalistic interactions (Goodwin et al. 2012). We quantified amount (word and utterance tokens) and complexity (word types, MLU) of linguistic behavior in both mother and child. We used mixed-effects growth curve models to quantify i) match within-conversation and ii) longitudinal impact between visits. Mother-child dyads are strongly correlated in their linguistic behaviors (R-squared range =.07-.62, p<0.001). Word types and tokens become increasingly matched with age; dyads in the ASD group show a shallower increase in match. For both groups, amount and complexity of maternal speech significantly predicted amount and complexity of child speech at the following visit (R-squared range =.1-.26, p<0.001). Child language also predicted maternal language at the following visit (R-squared range =.1-.3, p<0.001); however, for dyads in the ASD group, this impact was significantly smaller(p<.05).
Email: Letitia Naigles, letitia.naigles@uconn.edu

<div align="center">

11:40-11:55 (298)
</div>

Theory of Mind-Use in the Director Task: Factors Affecting the Level of Egocentrism Observed in Behavioral Responses and Eye Movements. JESSICA WANG, STEVEN FRISSON and IAN APPERLY, *University of Birmingham.* — The perspective-taking literature presents a dilemma: whilst adults are often egocentric (Keysar et al., 2003), 6-year-olds appear sensitive in distinguishing common versus privileged ground (Nadig & Sedivy, 2002). We identified three possible sources of these different levels of egocentrism within the Director task, corresponding to varied demands one faces in everyday social situations. Results suggest firstly, participants made many more egocentric errors when they had to infer for themselves that perspectival information was necessary to resolve reference. Secondly, the magnitude of common versus privileged ground only had a general effect on response time, but no direct effect on egocentrism. Finally, more egocentric effects were seen in eye movements when the Director gave more complex instructions for participants to follow. Variation

in these factors explains observed variation in egocentrism across experimental studies, and identifies likely sources of everyday difficulty in theory of mind-use.
Email: Jessica Wang, j.j.wang@bham.ac.uk

Recall II
Shoreline, Sunday Morning, 10:00-12:00
Chaired by Tobias Tempel, University of Trier

10:00-10:15 (299)
Motor Learning Benefits From Forgetting. TOBIAS TEMPEL and CHRISTIAN FRINGS, *University of Trier*. — Directed forgetting comprises costs and benefits. Whereas the intention to forget a just learned item list usually impairs later recall correspondingly to this intention, recall of subsequently encoded material profits. Reduced proactive interference, a shift of mental context, and different encoding strategies are assumed to cause this effect. We investigated list-method directed forgetting of motor sequences. Participants learned two sets of sequential finger movements. The instruction to forget the first set resulted in a benefit for the subsequently learned set. Participants receiving the instruction to forget the first set of motor sequences recalled significantly more sequences of the second set than participants not receiving this instruction. However, no cost effect for the first set of sequences emerged. This finding might indicate differential encoding caused by the instruction to forget.
Email: Tobias Tempel, tempel@uni-trier.de

10:20-10:35 (300)
Pharmacy Leaflets for Prescription Drugs: Enhancing Attention, Comprehension, and Memory. RUTH DAY, *Duke University*. — Pharmacy leaflets are provided when patients get prescription medications. These leaflets are supposed to provide important information about the benefits, risks, and safe use of the medications. However they are often difficiult to understand, remember, and use. We developed an enhanced design for pharmacy leaflets, based on both well-known and novel cognitive principles. In a nation-wide study, adults with a wide range of demographics saw either a current FDA prototype leaflet or one we designed to enhance cognition. The Enhanced group performed better on many tests of attention, comprehension, and memory — often at least 100% better than the Prototype group. A major feature of the Enhanced version is its overall spatial layout. Apparently this enabled participants to form a mental image and use it to navigate the leaflet during testing — both when the leaflet was present (open-book) and when it was absent (closed-book).
Email: Ruth Day, ruthday@duke.edu

10:40-10:55 (301)
Medial Temporal Lobe Activity Reflecting the Precision of Mental Time Travel. SEAN POLYN, JAMES E. KRAGEL and NEAL W. MORTON, *Vanderbilt University*. — Cognitive models of memory search propose that an internally maintained contextual representation targets particular memories, prompting retrieval of the details of those experiences. Neuroscientific studies implicate MTL circuitry

in these cognitive operations, but the computations carried out by these circuits remain mysterious. We used a retrieved-context framework to create two neurocognitive models of MTL function. In each model, neural signal in MTL (recorded during free recall) controlled a different cognitive operation. In the first model, MTL activity indicated general success in targeting the desired episode; here, MTL activity controlled the likelihood that a participant would successfully continue to recall items. In the second model, MTL activity indicated the fidelity with which the system retrieved the temporal context representation associated with a particular recalled item; here, MTL activity influenced the strength of temporal organization on a recall-by-recall basis. The latter model was significantly better at predicting the behavioral dynamics of free recall, consistent with the hypothesis that MTL activity indicates the precision of temporal context reactivation during memory search.
Email: Sean Polyn, sean.polyn@vanderbilt.edu

11:00-11:15 (302)
A Supramodal Inhibitory Control Process Supports the Inhibition of Memories and Actions. CATARINA FERREIRA, *University of Granada*, TAYLOR SCHMITZ and MICHAEL ANDERSON, *MRC Cognition and Brain Sciences Unit, Cambridge* (Presented by Michael Anderson). — The ability to inhibit prepotent responses is typically taken as a fundamental component of cognitive control. Much of the work on inhibitory control has, however, examined how people stop motor actions, often as a proxy for inhibitory control in cognition more broadly. One widely discussed domain to which inhibitory control may extend is the control of retrieval from memory. It remains unclear, however, what the relationship between motor and memory inhibition might be, and whether a common mechanism is involved. Here we report an fMRI experiment in which we directly compared, within-participants, the neural mechanisms engaged when people stop motor actions and memory retrievals. Both memory and motor stopping engaged a common region in right dorsolateral prefrontal cortex, activity in which predicted both successful forgetting and stop-signal reaction time. Nevertheless, connectivity analyses revealed that this region operated by targeting distinct regions involved in memory (hippocampus) and motor action (motor cortex). These findings indicate that suppressing unwanted memories is supported by response override mechanisms, and, more generally, that a supramodal stopping process supports the control of action and thought.
Email: Michael Anderson, michael.anderson@mrc-cbu.cam.ac.uk

11:20-11:35 (303)
The Two Faces of Selective Memory Retrieval. KARL-HEINZ BAEUML, INA DOBLER and ANDREAS SCHLICHTING, *Regensburg University*. — Recent work on directed forgetting and context-dependent forgetting suggests that, depending on the degree to which the original study context is accessible, selective memory retrieval can be detrimental or beneficial for the recall of other memories. Here we demonstrate in 2 experiments that the very same pattern arises in time-

dependent forgetting: selective retrieval is detrimental after short retention interval (when access to the study context is largely maintained) but is beneficial after prolonged retention interval (when context access is impaired). In 2 further experiments we show that the detrimental but not the beneficial effect is retrieval specific: when context access is maintained, retrieval but not restudy induces forgetting; when context access is impaired, both retrieval and restudy create recall improvement. The results are consistent with a two-factor account of selective memory retrieval that attributes the detrimental effect to inhibition or blocking but the beneficial effect to context reactivation processes.

Email: Karl-Heinz Bäuml, karl-heinz.baeuml@psychologie.uni-regensburg.de

11:40-11:55 (304)

When Does Distributed Practice Enhance Retention, and Why? A Distribution-Based Bifurcation Model of Reminding. VERED HALAMISH, *Tel-Aviv University*, ROBERT BJORK, *University of California, Los Angeles*. — Numerous studies in memory research across more than a century have demonstrated the benefits of distributing (versus massing) practice over time. The mechanism underlying this benefit is still debatable, but the notion that re-presentations trigger reminding, and that such reminding becomes more potent as a re-presentation is delayed, is a leading candidate. The reminding idea, though, in its basic form, cannot explain why distributed practice sometimes fails to enhance later recall. We propose that the reminding idea needs to be coupled with the assumption that different distributions of memory strengths across items result from shorter and longer spacing intervals. The resulting distribution-based bifurcation model not only yields two predictions that are supported by prior evidence, but also yields two new predictions—namely, that the benefits of distributed practice should be moderated by item difficulty and by degree of retroactive interference. In two experiments, we found support for these predictions.

Email: Vered Halamish, vhalamish@gmail.com

Reasoning/Problem Solving II
Beacon B, Sunday Morning, 10:20-12:00
Chaired by Fabio Leite, The Ohio State University at Lima

10:20-10:35 (305)

Do We Know What We Know When Thinking About Streaks? FABIO LEITE, *The Ohio State University at Lima*, DYLAN MOLENAAR, *University of Amsterdam*. — We examined whether our apparent sensitivity to wait time (i.e., how many instances of an event are expected to occur before a specific outcome) translates into explicit wait-time estimates. In two experiments, participants estimated wait time and the longest observed streak patterns in scenarios involving coin tosses or basketball shots. Based on outcome history, they also indicated whether there were coins or players that should be chosen over others to improve the odds of observing future successes. On average, participants' estimates of wait times

were inaccurate and estimates of the longest observed streak patterns were larger than what might be observed in reality, whereas participants' preferences for basketball players showed a stronger hot-hand belief for basketball shots than for coin tosses. Assuming sensitivity to wait times is acquired via experience, reasoning about that experiential knowledge may be an effortful cognitive process that most people do not employ by default.

Email: Fabio Leite, leite.11@osu.edu

10:40-10:55 (306)

Feedback and Heuristic Bias: I Knew It All Along. WIM DE NEYS, *CNRS - Paris Descartes University*. — Human thinking is easily biased by heuristic intuitions. Here I show how looking at a simple but neglected manipulation – the impact of elementary response feedback - can help us to advance the debate concerning the nature of this bias. Two experiments with conjunction fallacy problems and syllogisms show that feedback results in faster AND more accurate responding on problems where cued heuristics conflict with logical or probabilistic principles. Feedback did not affect performance on control problems where such conflict was not present. Faster reasoning times indicate that feedback helps reasoners to resolve an already detected conflict rather than helping them to notice the presence of the conflict per se. This argues against the popular view that heuristic bias results from lax monitoring and a failure to detect that cued heuristics are logically questionable. The key problem seems to be that reasoners do not know how to handle this heuristic/logic conflict.

Email: Wim De Neys, wim.de-neys@parisdescartes.fr

11:00-11:15 (307)

Information Use in Bayesian Reasoning. ANDREW COHEN, ADRIAN STAUB and JADE HEDRICK, *University of Massachusetts*. — Human reasoners do poorly in Bayesian inference problems, and this is usually attributed to neglect of base rate information. However, little research has examined how people actually combine base rate, true positive, and false positive information. In the present study, participants (N = 30) estimated the probability that a patient has a medical condition given a positive test result, with the three critical probabilities varying widely across items. Participants' eye movements were monitored while they inspected the information. While estimates of the posterior were generally very poor, almost all estimates were well explained as an additive linear combination of the three critical probabilities. Very few participants used all three probabilities, however, and the majority relied on only one, usually the true positive rate. The eye movement data suggested a modest relationship between use of a particular type of information and attention to that information during encoding of the problem. These results suggest that reasoners are not simply neglecting base rate information, but rather, that they are using a systematic, but thoroughly non-Bayesian, procedure.

Email: Andrew Cohen, acohen@psych.umass.edu

11:20-11:35 (308)

Enhancing Climate Change Cognition: Direct-to-the-Public Communication (www.HowGlobalWarmingWorks.org) and Controlled Experiments. MICHAEL RANNEY, DAV CLARK, LEE NEVO LAMPREY, KIMBERLY LE, MATTHEW SHONMAN, BOYA SHIRLEY HU and LISA ZHANG, *University of California, Berkeley*. — Our prior work shows massive public ignorance about global warming's basic mechanism, yet a 400-word explanation (a) hugely improves readers' understandings and (b) increases climate change concern and acceptance (Ranney et al., 2012; Clark, Ranney, & Felipe, 2013)—disconfirming "stasis theory," which hypothesized futility in increasing public climate wisdom. We presently describe (1) replications/extensions of (a) and (b)–– with the effects obtained among liberals and conservatives, (2) a novel study showing that seven apt statistics increase one's global warming acceptance (Clark, 2013), and (3) our recently introduced HowGlobalWarmingWorks.org––a now-popular website including five short videos (.9 to 4.7 min.) based on the 400 words. (For Mandarin videos, see HowGlobalWarmingWorks.org/Chinese.html). The website seeks to directly enhance public "climate change cognition," offering critical conceptual changes such as: that greenhouse gases represent a (leaky) one-way energy valve––and that anthropogenic global warming represents an extra greenhouse effect. We also analyze public and non-public comments about the website/videos.
Email: Michael Ranney, ranney@soe.berkeley.edu

11:40-11:55 (309)

Changing State Irrelevant Sound Impairs Problem Solving: Evidence for the Role of Subvocal Rehearsal in the Solution of Compound Remote Associate Problems? JOHN MARSH, *University of Central Lancashire*, EMMA THREADGOLD and SARAH GARNER, *City University, London*, LINDEN BALL, *University of Central Lancashire*. — Continuously changing, as compared to non-changing, to-be-ignored sounds produce marked disruption to the performance of visually-based serial short-term memory tasks (e.g., serial recall): The changing-state effect. This study investigated whether visually-based problem solving is also susceptible to the changing-state effect. Participants attempted to solve compound remote associate (CRA) problems in the presence of quiet, steady-state or changing-state irrelevant speech. Accuracy data indicate that problem solving is hindered by changing-state speech. The results were replicated in a second experiment wherein the minimum requirement for changing-state was used: Alternating tones of different pitch. The results extend the changing-state effect beyond serial recall and suggest that either CRA problem solving requires processing of serial order (e.g., subvocal rehearsal), or the changing-state effect is not restricted to serial short-term memory tasks (e.g., an attentional effect). Given the findings that CRA problem solving is impaired by articulatory suppression (Ball & Stevens, 2009) and that changing-state sound impairs speech planning (Jones, Macken, & Nicholls, 2004), we advocate the former interpretation.
Email: John Marsh, jemarsh@uclan.ac.uk

Spatial Cognition
Beacon A, Sunday Morning, 10:20-12:00
Chaired by Bernhard E. Riecke, Simon Fraser University

10:20-10:35 (310)

Underlying Perceptual Issues in Virtual Reality Systems: Does Display Type Affect Self-Motion Perception? BERNHARD RIECKE, JACQUELINE D. JORDAN, MIRJANA PRPA and DANIEL FEUEREISSEN, *Simon Fraser University*. — An embodied illusion of self-movement (vection) is a sensation necessary for allowing a convincing experience of self-motion in Virtual Reality (VR) when actual observer motion is unfeasible. While much research effort has been devoted to investigating how different stimulus parameters affect vection, there is little research investigating potential effects of the display itself. Using an active navigation task, we investigated if a stereoscopic projection system and a 3D TV would be similarly effective in inducing linear and curvilinear vection-in-depth in stationary observers if the field of view was matched. Repeated-measures ANOVAs revealed no significant difference between displays in neither vection onset latency, vection intensity, immersion, motion sickness, nor overall display preference. As expected, curvilinear paths yielded stronger vection with earlier vection onsets than straight paths. These results suggest that reported vection and user experience is surprisingly tolerant to display type. Further investigations that isolate individual display factors, such as luminance, contrast, resolution, or absolute size will provide a deeper understanding of their relative contribution and potential interactions.
Email: Bernhard E. Riecke, ber1@sfu.ca

10:40-10:55 (311)

Route Memory in Real, Virtual, and Hybrid Environments. INEKE VAN DER HAM, ANNEMARIE FABER, MATTHIJS VENSELAAR, MARC VAN KREVELD and MAARTEN LÖFFLER, *Utrecht University*. — Route memory is frequently assessed in of virtual environments. These environments can be presented in a fully controlled manner and are easy to use. Yet they lack the physical involvement that participants have when navigating real environments. For some aspects of route memory this results in lower performance in virtual environments. We assessed route memory performance in four different environments: real, virtual, virtual with directional information (compass), and hybrid. In the hybrid environment, participants walked the route outside on an open field, while all route information (i.e. path, landmarks) was shown simultaneously on a handheld tablet computer. Results indicate that performance in the real life environment was considerably better than in the virtual conditions, especially for tasks relying on survey knowledge, like pointing and map drawing. Performance in the hybrid condition however, hardly differed from real life performance. Performance in the virtual environment did not benefit from directional information. The hybrid condition seems to offer the best of both worlds: the performance level is comparable to that of real life for route memory, yet it offers full control of visual input during route learning.
Email: Ineke van der ham, c.j.m.vanderham@uu.nl

11:00-11:15 (312)

Oculomotor Inhibition of Return in Deaf. RAMESH KUMAR MISHRA, SEEMA PRASAD and SRIKANTH JAYARAMAN, *University of Hyderabad*, GOURISHANKAR PATIL, *NIMH, Hyderabad*, RAYMOND KLEIN, *Dalhousie University*. — There are not many on the issue of oculomotor control and particularly oculomotor inhibition of return in the deaf. Deaf subjects are faster and have superior periepheral vision. We examined oculomotor inhibition of return in deaf subjects who used Indian sign language and a group of control subjects. In a simple sequential saccade task, participants made saccades as a cross appeared in different locations. The final location of the cross was either an explored or an unexplored location. In both groups saccade latencies were longer to an explored location compared to an unexplored location, resulting into oculotor IOR. Direction of presentation did not have any effect on IOR in any group. Magnitide of IOR decreased as a function of decreasing eccentricity from the center of explored region. Critically, deaf and control subjects did not differ on any parameters. In another study, on a cuing task, deaf and control did not differ on latency or magnitude of IOR. However, deaf had a higher facilitation in the perephery. Both these studies fail to show any advantages related to speed or IOR in the deaf. We discuss the results with regard to visual attention, control and IOR as well as task effects.
Email: Ramesh Kumar Mishra, rkmishra@uohyd.ac.in

11:20-11:35 (313)

On the Top-View Disadvantage in Visual Object Recognition. RYOSUKE NIIMI, REI EHARA and KAZUHIKO YOKOSAWA, *The University of Tokyo*. — A top-view of common objects is often difficult to recognize (i.e., accidental view). In order to understand this top-view disadvantage we conducted a few object recognition experiments and manipulated the depression angle of the gaze line. Experiment 1 confirmed the top-view disadvantage; the reaction time was longer when objects were viewed with a large depression angle, for example 60°. In Experiments 2 and 3, we provided participants with depth cues in addition to the object stimuli. The objects were placed on a stage with textured floors and columns. The stage stimuli were presented prior to the objects. As a result of this presentation, the top-view disadvantage almost disappeared. We propose that the insufficient depth information was the major reason for this top-view disadvantage. In addition, we found that this disadvantage was more likely to occur when viewing large objects (e.g., truck) than small objects (e.g., kettle).
Email: Ryosuke Niimi, niimi@L.u-tokyo.ac.jp

11:40-11:55 (314)

Examining Chimpanzees' and Humans' Navigational Decision-Making Strategies in Virtual Small- and Large-Scale Space. FRANCINE DOLINS, *University of Michigan, Dearborn*, CHARLES MENZEL, *Georgia State University, Language Research Center*, CHRISTOPHER KLIMOWICZ, *University of Michigan, Ann Arbor*, JOHN KELLEY, *Georgia State University, Language Research Center*. — Foraging primates localize resources across ecologically complex landscapes, exploiting feeding sites of varying spatial dimensions to balance navigational efficiency and energy costs with nutrient intake, seasonal availability, competition and group size. Generation of navigational strategies and spatial representations in large- and small-scale space were predicted to differ by distance between landmarks, geometic features, and associations encoded. Comparing navigational strategies in environments of varied spatial scale presents significant methodological challenges. Thus, this study compared four captive chimpanzees and 16 humans in environments generated using virtual reality that varied in scale but displayed parallel landmark information. Results indicate both chimpanzee and human participants applied topological strategies in both small- and large-scale space. They did not demonstrate shifts in spatial strategy in relation to scale or resource distribution.
Email: Francine Dolins, fdolins@umich.edu

Cognitive Aging
Regency A-C, Sunday Morning, 10:00-12:00
Chaired by Soledad Ballesteros, Universidad
Nacional de Educación a Distancia

10:00-10:15 (315)

Brain Training With Non-Action Video Games: Results of the 3-Month Follow-Up. SOLEDAD BALLESTEROS, ANTONIO PRIETO, JULIA MAYAS, PILAR TORIL, CARMEN PITA, LAURA PONCE DE LEÓN and JOSÉ MANUEL REALES, *Universidad Nacional de Educación a Distancia*. — We conducted a randomized controlled study to investigate training effects and maintenance of training after a 3-month no-contact period of a video game training program in healthy older adults. Participants in the experimental and control groups were assessed at baseline, post-training, and 3-month follow-up. We found after 20 1-hr training sessions with video games from Lumosity significant improvements at post-training in the experimental group, and no variation in the control group in processing speed, attention (reduction of distraction and increase of alertness), immediate and delayed visual recognition, affection and assertiveness (Wellbeing SPF-IL Scale). We found no change in executive control and visuospatial working memory. Significant improvements at post-training became not significant at the 3-month follow-up except in assertiveness (p<0.01). We concluded that cognitive training effects disappeared over the 3-month no-contact period. The results suggest that repeated practice of the video games is necessary to maintain training benefits.
Email: Soledad Ballesteros, mballesteros@psi.uned.es

10:20-10:35 (316)

Diverse Cognitive Aging: Cross-Domain Performance in the Cam-CAN Project. MEREDITH SHAFTO and LORRAINE K. TYLER, *University of Cambridge*. — Despite growing interest in "successful" cognitive aging, assumptions persists that aging involves wide-ranging cognitive decline; a primary aim of cognitive aging research is identifying the common factors underpinning a variety of declining abilities. However, attempts to identify factors underpinning cognitive aging typically only examine measures that decline

with age, including general measures such as g or speed, or domain-specific measures such as episodic memory. To better characterize successful cognitive aging, in the Cambridge Centre for Ageing and Neuroscience (Cam-CAN; www.cam-can.com) we obtained measures on a wide array of cognitive domains including memory, language, emotion, attention, and action on 700 healthy adults aged 18 to 88 years. Results demonstrate variability in the relationship between age and performance, providing evidence from a single sample of both impaired and preserved performance in a number of domains. We examined factor structure across and within age groups and found that when using a range of cognitive measures, younger and healthy older adults display a similar level of cognitive diversity, and that "successful" aging is multidimensional in a healthy population.
Email: Meredith Shafto, mshafto@csl.psychol.cam.ac.uk

10:40-10:55 (317)
How Network Complexity Affects Our Understanding of Cognitive Processing Across the Lifespan. MICHAEL RAMSCAR and HARALD BAAYEN, *University of Tübingen*, BRADLEY LOVE, *University College London*. — Healthy ageing is associated with changes in cognitive function. These changes are usually attributed to decreases in neural plasticity: i.e., the cellular alterations underpinning the brain's ability to learn. However, it is impossible to determine whether learning and plasticity change across the lifespan without a proper understanding of the functional properties of the learning system. We consider the complexity constraints shaping the development and measurement of functional systems in humans. Current models of cognitive function across the lifespan tacitly assume a constant additive model of learning. We show that, empirically, this model is wrong, and that once the true network complexity of knowledge at various levels of linguistic description is considered, existing theories both underestimate the demands on learning in increasingly complex systems, and concomitantly massively overestimate the degree to which plasticity declines across the lifespan.
Email: Michael Ramscar, michael.ramscar@gmail.com

11:00-11:15 (318)
Simulating the Associate Memory Deficit of Older Adults in Long-Term and Short-Term/Working Memory: The Effects of Divided Attention in Younger Adults. MOSHE NAVEH-BENJAMIN and MATTHEW S. BRUBAKER, *University of Missouri*. — Older adults show an associative memory deficit in long-term episodic memory compared to younger adults. This age-related associative deficit has recently been shown to extend to short-term/working memory, as well. One hypothesis as to why this occurs is that older adults have fewer attentional resources to bind items together. Although previous research suggests that the associative deficit in long-term memory is not due to a decrease in older adults' attentional resources, the role that attentional resources play in the associative deficit in short-term memory remains unclear. The current studies tested younger adults in a continuous recognition paradigm under several divided attention conditions in an attempt to simulate an associative deficit similar to that seen in older

adults under full attention. The results suggest that under some conditions attentional resources may play a role in older adults' associative deficit.
Email: Moshe Naveh-Benjamin, navehbenjaminm@missouri.edu

11:20-11:35 (319)
Aging and Different Prospective Memory Tasks in Daily Life: Event-Based, Short Term Time, Time of Day Tasks. PETER RENDELL, *Australian Catholic University*, NATHAN ROSE, *University of Wisconsin-Madison*, SUSAN SAPEGA and GILL TERRETT, *Australian Catholic University*, PHOEBE E. BAILEY, *University of Western Sydney*. — There are robust age-related deficits on time-based tasks in laboratory prospective memory (PM) studies, that involve completing a task after a short period of time. In contrast, there is often no age-difference on time-based tasks in naturalistic studies that involve completing tasks at set time-of-day. This study investigated event-based tasks and both types of time-based tasks within a naturalistic setting, and also whether each task benefits from the implementation intentions strategy. Forty younger and 40 older adults used adapted mobile phones to complete over 3 days, 4 event-based PM tasks per day (take photos of events). Over another 3 days, participants had 4 time-based PM tasks per day (answer questions): 2 short-term-time (10, 15, or 20 min after alert) and 2 time-of-day tasks (e.g. 11:00am and 4.30pm). The preliminary findings support the prediction of larger age-differences and smaller benefits of implementation-intentions on short-term-time task than both time-of-day and event-based tasks.
Email: Peter Rendell, peter.rendell@acu.edu.au

11:40-11:55 (320)
Speech Fillers and Disfluencies in Picture Descriptions of Young and Older Adults. LORI JAMES, CHELSEA PLACZEK and BRITTANY CHAMBERS, *University of Colorado, Colorado Springs*. — Young and older adults described six cartoon pictures, three containing visual errors or anomalies and three without errors. We predicted that the presence of visual errors would result in more speech fillers (e.g., "um," "ah") and disfluencies (e.g., stutters, slips of the tongue, sentence re-starts), and that older adults' speech would be differentially compromised for pictures with visual errors. Analysis of speech fillers yielded an interaction between error presence and age, because older adults produced more fillers than young adults when describing pictures with errors, but not for pictures without errors. A separate analysis of all other speech disfluencies (summed together because they were rare) revealed an age difference, but no main effect of error presence, and no interaction of error presence and age. Older adults had more non-filler speech disfluencies than young adults whether they were describing pictures with or without errors. Because speech fillers can indicate difficulty in planning utterances, we suggest that the need to represent the novel errors contained in the pictures posed particular difficulty for older adults.
Email: Lori James, ljames@uccs.edu

Cognitive Control
Regency D-F, H, Sunday Morning, 10:00-12:00
Chaired by Matthew Finkbeiner, Macquarie University

10:00-10:15 (321)

Watching the Simon Effect Unfold: Insight From the Reach-to-Touch Paradigm. MATTHEW FINKBEINER, *Macquarie University*, ANDREW HEATHCOTE, *University of Newcastle*. — Being fast and accurate in the Simon task involves attending to the task-relevant attributes (e.g. color) and ignoring the task-irrelevant attributes (e.g. location). According to standard dual-route accounts of the Simon effect, a fast direct route transiently encodes task-irrelevant spatial attributes and a slower 'cognitive' route encodes task-relevant color attributes. Interference arises when these two routes produce conflicting responses. Following from this account, responses made early in stimulus processing should be captured by the stimulus' position by virtue of being controlled by the fast, direct route. In contrast, responses made later in stimulus processing should be controlled by the slower cognitive route and reflect the encoding of task-relevant features. Using the reach-to-touch paradigm, we confirm this prediction by showing how subjects' reaching movements travel in the direction of the stimulus when initiated early in stimulus processing (~150ms) but not when initiated later in stimulus processing (~300ms).
Email: Matthew Finkbeiner, matthew.finkbeiner@gmail.com

10:20-10:35 (322)

Task-Switching and Visual Behavior. MICHAEL DODD, MARK MILLS and JORDAN GRUBAUGH, *University of Nebraska - Lincoln*, EDWIN DALMAIJER and STEFAN VAN DER STIGCHEL, *Utrecht University* (Presented by Michael Dodd). — The study of task-switching has a rich history (Monsell, 2003) but has been surprisingly overlooked as it relates to vision. Recent examinations of task set and visual behavior have demonstrated differences in the influence of memory on attentional allocation and the spatial and temporal characteristics of oculomotor kinematics (Dodd et al., 2009; Mills et al., 2011). In the present series of experiments, we examine the influence of task switching on oculomotor kinematics (e.g., saccade amplitude, fixation duration) in addition to examining whether these effects are moderated when images repeat across tasks. Participants view scenes while either searching for a target, memorizing the scene, or evaluating the scene, with task set being either blocked or mixed. These experiments provide important insight into the costs and benefits associated with task switching as it relates to visual behavior, in addition to demonstrating the flexibility of the visual system.
Email: Michael Dodd, mdodd2@unl.edu

10:40-10:55 (323)

The Fate of Completed Intentions: Mechanisms and Moderators of the Persistence and Deactivation of Executed Intentions. THOMAS GOSCHKE, *Technische Universität Dresden*, MORITZ WALSER, STEFANIE BECK, HANNES RUGE, MARCUS MOESCHL and RICO FISCHER, *Department of Psychology, Technische Universität Dresden*. — While prospective memory (PM) research was long focused on retrieval of future intentions, recently the mechanisms mediating the deactivation of completed intentions gained increasing attention. This interest is instigated by studies from our and other labs indicating that completed intentions entail aftereffects in terms of slower ongoing-task responses when no-longer-relevant PM cues appear. However, mechanisms and moderators of such aftereffects remain poorly understood. In a series of behavioral and fMRI experiments we obtained evidence that (1) aftereffects reflect persisting residual activation of completed intentions as indicated by interference from intention-related distractors; (2) persisting intention activation promotes automatic retrieval of completed intentions as indicated by PM-cue-related activation in brain areas involved in stimulus-driven attention and memory retrieval; (3) persisting intention activation entails perseveration of attentional search sets as indicated by the finding that aftereffects are attenuated by overwriting completed intentions with new attentional search sets. Results contribute to our understanding of the mechanisms underlying the persistence and deactivation of completed intentions.
Email: Thomas Goschke, goschke@psychologie.tu-dresden.de

11:00-11:15 (324)

Implementation Intentions Enhance Perceptual Processing in Decisions Under Conflict. MICHAEL DAMBACHER, MAIK BIELEKE and RONALD HÜBNER, *Universität Konstanz*, PETER GOLLWITZER, *New York University*. — A wealth of studies has shown that action control benefits from the formation of if-then plans, so-called implementation intentions (IIs: "if X arises, then I do Y"), rather than from simple goal-directed plans ("I intend to do Y"). While positive II-effects have generally been attributed to improved accessibility of action-relevant cues and enhanced cue-response links, the dynamics of the underlying mechanisms have not yet been formally established. Here, we used the flanker task to delineate the sources of II-effects in perceptual decisions involving response conflicts. In a series of experiments, data consistently yielded enhanced performance to II-critical stimuli compared to control conditions. Importantly, fits of the dual-stage two-phase (DSTP) sequential sampling model revealed that IIs improve early sensory filtering, leading to increased drift rates of response selection. Our findings augment previous results on II-effects in decisions under conflict and demonstrate that if-then plans indeed increase the efficiency of perceptual processing.
Email: Michael Dambacher, michael.dambacher@uni-konstanz.de

11:20-11:35 (325)

Overcoming Mirror Errors in Reading Is Rooted on Learning to Inhibit Mirror Generalization for Letters. GRÉGOIRE BORST, EMMANUEL AHR, MARGOT ROELL and OLIVIER HOUDÉ, *Paris Descartes University*. — Mirror generalization —representing an object and its mirror-image as a single representation— is a built-in property of the neural network that supports the recognition of objects. The mirror-generalization process causes mirror errors for letters with mirror-image counterparts (b/d) and must be

unlearned before an individual can become an expert reader. In the present study we investigated whether the ability to discriminate such letters is rooted on the ability to inhibit the mirror-generalization heuristic. We designed a negative priming paradigm in which participants judged whether two letters were identical on the prime and two animals (or buildings) were identical on the probe. Participants required more time when determining that two animals (but not two buildings) were mirror images of each other when preceded by letters with mirror-image counterparts than without mirror-image counterparts (f/t). Our results suggest that the mirror-generalization heuristic must be inhibited to overcome mirror errors in reading.
Email: Grégoire Borst, gregoire.borst@parisdescartes.fr

11:40-11:55 (326)

Good Things Come to Those Who Wait: Enhancement in a Rule-Based Category Learning Task After Social-Evaluative Stress. SHAWN ELL, STEVE HUTCHINSON, LAUREN HAWTHORNE, LAUREN SZYMULA and SHANNON K. MCCOY, *University of Maine.* — Stressful situations result in the activation of multiple physiological responses. Recent research suggests that the time varying nature of these physiological responses has important implications for cognitive function, particularly processes dependent upon prefrontal cortical function. Presently we consider the temporal impact of this response in relation to rule-based categorization – a task thought to depend on working memory and cognitive control processes. Rule-based category learning performance was tested after completion of a social-evaluative stressor (modified version of the Trier Social Stress Test) at varying time delays relative to cessation of the stressor (no delay, short delay, and long delay conditions) or after a no-stress, comparison condition. As expected, participants in the three stress conditions, but not the no-stress condition, were physiologically and psychologically stressed. Participants in the long delay condition performed better on the rule-based task than participants in the no delay, short delay, and no-stress conditions. These data are consistent with a literature suggesting that cognitive processes dependent upon working memory may be enhanced after recovery from acute stress.
Email: Shawn Ell, shawn.ell@umit.maine.edu

POSTER SESSION I
Thursday Evening
Grand Ballroom, Long Beach Convention Center
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION I •

(1001)

Allocation of Attention During Multiple Object Tracking: Parallel Allocation and Pooling of Resources Based on Task Demands. JUSTIN ERICSON and MELISSA BECK, *Louisiana State University*. — Evidence for a serial attentional mechanism in multiple object tracking (MOT) includes an attraction of attention to individual targets that change trajectory (local changes) (Howard & Holcombe, 2010) and a decline in performance as the number of local changes increases (Ericson & Beck, 2013). However, simultaneous and synchronized changes in trajectory to all items (global changes) do not affect MOT accuracy (Liu et al., 2005), suggesting a global attentional mechanism is also involved. This study employed a rotating tracking design in which global and local changes in trajectory occurred across latencies ranging from 0-250ms. Local changes impacted performance more than global changes and, when two targets sequentially changed local trajectory within a 150ms temporal window, tracking accuracy was reduced. This suggests that tracking is primarily parallel, but that some attentional resources may be devoted or serially transferred towards target items that require more resources due to ongoing task demands.
Email: Justin Ericson, jerics1@lsu.edu

(1002)

ERPs Reliably Track Visuo-Spatial Attention to Within ± 0.7 Degree. MARTIN ARGUIN, MERCÉDÈS AUBIN, FRÉDÉRIC GOSSELIN and PIERRE JOLICOEUR, *Université de Montréal*. — ERPs were recorded while participants identified a cued letter within a 5-letter string centered at fixation. Vertical bars above and below the target location preceded the letter display (100 ms SOA) and served as the cue. Each letter was independently presented as two 33 ms flashes occurring at random moments within a 200 ms display window. ERP amplitudes at electrodes PO7 and PO8 within time windows of 70-120 and 230-280 ms after letter onset were selected as the best data from which to determine the locus of attention. A classifier was trained for this task using 60% of the available data (performance then assessed with full data set). The location of attention determined by the classifier was 60% correct, which is far better than chance (p < .005). Mean distance between the classifier decision and true target location was half of the inter-letter distance, or 0.7 degree of visual angle.
Email: Martin Arguin, martin.arguin@umontreal.ca

(1003)

Temporal Distortion Irrespective of Stimulus Frequency: No Evidence of an Oddball Effect in Duration Estimation. TERESA BIRNGRUBER, HANNES SCHROETER and ROLF ULRICH, *Universität Tübingen*. — Human duration perception can be distorted by various factors. One specific phenomenon—the temporal oddball effect—describes the finding that rare, deviant stimuli (oddballs) are temporally overestimated compared to repeatedly presented standards of identical physical duration. In the classical oddball paradigm, oddballs are randomly intermixed in a series of consecutive standards and their duration is judged relative to these standards. In the present study, we modified this procedure by (a) making the presentation of the to-be-judged stimulus predictable in space and time and (b) asking participants to judge the duration of both oddballs and standards. Thus, the temporal estimates of oddballs and standards could be compared directly. We observed a general temporal overestimation of all to-be-judged stimuli. However, there was no difference between the duration estimates of oddballs and standards. These findings are discussed in terms of prevailing attentional models of time perception.
Email: Teresa Birngruber, teresa.birngruber@uni-tuebingen.de

(1004)

Changing How You Search Influences the Spatial and Temporal Characteristics of Eye Movements. JORDAN GRUBAUGH, MICHAEL DODD, MARK MILLS and BRETT BAHLE, University of Nebraska-Lincoln, EDWIN DALMAIJER and STEFAN VAN DER STIGCHEL, Utrecht University. — Previous research has demonstrated that task set influences the spatial and temporal characteristics of eye movements, such as the rate of change in fixation duration (Dodd et al., 2009; Mills et al., 2011), particularly during visual search. In these tasks, search is generally participant-directed, so participants have no expectation regarding where the target will appear and can search however they choose. However, many real world search tasks are constrained by top-down knowledge regarding a target's expected location, which can be replicated in the laboratory via experimenter-directed search (participants receive explicit direction where to search). The current study examined the influence of task set (search, memorize, evaluate), instruction type (experimenter-directed vs. participant-directed), and image repetition on eye movements. Instruction type led to differences in oculomotor kinematics (saccade amplitude, fixation duration), and these effects were moderated by whether images were always novel or could repeat.
Email: Jordan Grubaugh, jordangrubaugh23@gmail.com

(1005)

Allocation of Visual Attention to Tracked Objects Is Mandatory. ANNIE TRAN and JAMES HOFFMAN, *University of Delaware*. — The visual indexing account of multiple object tracking (MOT) claims that moving targets are tracked with indexes, not visual attention (Pylyshyn & Storm, 1988). Alternative models (Cavanagh & Alvarez, 2005) emphasize the importance of visual attention in MOT.

A key difference between these approaches is that access to object identity requires attention. We tested this prediction in a response competition paradigm in which irrelevant letters appeared on tracked or untracked objects while observers searched for a target in a continuous stream of letters appearing in a fixed location. We found that response-incompatible letters appearing on tracked objects, but not untracked objects, interfered with responses to relevant targets appearing in the attended stream. These results suggest that observers pay attention to the objects they are tracking, even when indexing theory holds that this is not an optimal strategy, suggesting that visual attention is required for object tracking.
Email: Annie Tran, atran@psych.udel.edu

(1006)

Luminance Outshines Lightness in the Object-Reviewing Paradigm. ANJA FIEDLER and CATHLEEN MOORE, *University of Iowa*. — Previous work has shown that objects' surface features and scene-based information can influence the perception of object correspondence (e.g., Moore, Mordkoff, & Enns, 2007; Moore, Stephens, & Hein, 2010). The present study contrasted the effects of objects' luminance (physical surface feature) against the effects of lightness (perceived surface feature) on object correspondence. To do so, we combined the object-reviewing paradigm with the checkershadow display (Adelson, 1995) and manipulated the luminance of objects and their perceived lightness. Participants were faster in a matching task, when the matching symbols were presented in the same objects compared to when they were presented in the opposite objects. This object-specific preview-benefit was eliminated, however, when luminance abruptly switched between objects, but not when objects' lightness changed and luminance was constant. In summary, object correspondence, as measured through the object-reviewing paradigm, depended on objects' luminance rather than on their lightness as induced by the background scene.
Email: Anja Fiedler, fiedler.anja@gmx.net

(1007)

The Impact of Video Game Playing on the Extraction of Statistical Summaries in Visual Displays. OYKU ÜNER, AYSU MUTLUTÜRK and AYSECAN BODUROGLU, *Bogazici University*. — People efficiently extract summary statistics of displays. However, it is unclear whether this is automatic, or the end-result of strategic processes. To investigate the impact of perceptual learning processes on summary statistics, we compared action (AVGP) and strategy (SVGP) video game players to non-gamers across visual and spatial tasks of summary statistics. In the mean size task participants estimated the mean size of a set whose variance and mean were varied. In the centroid task, participants estimated the center-of-mass of randomly located items in a display while configural cues were manipulated. Overall, errors in both tasks were correlated, suggesting that the ability to extract summary statistics may be domain-general. Critically, AVGP and SVGP outperformed non-gamers in the

centroid task. There were only action game related benefits in mean size estimation. Results suggest that there may be strategic influences on the extraction of summary statistics.
Email: Aysecan Boduroglu, aysecan.boduroglu@boun.edu.tr

(1008)

The Impact of Correlated and Uncorrelated Noise on Visual Perception. MARY KISTER KAISER, *NASA Ames Research Center*, LINDA TOMKO, *San Jose State University*. — Although the phenomenon of binocular summation is well documented, it is unclear the extent to which the human visual system can exploit this mechanism in dealing with image noise. Previous studies (e.g., Pardhan & Rose, 1999) have demonstrated that detection thresholds are elevated when the noise in static binocular images is correlated (compared to fully independent). However, the impacts of dynamic noise and of partially correlated noise have not been adequately examined. In a repeated-measures study, we examined both detection and discrimination thresholds in the presence of dynamic, salt-and-pepper noise with binocular correlations of 0, 0.5, or 1.0. We also examined whether the addition (and degree of correlation) of additional noise artifacts typical of night-vision devices (i.e., "poppers") affects thresholds. Findings will be presented and discussed.
Email: Mary Kister Kaiser, mary.k.kaiser@nasa.gov

(1009)

Variance Discrimination Between Orientation and Size: Efficiencies in Cross-Task. SACHIYO UEDA, AKIRA ISHIGUCHI and MIDORI TOKITA, *Ochanomizu University*. — We perceive the statistical information of environment to interact them effectively. Many researches have shown intriguing ability to perceive average values. However it is possible that the variances are more important and unique statistics in terms of common concept across different stimuli. In this study, we conducted some cross tasks of variance discrimination between different stimulus properties (e.g., orientation and size) and compared the performance in the cross-task with in the uni-task (discrimination between same stimulus properties). To compare the performances, we employed 'standard Weber Fraction' as an index. We also examined the tendency of the standard Weber Fraction as a function of pedestal variance. The results showed that discrimination precision in cross-task was not worse than in uni-task. The tendency of the standard Weber Fraction in cross-task was similar to in uni-task. These results suggest the possibility of mechanism of variance perception which does not depend on stimulus properties.
Email: Sachiyo Ueda, g1070304@edu.cc.ocha.ac.jp

(1010)

Composite Effects for Static and Dynamic Facial Expressions. SIMONE FAVELLE and ALANNA TOBIN, *University of Wollongong*, ROMINA PALERMO, *University of Western Australia*. — Facial expressions have been shown to be processed holistically. However, most of this research has been conducted using static images of expressions, which neglects the fact that real world facial expressions involve movement. The current study used the composite task to determine

whether facial expressions in motion show similar hallmarks of holistic processing to static images of expressions. Upright and inverted conditions were included to test whether holistic processing was specific to upright facial expressions and also to attempt to isolate the influence of the motion per se. Overall, results showed clear evidence of holistic processing for both static and dynamic upright expressions, but not for inverted expressions. The magnitude of the composite effect in static and dynamic expressions was similar for all expressions except for fear. Thus, while both static and dynamic expressions appear to be processed holistically, motion may emphasise featural information in expressions of fear.
Email: SImone Favelle, simone_favelle@uow.edu.au

(1011)

Neither Context nor Categorical Inhibition Cleanly Accounts for Recognition-Induced Forgetting. ASHLEIGH MAXCEY, *Manchester University*. — The present study used visual stimuli to provide novel tests of the competing theoretical accounts of forgetting during the typical retrieval-induced forgetting paradigm, the context (Jonker et al., 2013) and the inhibition (Anderson, 2003) accounts. In a modified recognition-induced forgetting paradigm (Maxcey & Woodman, in press), an additional category of objects was interleaved into both the study and recognition-practice phases. In Experiment 1 memory for secondary objects in the recognition-practice phase was superior to study phase objects, as predicted by the context account, not the inhibition account. In Experiment 2 the study context was reinstated and memory for secondary objects in the study phase was superior, without impairing the recognition-induced forgetting effect, contrary to the context account. These findings supported neither of the tested accounts, pushing theoretical perspectives of forgetting to account for how these memory mechanisms would operate as we encounter, and reencounter, objects in our visual world.
Email: Ashleigh Maxcey, ammaxcey@manchester.edu

(1012)

Reading8unsegmented3text2reduces5preview9benefits. HEATHER SHERIDAN, *University of Southampton*, EYAL REINGOLD, *University of Toronto*. — Reading English text without spaces leads to slower reading rates, longer fixations, and disruptions to saccadic programming and lexical processing (Sheridan, Rayner, & Reingold, 2013). To explore the source of these deficits, we used a gaze-contingent boundary paradigm to manipulate parafoveal preview (i.e., valid vs. invalid preview) in a normal text condition that contained spaces (e.g., "John decided to sell the table") and in an unsegmented text condition that contained random numbers instead of spaces (e.g.,"John4decided8to5sell9th e7table"). Preview effects on mean fixation durations were larger for normal than unsegmented text conditions, which indicates that one source of the deficits for unsegmented text is a reduction in parafoveal preview benefits relative to normal reading. Moreover, distributional analyses revealed a delay in the onset of both preview effects and word frequency effects

on fixation durations for unsegmented relative to normal text. We discuss possible mechanisms, such as visual masking and word segmentation difficulties.
Email: Eyal Reingold, reingold@psych.utoronto.ca

(1013)

Psycholinguistic Processing in Reading of Dynamic Text. HANNAH HARVEY and ROBIN WALKER, *Royal Holloway University of London*, SIMON LIVERSEDGE and HAYWARD GODWIN, *University of Southampton*. — Little is known about the reading of dynamic scrolling text, despite its prevalence in digital media (e.g. TV news tickers). The horizontal scrolling of text presents a conflict to the attentional and oculomotor systems, requiring tracking of the text right-to-left simultaneously with left-to-right gaze and attention shifts for processing each word. Here we investigated known lexical (word length and frequency; Experiment 1) and sentence-level processing (predictability; Experiment 2) effects when reading static and dynamic text. The effects of word frequency, word length, and predictability were replicated with dynamic text, however a dissociation was found, with increased fixation durations and reduced skipping probability during reading of dynamic scrolling text compared to static text (Experiment 2 only). This suggests that the additional demands imposed on the oculomotor and attentional systems by dynamic text increase difficulty of sentence-level psycholinguistic processing, whilst lexical processing is unaffected.
Email: Hannah Harvey, Hannah.Harvey.2010@live.rhul.ac.uk

(1014)

The Effects of Feedback and Target Prevalence on Visual Search. CHAD PELTIER and MARK BECKER, *Michigan State University*. — Lab-based visual search experiments have been used to construct models of search dynamics and search termination in target absent trials. These models might be applied to understand real-world search performance. However, there are critical differences between most lab-based and real-world searches that may make it difficult to generalize from the lab to the real-world. Specifically, in the lab there is often trial-by-trial feedback and target prevalence is high (50% or greater). By contrast, in many important real-world search tasks (e.g. radiology and baggage screening) performance-based feedback is often impossible to give, and targets are rare. To investigate how these factors influence search dynamics, we directly manipulated target prevalence and feedback. We found that target prevalence and feedback interact to influence search accuracy and duration. In low prevalence searches feedback decreases search duration and increases misses, but in high prevalence searches feedback is not related to search duration or accuracy.
Email: Chad Peltier, peltie11@gmail.com

(1015)

What Drives Eye Movements in Narrative Film Viewing? The Roles of the Film Stimulus Versus Higher-Level Comprehension. JOHN HUTSON, *Kansas State University*, TIMOTHY SMITH, *Birkbeck, University of London*, JOSEPH MAGLIANO, *Northern Illinois University*, LESTER

LOSCHKY, *Kansas State University*. — Reading research has shown clear relationships between comprehension and eye-movements, but do these hold for film? We tested competing hypotheses: H1) mental model: viewers' narrative mental models guide attention during film viewing, versus H2) tyranny of film: viewers' attentional synchrony eliminates comprehension-based attentional differences. We tested these using a clip from "Touch of Evil" (Welles, 1958) by manipulating the presence/absence of film context and measuring viewers' film comprehension and eye-movements. In the context condition, viewers started by seeing a bomb placed in a car, followed by the car driving through city streets. The no-context condition didn't see the bomb. To measure narrative comprehension, after the clip, we asked participants what would happen next, and measured whether they mentioned the bomb. Three experiments showed the context manipulation created differences in narrative comprehension, but there were no differences in eye movements based on narrative comprehension, strongly supporting the tyranny of film hypothesis.
Email: John Hutson, jphutson@ksu.edu

• PERCEPTION •

(1016)

Volitional and Automatic Orienting of Attention Following a Motion Cue. KATHERINE E. BURNETT and AVISHAI HENIK, *Ben Gurion University of the Negev*. — Does motion orient attention? We used a central patch of coherent translating motion as an 80% reliable cue in a Posner task. For one group of participants, the direction of motion predicted the location of an upcoming target (pro-cue). For a second group, the opposite direction to the motion predicted the location (anti-cue). For both groups, reaction time was faster when the target appeared at the predicted location (valid trials) than the other location (invalid trials). This difference - the validity effect - reflects voluntary attention orienting. At the earliest (150ms) and latest (1000ms) SOAs, the pro- and anti-cues elicited similar validity effects. Interestingly, at the 500ms SOA, the validity effect for the pro-cue was larger than for the anti-cue, and also larger than for the other SOAs. We suggest that this indicates the added contribution of automatic orienting to the attentional effects. Therefore, motion automatically orients attention.
Email: Katherine E. Burnett, k.e.burnett@hotmail.co.uk

(1017)

Bunnies and Snakes: Visual Threat Modulates Perception of Looming Auditory Stimuli. BREANNA H. LABOS and JOHN NEUHOFF, *The College of Wooster*. — Recent work has shown that looming visual stimuli that are threatening (e.g., snakes) are judged to have a sooner arrival time than those that are perceived as less threatening (e.g., bunnies; Vagnoni, Lourenco, & Longo, 2012). This work suggests that the emotions elicited by threatening stimuli can modulate visuo-spatial perception and estimates of time-to-arrival. Here we show that this influence is multisensory. We presented

listeners with threatening or non-threatening visual looming stimuli while the estimated the time-to-arrival of an unrelated looming auditory tone. Participants judged looming tones paired with threatening stimuli to arrive sooner than tones presented with non-threatening stimuli. The results support an embodied emotion account of multisensory perception.
Email: John Neuhoff, jneuhoff@wooster.edu

(1018)

The Effects of Prior Belief, Expectations, and Experience on Belief in Ghosts. WILLIAM LANGSTON and TYLER HUBBARD, *Middle Tennessee State University*. — Beliefs can have a variety of important consequences (e.g., prior beliefs about intelligence can affect performance in math classes). Some beliefs, once established, can be surprisingly difficult to overcome (e.g., that vaccines cause autism), and these beliefs can affect decisions. The relationship between experience and belief is not clear. Some research indicates that belief precedes experience, whereas other research suggests that experience is the source of belief. We investigated the relationship between prior belief, expectations, and experience in the context of evaluating ghost evidence. Participants rated pictures that they were told did or did not contain a ghost (some participants knew which were which and some did not). The ratings were done by looking for pendulum movement in response to "real" ghost pictures. The results were that experience (pendulum movement) increased participants' belief, regardless of their prior belief. The results are explained in terms of confirmation bias and ideomotor effects.
Email: William Langston, william.langston@mtsu.edu

(1019)

Recognizing Brand Logos In and Out of Context. REBECCA R. PLOTNICK and KATHLEEN GALOTTI, *Carleton College*. — We present an expansion on Nickerson and Adams' (1979) classic study of people's recall and recognition of a common object, a penny, using sixteen corporate logos as stimuli. Half of the logos were presented in a familiar context (e.g. a Pepsi logo on a soda can) and half of the logos appeared without a context. Overall, participants correctly identified about 60% of the correct versions of logos, compared to Nickerson and Adams' (1979) overall correct recognition of 41%. There was a marginally significant improvement in performance from placing the logos in a context (61% correct) versus in isolation (58% correct), as well as wide variation in recognition performance for different specific logos (ranging from 29% to 94% correct identification). We discuss implications for theories of visual memory as well as the larger context of embodied cognition.
Email: Kathleen Galotti, kgalotti@carleton.edu

(1020)

Quantifying Perception in the Detection of Signal in Noise. PETER HU, SHANNON HEALD, PETER MALONIS and HOWARD NUSBAUM, *University of Chicago*. — Noise is typically modeled using randomly generated numbers. For any particular defined signal, any such sample of noise will have some pattern similarity, however minimal. Recent research has presented thousands of such noise samples in

a visual array and demonstrated that observers can pick out noise samples that bear some similarity to a target mental image. Aggregation of positive noise samples yields weak images purported to reconstruct the mental image, but the selection of such samples appears idiosyncratic to the observer as is the reconstructed image.We created a million randomly-generated 50x50 pixel visual noise samples and rank ordered the list according to statistical similarity to a single specific target image (a black S on white background). The 100 highest similarity noise samples had a mean correlation with the target of .006 and were significantly above 0; the 100 least correlated were indistinguishable from 0. 24 participants were instructed to respond to each of the 200 samples with a YES (for detecting an S) or NO (no detection) responses. 22 of the 24 participants had significantly positive d-primes indicating a reliability to detect an S that was not present in the noise.
Email: Peter Hu, pthu@uchicago.edu

(1021)
Influence of Haptic-Visual Asynchrony on Stiffness Perception. SUNG HUN SIM and BING WU, *Arizona State University*, ROBERTA KLATZKY, *Carnegie Mellon University*. — This study investigates how the integration of visual and haptic information in stiffness perception is affected by temporal asynchrony between the two senses. In two experiments, subjects held the handle of a haptic interface to actively explore a virtual elastic material, felt the feedback force, and at the same time saw the deformation of the material in a simulated ultrasound video that was presented on a LCD with a latency experimentally set from 0ms to 166ms relative to the haptic feedback. Subjective intensity and discriminability of stiffness levels were assessed by magnitude estimation and 2AFC procedures, respectively. The results showed that perceived stiffness gradually increased with the haptic-visual latency, while JND was essentially constant. Further experiments assess the relative weighting of visual and haptic information and the change of the weights with asynchrony. (Supported by NIH grant 5R00EB008710) Email: Sung Hun Sim, shsim1443@gmail.com

(1022)
Variability and Stability in Perception of the McGurk Effect. DEBSHILA BASU MALLICK, *Rice University*, MICHAEL BEAUCHAMP and JOHN MAGNOTTI, *University of Texas Medical School at Houston*. — In the McGurk effect, pairing incongruent auditory and visual syllables produces a percept different from the component syllables. There is no agreement in the literature about how frequently the illusion is perceived: published estimates range from 20% to 100%. One possible source of discrepancy is stimulus-related: since the original stimuli are not available, published studies often use a single stimulus created de novo for that study. Another possible source of discrepancy is individual differences: individuals may vary in their susceptibility to the McGurk effect, but the stability of these individual differences in unknown. To examine interstimulus and intersubject differences and their stability, we measured McGurk perception using 14 different McGurk stimuli in 165 English-speaking adults. Forty participants returned for a 12-month retest session. There

were dramatic interstimulus differences (17% to 81%) and intersubject differences (0% to 100%) but individual subject susceptibility was stable over time (r = 0.91).
Email: Debshila Basu Mallick, debshila@rice.edu

(1023)
Correlates of Multisensory Integration in the Broader Autism Phenotype. AARON MITCHEL, *Bucknell University*, MARISSA W. MITCHEL, *Geisinger Autism & Developmental Medicine Institute*, IAN J. WELLINGTON, *Bucknell University*, BRENDA FINUCANE, *Geisinger Autism & Developmental Medicine Institute*. — The ability to bind temporally proximate multisensory stimuli varies across individuals and corresponds to audiovisual integration abilities (Stevenson et al., 2012). Furthermore, temporal binding and multisensory integration abilities are affected in individuals with autism spectrum disorder (Foss-Feig et al., 2010; DePape et al., 2012). We examined the genetic and social-cognitive underpinnings of individual differences in temporal binding and multisensory integration abilities in the general population. In an undergraduate sample, we measured audiovisual integration tendency, the ability to bind temporally proximate stimuli, degree of ASD-like social traits, and common variants on the CNTNAP2 gene, associated with language impairment and risk for autism (Alarcón et al., 2008). Degree of ASD-like traits was correlated with temporal binding ability. Furthermore, perceptual and social-cognitive factors predicted common variants on CNTNAP2. This study is the first to link perceptual abilities with ASD-like traits in the general population and to document genetic correlates of multisensory integration abilities.
Email: Aaron Mitchel, adm018@bucknell.edu

(1024)
Non-Random Associations Between Graphemes and Colors: How Do Japanese Non-Synesthetes Associate Kana Characters With Colors? JUNICHI NAGAI, *University of Sacred Heart*, KAZUHIKO YOKOSAWA, *University of Tokyo*, MICHIKO ASANO, *Rikkyo University*. — We examined how Japanese non-synesthetes associate colors to Kana (Japanese phonetic characters). Kana consists of two distinct and corresponding subsets, Hiragana and Katakana, which represent the same set of sounds but differ in their usage and shapes, and etc. For each of 92 Kana characters, participants chose the best color from 11 basic color terms. The same test was repeated with a two-week interval. Results showed that color choices for Hiragana characters and those for their Katakana counterparts were remarkably consistent, suggesting that graphemes having the same sound tended to be associated with the same colors. This is comparable to those reported for Japanese synesthetes, though choices of our participants were not temporally consistent. Additionally, higher frequency characters tended to be associated with more distinctive colors, as reported for Western synesthetes. These suggest that grapheme-color synesthesia may have some origins in the cross-modal association mechanisms common to us all.
Email: Junichi Nagai, nagai@u-sacred-heart.ac.jp

(1025)

On the Locus of Multimodal Duration: A MMN Study. MARIA DOLORES DE LA ROSA GAMIZ and KARIN MARIA BAUSENHART, *University of Tübingen* (Sponsored by Jeff Miller). — Previously, we showed that perceived visual duration is strongly biased by concurrently presented auditory intervals with conflicting durations (De la Rosa & Bausenhart, 2013). We suggested that this multimodal integration depends on perceptual interactions arising at an early stage of processing. Alternatively, however, participants might deliberately judge the auditory instead of the visual duration. Accordingly, the observed multimodal integration effects would arise at a decisional stage of processing. To distinguish both alternatives, we measured the mismatch negativity component of the event-related potential which reflects pre-attentive deviance detection and thus, an early processing stage. Specifically, we investigate whether the MMN is elicited by auditory, visual and audiovisual deviant durations presented among a train of auditory, visual and audiovisual standard durations, respectively. In case of an early locus of multisensory integration, audiovisual deviants should evoke enlarged auditory and visual MMNs in frontal and parieto-occipital areas, respectively.
Email: Maria Dolores De la Rosa Gamiz,
maria-dolores.de-la-rosa-gamiz@uni-tuebingen.de

• ACTION AND PERCEPTION I •

(1026)

Cognitive Representation of Dual-Task Demands: Towards a Gestalt View of Human Action. LYNN HUESTEGGE, *RWTH Aachen University*, ALEKSANDRA PIECZYKOLAN, *Universität Würzburg*, IRING KOCH, *RWTH Aachen University*. — Previous theory on dual-task control mainly focused on temporal mechanisms (e.g., serial vs. parallel response selection). Comparatively little research has been devoted to general structural representations of dual-task demands. Here, we asked whether such demands are represented as the sum of the two component tasks, or as a distinct entity (similar to an unrelated third task) by testing for partial repetition benefits (e.g., in switches from combined task demands [A+B] to single task demands [A]). Experiment 1 and 2 focused on dual-response demands triggered by single stimuli. In Experiment 3 we utilized distinct stimuli for each component response to address dual-task demands on a more general level. Overall, there was no evidence for partial repetition benefits when response components repeated across switches. We conclude that dual-task demands are represented as a distinct entity instead of a combined activation of component representations. The findings have important implications for basic assumptions of theories on dual-task control (e.g., that task representations are structurally similar under single- and dual-task demands), and suggest that dual-task demands are represented in terms of a distinct Gestalt.
Email: Lynn Huestegge,
Lynn.Huestegge@psych.rwth-aachen.de

(1027)

Can Vection Produce Recalibration in Rotational Locomotion? BENJAMIN CHIHAK, MATTHEW WEST and HANNAH MAHONEY, *Aquinas College*. — Perceptual-motor recalibration effects have been demonstrated for translational and rotational locomotion in both real and virtual environments (Kuhl et al, 2008; Rieser et al, 1995; Ziemer et al, 2013). Previous work has theorized two primary components that contribute to spatial updating during rotational locomotion: a perceptual-motor learning mechanism and a biomechanically-driven sensory-adaptation mechanism (Pick, Rieser, Wagner, Garing, 1999). Our research further investigates this sensory-adaptation mechanism in order to clarify it theoretically, and evaluate its contribution to the recalibration effects observed in previous work. In our study, participants rotated to face targets while blindfolded in order to evaluate their spatial updating in the absence of vision. This was done before and after an intervention phase during which a circular treadmill was used to create mismatches between visual, vestibular, and kinematic sources of information. We sought to determine the relative contributions of these sources of information to spatial updating while rotating.
Email: Benjamin Chihak, ben.chihak@aquinas.edu

(1028)

Morin and Grant (1955) Revisited: Influence of Action-Effect Feedback on Learning. JING CHEN and ROBERT PROCTOR, *Purdue University*. — Action effects are events that are produced as a consequence of a response. Morin and Grant (1955) conducted an 8-choice task in which when one of the response keys was pressed, a feedback light (i.e., action effect) was lit in a row below the stimulus lights. After several practice sessions, the feedback lights were removed in a transfer session, and response times lengthened greatly, indicating reliance on the feedback. We revisited this paradigm, examining the influence on acquisition and transfer performance of task difficulty, reliability of the visual feedback, and task instruction. Decreased task difficulty and unreliable visual feedback resulted in superior performance in the transfer session, indicating better learning of the stimulus-response mapping and less reliance on the feedback during learning. Task instructions emphasizing learning of the mapping or that there would be a later test without the feedback lights did not influence participants' performance in the transfer session.
Email: Robert Proctor, proctor@psych.purdue.edu

(1029)

Undershoot Biases in Targeted Aiming. ANDREW SLIFKIN, JEFFREY EDER and PATRICK BYRNE, *Cleveland State University*. — According to dominant theories of motor control, speed and accuracy are optimized when movements are planned to reach the target center in a single open-loop shot (viz., Meyer et al., 1988). The current study tested that prediction. Participants (n = 20) were required to generate 100 consecutive targeted hand movements under each of 15 unique conditions: There were three movement amplitude requirements (80,160, 320 mm) and within each there were five target widths (5, 10, 20, 40, 80 mm). According to the

results, it was only at the smaller target widths (5, 10 mm) that participants aimed for the target center; as width increased (20, 40, 80 mm), participants increasingly undershot the target center. We will discuss the implications of the results both for motor control theories in general and for extending our recent model of the time-series structure of movement outcomes (Slifkin and Eder, 2012; Slifkin and Eder, 2014).
Email: Andrew Slifkin, a.slifkin@csuohio.edu

(1030)
Cognitive Framing Effects in Physical Tasks. JOHN M. HUHN III, CORY ADAM POTTS and DAVID ROSENBAUM, *Pennsylvania State University*. — Cognitive framing effects, made famous by Kahneman and Tversky, have been explored in high-level decision-making (e.g., economic planning). Here we report cognitive framing effects in a physical task. Our participants moved a horizontally oriented pipe from one height to another, turning the pipe 180 degrees to bring one end or the other to targets on the left or right at various levels. All of the tasks could be completed by always rotating the pipe clockwise or by always rotating the pipe counter-clockwise. Nevertheless, most participants rotated the pipe so the end going to the target moved through the upper visual hemisphere (i.e., clockwise on the way to right-side targets and counter- clockwise on the way to left-side targets). We discuss this new cognitive framing effect for physical action in terms of the influence of attention on movement and the similarities between perceptual-motor planning and high-level decision-making.
Email: David Rosenbaum, dar12@psu.edu

(1031)
Behavioral Dynamics of the Human Walk-Run Transition. MOHAMMAD ABDOLVAHAB, JASON GORDON and TILL FRANK, *University of Connecticut* (Sponsored by Claire Michaels). — Humans switch from walking to running at a particular speed. In experiments in which the transition from walking to running or running to walking has been observed, it has been shown that the transition speed depends on the presentation sequence — i.e., speed increasing versus decreasing. This study examined walking and running on a treadmill while speed was varied. Gait transitions were observed. The dimensionless Froude number (speed scaled by participant's leg length) acted as a body-scaled control parameter for the two gaits (walk or run). Through modeling and experimental results, it was shown that the transitions and their observed hysteresis (i.e., a Froude number larger for the increasing sequence than that for the decreasing sequence) can be accommodated by an order parameter dynamics typifying self-organizing systems within the framework of synergetics and dynamical systems theory.
Email: Mohammad Abdolvahab, vahabmo@gmail.com

(1032)
Representation of Serial Order in Action Planning Prior to Response Execution: Activation of and Associations Between Action Elements. EZANA TADDESE, TORI ANDERSON, REBECCA LA and LISA FOURNIER, *Washington State University*. — Execution of an action is

delayed if it partly overlaps with an action plan currently maintained in working memory (partial repetition costs, PRC). PRCs were recently shown to be limited to cases where the current action (e.g., left) overlaps with the first feature (e.g., left then up) but not the last feature (e.g., up then left) of the action sequence maintained in WM, consistent with models assuming serial order is represented prior to response execution by a gradient of feature activation. We manipulated the relative frequency of the different action elements of the planned sequence (first, last, or both) maintained in WM to examine whether increasing activation of the last feature in the action sequence would lead to a PRC. Results showed a PRC for first-feature overlap but not for last-feature overlap. This suggests that action features are associated in a forward direction, not bidirectionaly, prior to response execution.
Email: Ezana Taddese, ezana.taddese@email.wsu.edu

(1033)
Planning Reaches to Intercept Moving Targets With Ambiguous Paths. DEBORAH BARANY, JASON GILBERT and SCOTT T. GRAFTON, *University of California, Santa Barbara* (Sponsored by F. Gregory Ashby). — Interceptive actions require a transformation of multiple perceptual variables into appropriate motor commands. The spatio-temporal constraints for these actions might not only influence the motor output, but also how the perceptual variables are initially integrated. To investigate the bidirectional effects between perceptual and motor variables during interceptions, we used a modified bounce-stream task in which two moving targets appear to either stream through or bounce off each other. The paths were unambiguous or ambiguous, and a brief sound occurred at different time points relative to target coincidence. Importantly, participants either passively perceived the paths or intercepted one of the targets based on whether a stream or bounce was perceived. On ambiguous trials, perception of bouncing increased when the sound was closer to coincidence. However, this bounce inducing effect was diminished for intercept trials relative to perceive-only trials, suggesting that performance constraints required for planning interceptions suppress cross-modal influences on motion perception.
Email: Deborah Barany,
barany@dynamicalneuroscience.ucsb.edu

(1034)
Voluntary Action and Time Perception. MATTI VUORRE and JANET METCALFE, *Columbia University* (Sponsored by Lisa Son). — Voluntary actions alter the perceived timing of events: In contrast to involuntary actions, voluntary actions are perceived as having occurred later, and their effects as having occurred earlier in time. According to a proposed explanation, voluntary actions temporarily slow down an internal clock, reducing subjective elapsed time between events.We tested the slowed clock hypothesis by showing subjects stimuli that could result in perceived apparent motion. Subjects either initiated the display by a voluntary action, or passively observed the display, and then reported whether they saw motion, or estimated the inter-stimulus interval. According to the slowed clock hypothesis, subjects should observe more

motion in the voluntary action condition. Although the voluntary action condition led to shorter interval estimates, motion responses did not change between conditions. These results argue against the slowed clock hypothesis and suggest that voluntary actions influence retrospective timing judgments, but not visual perceptual processing.
Email: Matti Vuorre, mv2521@columbia.edu

(1035)
Exploring Vertical Meridian Asymmetry for Faces: The Upper-Hemifield Advantage. GENEVIEVE QUEK and MATTHEW FINKBEINER, *Macquarie University*. — Visual capabilities are not uniform across the visual field. For example, performance on tasks of contrast sensitivity, visual acuity, and motion perception is reliably better in the lower visual field (LVF) than the upper visual field (UVF). Where vertical asymmetry has been well-documented for a range of low-level stimuli, the impact of vertical hemifield presentation on the perception of higher-level objects is relatively unknown. We present two studies which suggest that, unlike many other stimulus types, perception of human faces may enjoy an upper-hemifield advantage. We combine masked priming with a behavioural reaching paradigm to show that i) masked faces affect target-categorisation earlier when presented in the UVF than the LVF, and ii) masked-face processing depends on attention in the LVF but not the UVF. Finally, we test and refute the possibility that this UVF advantage for face-perception is driven by an upward bias in voluntarily directed spatial attention.
Email: Genevieve Quek, genevieve.lauren.quek@gmail.com

(1036)
Using Eye Gaze as a Mode of Control Leads to Increased Inattentional Blindness. JAMES CUNNINGHAM, JOHN SWEET and JAMES MILES, *California State University, Long Beach*. — It is becoming more common to use eye-gaze interfaces in new consumer technologies. Although this provides a new mode of control, using the oculomotor system in this way may cause observers to miss or react more slowly to visual stimuli because their attentional resources are focused on controlling eye movements rather than observing objects. To test this assumption, participants either passively followed a target moving along a track, moved it with a joystick, or moved it with their eye-gaze position. Concurrently, participants responded to occasional 200 ms changes in target shape by pressing a button. Results showed that participants made slower responses and were also significantly more likely to miss changes in the target shape with eye-gaze control even though the target was always at the center of the visual field in this condition. We discuss how eye-gaze control may be more vulnerable to inattentional blindness than other control modes.
Email: James Miles, jmiles@csulb.edu

(1037)
Expectancy and Modality Effects in Time Perception: Common Attentional Mechanisms? PAULE ELLEFSEN-GAUTHIER, ANDRÉE-ANNE OUELLET and CLAUDETTE FORTIN, *Universite Laval*. — Attention processes related to

time perception were investigated using a time production task with two conditions (with and without break) and stimulus modality (auditory and visual). Additionally, younger and older adults completed the task in order to explore age-related changes in attention and timing. As expected, produced intervals were longer in visual than in auditory trials, and intervals lengthened as a function of pre-break duration. More importantly, the modality effect was exacerbated in the break condition, thus supporting previous work showing that break-expectancy and modality effects are not independent. These results were obtained for all participants as older adults' performance was generally similar to that of the younger group. These results are interpreted within current models of time processing which posit that auditory stimuli orient attention to time more efficiently than visual stimuli in a context of attention sharing, thus reducing the distracting effect of break expectancy.
Email: Paule Ellefsen-Gauthier,
paule.ellefsen-gauthier.1@ulaval.ca

(1038)
The Effects Load Carriage and Physical Fatigue on Cognitive Performance. MARIANNA EDDY, *US Army NSRDEC & Tufts University*, LEIF HASSELQUIST, JESSICA HOWE, JENNIFER ROURKE, MEGAN COYNE, MEGHAN O'DONOVAN, JESSICA BATTY, TAD BRUNYE and CAROLINE MAHONEY, *US Army NSRDEC*. — Studies examining the effects of exercise on cognition have produced mixed results, partly due to the different methods for measuring physical fatigue and the time of cognitive test administration. In the current study, we measured cognitive performance while participants walked for two hours on a treadmill. During the first hour participants walked on an uphill grade of 4% and for the second hour at a downhill incline (-8%) or a variable grade (alternating 4, 0, -8%) either carrying a load of 88 lbs. or no load while performing cognitive tasks. Cognitive performance was measured on two tasks: an auditory go/no-go task and a visual target detection task. On the auditory go/no-go tasks, participants missed more go trials when they were in the load carriage condition compared to the no load carriage condition. Reaction times after a no-go trial were slower for the loaded condition compared to the unloaded. On the visual target detection task, reaction times decreased while accuracy increased over time but did not differ between load conditions. These results suggest a dissociation in the types of tasks affected by physical fatigue during exercise.
Email: Marianna Eddy, marianna.eddy@tufts.edu

(1039)
Cognitive Constraints in Motor Imagery. STEPHAN FREDERIC DAHM, *UMIT University for Health Sciences, Medical Informatics and Technology*, MARTINA RIEGER, *University for Health Science, Medical Informatics & Technology*. — Bimanual movements are initiated faster when moving to same than to different targets and when targets are arranged in an inner/outer fashion than in a left/right fashion (Weigelt et al., 2007, Psych. Res.). We investigated whether these cognitive bimanual coordination constraints are also observable in motor imagery. 24 participants performed bimanual

movements to two of four possible target positions. Target similarity and arrangement were manipulated. Participants performed one execution and three imagery conditions. In the latter they indicated starting, ending, or starting and ending of the movement. In imagination and execution participants reacted faster when targets were arranged in an inner/outer fashion than in a left/right fashion. Participants also reacted faster to same than to different targets both during action planning and action execution. In conclusion, cognitive coordination constraints are represented in motor imagery of fast bimanual movements.

Email: Stephan Frederic Dahm, stephan.dahm@umit.at

(1040)

Braking Bad: The Dynamic Influence of Anxiety on Visually Guided Action Performance. IAN RUGINSKI, MICHAEL N. GEUSS and JEANINE STEFANUCCI, *University of Utah.* — Previous research shows that emotions can influence perception, but it is unclear whether changes in emotion also alter actions. In the current study we tested whether performance of a braking task (see Fajen, 2008) was altered when anxious. We hypothesized that anxiety would 1) lead to poor braking performance and 2) that changes in braking performance would be due to differences in the visual information that individuals utilized to guide braking. Results indicated that when anxious the margin of error for braking decreased, and that the size of the target may have been used to control braking rather than more optimal visual information (Fajen, 2008). Thus, individuals utilize visual information differently when anxious, which may lead to poorer performance of actions.

Email: Ian Ruginski, Ian.Ruginski@psych.utah.edu

(1041)

Conversing With a Devil's Advocate: Dialogical Dynamics of Movement and Speech in Deception and Conflict. NICHOLAS DURAN, *Arizona State University*, RICCARDO FUSAROLI, *Aarhus University.* — We examined the multichannel, multimodal interpersonal coordination of 38 pairs of participants as they debated strongly held opinions across two conversations, either disagreeing or agreeing with each other. In half the conversations, one of the speakers, unbeknownst to the other, is also asked to deceptively assume a position opposite to his or her own beliefs (i.e., devil's advocate). We measured motor (head, arm/torso and legs) and linguistic (turn-taking, speech rate) coordination by employing windowed lagged cross correlation and cross recurrence quantification. For motor movements of the head, results revealed opposite patterns of synchrony across conflict, with statistically significant increases from disagreement to agreement in truthful conversations and significant decreases in deceptive conversations. For speech rate, greater coordination was found for deceptive conversations, as well as decreased coordination in both disagreement and agreement. These findings highlight the role of alignment as a powerful mechanism that flexibly adapts to conversational and contextual demands.

Email: Nicholas Duran, nicholas.duran@asu.edu

• EMBODIED COGNITION I •

(1042)

Linked to Your Partner: Extended Sensorimotor Coupling After Joint Action. TAMER M. SOLIMAN and ARTHUR GLENBERG, *Arizona State University.* — When people closely coordinate their actions, we propose that they develop a joint body schema (JBS). That is, parameters that control A's actions (e.g., timing and force) are adapted to perceived parameters of B's actions. Similarly, A automatically maps stimulation near B's body onto her own body. We demonstrate both of these effects in multiple experiments. The participant (A) and experimenter (B) either jointly move a wire to cut through candles (requiring close coordination) or cut candles independently. After cutting for five minutes, we measure A's perception and action relative to B. When A is stimulated by buzzers on her index finger and thumb, she confuses the location of the buzz when B's index finger and thumb are near incongruously lit LEDs, but more so after joint cutting. Also, when A attempts to draw straight lines while watching B draw circles, A's lines deviate toward a circle, but more so after joint cutting. Thus, coordination induces a JBS that shapes perception and action even after completion of the task.

Email: Arthur Glenberg, glenberg@asu.edu

(1043)

When Enactment Improves Object Memory for Order. SEBASTIEN LAGACE, MARIE-CLAUDE GUERRETTE and KATHERINE GUERARD, *Universite de Moncton.* — Action phrases such as "raise your hand" are better recalled if participants performed the action described by the phrase compared to a condition where they do not perform any action (what is known as the enactment effect; Engelkamp & Zimmer, 1989). Some studies suggested that enactment improves item retention, but is detrimental to order retention (Olofsson, 1996). The objective of the present study was to further investigate the role of enactment on order memory using a serial recall task where participants had to recall the order of presentation of series of objects. Our results showed that performing the action associated to the objects to retain improved memory for order. These results suggest that the effect of enactment on memory for order depends on the type of information to retain.

Email: Katherine Guerard, katherine.guerard@umoncton.ca

(1044)

Air Traffic Controller Situation Awareness Is Embodied. DAN CHIAPPE, THOMAS STRYBEL, KIM-PHUONG VU, LINDSAY STURRE, *California State University, Long Beach.* — We tested our embodied approach to situation awareness in air traffic control which holds operators rely on interactions with their displays to access limited information, with only certain information held internally. We tested 17 air traffic controllers to examine whether general information about the airspace (e.g., locations of aircraft conflicts) is held in working memory, while specific information (e.g., aircraft callsigns) is offloaded to displays. This was done in a simulation where controllers managed air traffic. Participants were periodically presented with questions about the airspace (e.g., Is AAL123

co-altitude with SWA566?) on a separate display located beside their radar display. We recorded eye gaze to determine where they look while answering questions. Do they turn to look at the radar display, or keep looking at question display? We found participants looked at radar displays more when answering questions about specific information compared to general information, consistent with our embodied approach.
Email: Dan Chiappe, dan.chiappe@csulb.edu

(1045)

Examining Possible Perceptual Proxies of Flow State. DEVIN GILL, J. SCOTT JORDAN and J. COOPER CUTTING, *Illinois State University*. — Nakamura and Csíkszentmihályi (2002) define flow as an individual's deep engagement in an intrinsically rewarding activity. McGonigal (2011) suggests that video games are flow elicitors. If video games are flow elicitors, then the spatial planning required for game play may relate to flow in predictable manners. Over two experiments, we tested whether a simple video game type experiment could elicit flow using contextual (i.e., implied friction) and conceptual (i.e., ambiguous stimulus labeled either bullet-train or house) manipulations to assess their effects trial-by-trial on two dimensions of flow (i.e., sense of control and temporal perception) and spatial displacement, as well as an overall flow score. Implied friction increased forward displacement, but had no main effect on either sense of control or temporal perception. Interesting relations did, however, arise between the small-scale perceptual and large-scale paper-pencil measures of flow indicating that traditional perceptual measures may be useful in future explorations of flow state.
Email: Devin Gill, dmgill@ilstu.edu

(1046)

Attention and Action Representation in a Movement Congruency Effect. SILVIYA DONEVA and GEOFF COLE, *University of Essex*. — It is commonly assumed that many 'joint-action' effects are due to action mirroring. However, recent evidence shows that lower-level mechanisms can also elicit some of these effects. In the present research we used a 'movement congruency' paradigm to assess the importance of action co-representation and luminance transients in joint-action. In Experiment 1, co-actors alternated reaching responses with a confederate who either used the same (right hand) or a different effector (right foot) to respond. In Experiment 2, participants performed the task either with a biological partner or were presented with attention-capturing transients that mimicked a hand movement. A significant 'movement-congruency' effect emerged even when a different effector was used and when there was no human co-actor present. We interpret the present findings in the context of inhibition of return, rather than action co-representation, and propose that some joint action effects can be driven in a more bottom-up fashion.
Email: Silviya Doneva, sdoneva@essex.ac.uk

(1047)

Revisiting the Space-Time Metaphoric Association: Does the Movement of Spatial Reference Frames Matter? JIUSHU XIE, YANLI HUANG, CHI-SHING TSE and WING-CHEE SO, *Chinese University of Hong Kong* (Sponsored by Melvin Yap). — We always associate past to the left and future to the right. However, little is known about whether the mobility of stimuli presented at the left and right would influence our judgment of temporal words. In each trial, participants saw an left-pointing or right-pointing arrow, which was static on the left/right side of the screen (static condition) or moving from-left-to-right/from-right-to-left within the left/right side of the screen, independent of where it appeared (moving condition). Then, participants saw a centrally presented temporal word and judged whether it conveyed the meaning of past or future. Participants' responses were faster when the temporal word was congruent (vs. incongruent) with arrow's location in the static condition (e.g., "past" word preceded by an arrow appearing on the left), but were faster when the word was congruent (vs. incongruent) with arrow's moving direction in the moving condition (e.g., "past" word preceded by a moving-to-left arrow).
Email: Jiushu Xie, jiushuxie@gmail.com

(1048)

The Sound of Sentences: The Influence of Linguistically Implied Sounds on Physical Sound Processing. CAROLIN DUDSCHIG, IAN GRANT MACKENZIE, JESSICA STROZYK, BARBARA KAUP and HARTMUT LEUTHOLD, *Universitaet Tuebingen*. — Grounded models of language comprehension propose a close connection between language understanding and sensorimotor processes in the brain. In an electrophysiological study the sensory associations of processing linguistically implied sounds were investigated. Participants either read sentences describing auditory events (e.g. "The dog barks"), heard a physical sound or had to imagine a sound. We directly compared the influence of the three sound conditions (linguistic, physical, imagery) on subsequent physical sound processing. ERP difference waveforms indicated that in all three conditions the prime compatibility influenced the physical sound processing. Dipole source localization of these difference waveforms showed a clear dissociation between the effect of the physical sounds (superior temporal area) and the effect of the linguistically implied sounds or the imagined sounds (inferior temporal area). Implications for the grounded models of language understanding will be discussed.
Email: Carolin Dudschig, carolin.dudschig@uni-tuebingen.de

(1049)

Pulling Pictures Into Focus: Motor-Induced Remembering. MARK OAKES, ALAN SEARLEMAN and ALEX FREDETTE, *St. Lawrence University*. — The theory of embodied cognition states that changes in our bodies can influence the workings of our minds. For example, research indicates that we perceive others as friendlier when we are holding a warm drink than when holding a cold drink. Past research has shown evidence of a motor-induced remembering effect (MIR): words paired with flexion responses (arm movements toward the body)

are recognized more often than words paired with extension responses (arm movements away from the body). The present study sought to explore this effect using pictures. A computerized task required participants to move a joystick toward or away from themselves depending on whether or not a series of displayed pictures contained liquid water. Subsequently, participants were given a surprise recognition task to distinguish between the previously seen pictures and new pictures. Males were better able to discriminate between old pictures and highly-similar new pictures when old pictures were paired with flexion responses. These findings suggest that MIR extends to pictures, but only in males, possibly because they are more spatially oriented than females.
Email: Alan Searleman, asearleman@stlawu.edu

(1050)
Testing the Asymmetric and Automatic Nature of Spatial-Valence Metaphoric Association. YANLI HUANG and CHI-SHING TSE, *Chinese University of Hong Kong.* — Spatial-valence metaphoric congruency effect occurs when the activation of spatial concepts (up/down) facilitates the processing of valence concepts (positive/negative), and/or vice versa. Two experiments were conducted to investigate the asymmetry and automaticity of this spatial-valence metaphoric association. Participants' judgments of word valence were influenced by whether the word appeared at the top or bottom of the screen (Study 1), but participants' spatial attention in a letter discrimination task was not biased by the primed valence information (Study 2), showing the spatial-to-valence (but not valence-to-spatial) congruency effect. When participants performed the task simultaneously with a verbal working memory load (Study 1), the spatial-to-valence congruency effect was eliminated, suggesting that the spatial-to-valence metaphoric association may not be automatically activated. Analyses of reaction-time distribution revealed that the spatial-to-valence metaphoric congruency effect in non-WML blocks tended to increase as a function of bins. The implications of these results on Conceptual Metaphor Theory are discussed.
Email: Yanli Huang, yanlihuang1010@gmail.com

(1051)
Spatial Grounding of Abstract Domains: Is There a Common Ground for Time and Valence? IRMGARD DE LA VEGA, VERENA EIKMEIER, ROLF ULRICH and BARBARA KAUP, *University of Tuebingen.* — According to several theories, we use spatial structures to understand abstract domains that cannot be experienced directly. This assumption has been corroborated by empirical findings in the field of the abstract domains time and valence: Right-handers in a left-to-right writing culture respond faster with the right to positive and future, and with the left to negative and past. Two experiments investigated whether this processing of time and valence relies on shared spatial structures. Right-handers classified temporal expressions (tomorrow, yesterday) and positively or negatively connoted words (love, hate) according to their temporal reference or valence by pressing a left or right key. Participants committed more errors and responded slower when the mapping was incongruent (positive/past mapped

onto one key and negative/future onto the other) than in a congruent mapping (one key for positive/future, one key for negative/past). These results hint at a common framework underlying the processing of time and valence.
Email: Irmgard de la Vega, irmgard.delavega@uni-tuebingen.de

• EMOTION AND COGNITION I •

(1052)
Neural Correlates of Emotional Directed Forgetting: The Role of Valence and Arousal. SARA GALLANT and BENJAMIN J. DYSON, *Ryerson University* (Sponsored by Lixia Yang). — Prior evidence suggests that emotional stimuli may be disruptive to the directed forgetting (DF) effect, which occurs when greater memory is observed for information cued as to-be-remembered versus to-be-forgotten. The present study sought to determine whether valence and arousal differentially contribute to the emotional DF disruption. Young adults completed a DF task for high and low arousing positive, negative, and neutral words, while event-related potentials (ERPs) were recorded. Behaviourally, the DF effect was reduced for emotional stimuli, regardless of arousal level. Frontal ERPs showed enhanced positivity for forget-cued stimuli, an effect that was modulated by arousal across valence conditions. In particular, information of reduced environmental importance (e.g., low arousal neutral words) seemed to be more malleable in terms of DF. Results are discussed in terms of the potential underlying mechanisms at work during DF of emotional information.
Email: Sara N. Gallant, s7gallan@psych.ryerson.ca

(1053)
Distracted by Danger: Temporal and Spatial Dynamics of Saccade Programming in the Presence of Threat. EDWIN S. DALMAIJER, *University of Oxford*, MANON MULCKHUYSE, *Donders Institute for Brain, Cognition and Behavior.* — Emotional stimuli, such as threatening stimuli, are known to influence visual selection. However, how and when these stimuli modulate visual selection is not yet clear. In the current study we measured eye movement behavior to index the time-course of emotional modulation on visual selection. Observers made a speeded saccade to a neutral target stimulus in a visual search display while a threatening (CS+) or a non-threatening (CS-) onset distractor was presented. The results showed that short and long saccades latencies were increased in the presence of a threatening relative to a non-threatening distractor, suggesting delayed disengagement of attention from the threatening distractor. In addition, the threatening distractor captured the eyes more often than the non-threatening distractor although threat did not affect saccade latency of these error saccades. The present findings indicate that threat affects both covert and overt attentional processes in order to prioritize threatening stimuli in spatial visual selection.
Email: Manon Mulckhuyse, manon.mulckhuyse@gmail.com

(1054)

Anticipated Aversiveness Does Not Modulate Distraction by Neutral Images: An Emotion-Induced Blindness Study. BRIANA KENNEDY and STEVEN MOST, *University of New South Wales*. — In an emotion-induced blindness (EIB) task, participants search for a single target embedded within a rapid serial stream of pictures, and on any given trial the target can be preceded by an emotional or neutral distractor. Target perception is more impaired in the wake of emotional- than neutral- distractors. Yet the impairment caused by neutral distractors is notable too. We investigated whether disruption by neutral distractors stems from participants' expectations in a context where any rapidly presented distractor has the potential to be emotionally aversive. Negative and neutral distractors were either intermixed within blocks or separated between blocks. Neutral distractors impaired performance regardless of whether participants knew that no negative distractors could appear. Intriguingly, anxiety predicted performance following neutral distractors in the blocked- but not intermixed- condition. These results suggest neutral items may distract regardless of context, but the degree of distraction depends on a combination of expectations and anxiety.
Email: Briana Kennedy, b.kennedy@student.unsw.edu.au

(1055)

The Effects of Mood Induction on Proactive and Reactive Cognitive Control. LIXIA YANG and LINDA TRUONG, *Ryerson University*. — The dual mechanisms of control framework (Braver, 2012) postulates two modes of cognitive control: proactive (cue-focused) and reactive (probe-focused) control. Research has found that younger adults tend to use proactive control. However, this research has typically been examined with experimental paradigms using basic stimuli (e.g., letters) and with minimal focus on the effects of emotions. This limits the generalizability of findings to real world performance. In light of recent research on affective influences on the use of proactive and reactive control (e.g., Chiew & Braver, 2014), our experiment aimed to examine the effect of mood inductions on the use of the two control modes. Young participants were induced into positive, negative, and neutral moods prior to completing a modified AX-continuous performance task (AX-CPT) with neutral face cues and letter probes. Preliminary analyses on AX-CPT task accuracy and response times indicated no effects of mood on task performance. Additionally, there was no evidence of the pattern of proactive control preference typically demonstrated in younger adults. Implications of these results for future manipulations of cognitive control tasks will be discussed.
Email: Lixia Yang, lixiay@ryerson.ca

(1056)

Affective Modulation of Attention Breadth. IRENA DOMACHOWSKA, THOMAS GOSCHKE, and ANNETTE BOLTE, *Technische Universität Dresden*. — The process of pursuing goals and shielding them from distractors can be modulated by affect. We hypothesized that phasic positive affect decreases goal shielding and, consequently, leads to higher distractibility. In Experiment 1, using a visual search task, participants had to categorize pop-out targets and ignore distracters. Each trial was preceded by an erotic picture. We found that positive affect increased distractibility indicated by increased RTs incurred by distracters and incompatible trials, suggesting wider attention breadth. To rule out that the effect was due to high arousal, in Experiment 2, we used the same task with affective primes matched for arousal, but with negative valence. As expected, no interaction between affect and distracter was found. Contrary to previous claims that effects of positive emotions on broadening attention scope are due to the low motivational intensity of affective manipulations, current results show that also highly arousing erotic images can widen the attention breadth.
Email: Irena Domachowska, irena.domachowska@gmail.com

(1057)

Emotional Category of Word Affects Encoding Specificity Performance. WILLIAM STURGILL, *Rockhurst University*. — A mixed-list, within-subjects encoding specificity design was used to assess whether the emotional category of the target word (Neutral, Hostile, Negative, Positive) affected word recall. Participants received 48 cue-above-target word pairs at encoding with the instruction to judge the rhyming or the associative relationship between the words for 5 sec. Context at immediate recall was manipulated with a rhyme or an associate cue that was context matched, as per encoding-specificity manipulation, but not identical to the encoding cue, and participants were allowed 5 sec to type the word that came to mind. Although this context cueing procedure produced low recall performance, results suggested that emotional category affected recall, and, importantly, that participants adopted an encoding strategy to associate even with rhyme encoding instructions. The strategy was used by both high and low quartile working-memory-capacity participants; hence, both groups apparently adopted a similar retrieval plan at encoding.
Email: William Sturgill, william.sturgill@rockhurst.edu

(1058)

Non-Monotonic Relationships Between Emotional Arousal and Context Memory. CHRISTIAN BOYWITT, *University of Mannheim*. — Accounts of the effect of emotion on memory implicitly assume a monotonic relationship between emotional arousal and memory such that increasing arousal goes together with increasing or decreasing context memory. However, non-monotonic relationships are also possible and could offer explanations for discrepant findings. Two experiments using emotional pictures demonstrate non-monotonic effects of increasing arousal on subjective retrieval experiences and context memory. The frequency of recollective retrieval experiences followed a linear-quadratic trend with increasing arousal while memory for the context feature 'frame color' decreased linearly. Thus, experiences of conscious recollection became dissociated from context memory with increasing arousal. Memory for the 'screen position,' however, differentiated between consciously recollected and familiar memories even at high levels of arousal albeit to a lesser extent. In sum, the results suggest that

null effects and negative effects of arousal on context memory could be reconciled by non-monotonic relationships between arousal, context memory, and retrieval experience.

Email: Christian Boywitt, boywitt@uni-mannheim.de

(1059)

Memorability of Emotional Information as a Function of Self-Referential Encoding in Naturally-Cycling Women and Users of Oral Contraceptives. SERGE ONYPER, ERIN SWEENEY, ABIGAIL FRANK and LORAINA GHIRALDI, *St. Lawrence University*. — The current study examined the positivity effect (mnemonic advantage of positive over negative information) in the context of self-referential encoding and explored the influence of female reproductive hormones on the effect of emotional valence on memory. Participants, college-aged women who were either naturally-cycling or on oral contraceptives and male controls, rated 108 positive, negative, and neutral personality traits for self-reference, social desirability, or presence of a letter. Both male and female participants remembered more traits that were evaluated self-referentially than traits evaluated for social desirability or presence of a letter, which themselves differed significantly. Thus, our results replicate the well-established self-reference effect. However, memory for positive traits did not differ from memory for negative traits, revealing no positivity effect. Surprisingly, recognition of emotional traits compared to neutral traits was impaired. Neither the use of oral contraceptives nor the phase of the menstrual cycle of female participants moderated memory retrieval.

Email: Serge Onyper, sonyper@stlawu.edu

(1060)

Context Modulates Automaticity of Facial Mimicry. ALEXANDER KIRKHAM, *University of York*, RALPH PAWLING, *Liverpool John Moores University*, STEVEN TIPPER, *University of York*. — Facial mimicry is thought to assist in relationships with others through empathy and communication; yet it is unknown if it is an automatic or contextually driven response. Participants had facial EMG responses recorded whilst viewing and categorising faces as smiling or frowning. In Study 1 participants implicitly learnt to associate 4 faces as showing consistent emotions (smiling at positive images/frowning at negative images), and 4 different faces as showing inconsistent emotions (reverse expressions to the same images). EMG results exhibited highly similar mimicry to both consistent and inconsistent faces. In Study 2 participants explicitly associated all faces as showing consistent (2a) or inconsistent (2b) emotions. EMG results in 2a showed traditional strong mimicry effects. In 2b mimicry towards frowns remained but was greatly reduced compared to 2a. No mimicry was shown toward smiles. The results show that facial mimicry is automatic unless contextual factors are explicitly clear and defined.

Email: Alexander Kirkham, alexander.kirkham@york.ac.uk

(1061)

Metamemory Processes Affect Updating of Emotional Memory Bindings. TANYA KARAM-ZANDERS, SEAN MICHAEL LANE and KACIE MENNIE, *Louisiana State University*. — In previous research on memory updating (Novak & Mather, 2009), participants repeatedly study and are tested on the locations of emotional and neutral pictures. When participants make erroneous item-location bindings, they are more likely to subsequently repeat those errors for emotional items than for neutral items even after having another study opportunity. These findings have been attributed to the fact that bindings to emotional items are more resistant to change than bindings to neutral items due to greater proactive interference. In two experiments, we examined this effect and found evidence that metamemory processes likely play a major role. In particular, providing corrective feedback during re-study reduced the repetition of emotional errors and promoted better accuracy for the location of emotional pictures. Altogether, the evidence suggests that differences in the way that emotional and neutral information is monitored following initial retrieval affects how subsequent study trials are processed.

Email: Sean Michael Lane, slane@lsu.edu

(1062)

Fear/Surprise Confusion: Perceptual or Attentional Limitation? ANNIE ROY-CHARLAND, MÉLANIE PERRON and LEILA REGUIGUI, *Laurentian Université*. — Among basic emotional facial expressions, fear is most often misidentified, its expression being confused with surprise. The perceptual and attentional limitations hypothesis has been suggested, which attributes the difficulty to the high degree of physical similarity between these emotions. While studies show support for this hypothesis, distinctions between perceptual and attentional processes had yet to be elucidated. The current study aimed to rectify this shortcoming by discriminating between these alternative possibilities during a recognition task where expressions of fear and surprise were blurred in the eye or mouth areas to eliminate distractions and redirect attention to fear-indicative cues. Results revealed lower accuracy rates when fear comprised a single distinctive cue in the brow. When distractors in the mouth were blurred, recognition rates increased significantly, proving that the relevant information is indeed perceived, and that the difficulty is better explained by the lack of attention to relevant cues in the brow.

Email: Annie Roy-Charland, aroycharland@laurentian.ca

(1063)

Micro-Expression Training Tools: A Comparative Study Using Eye-Tracking. MÉLANIE PERRON, ANNIE ROY-CHARLAND and RENÉE GÉLINAS, *Laurentian Université*. — While facial expressions can provide information about a person's emotional state, humans also have the ability to control their facial muscles. Deception might imply an attempt to mask an emotion with a different expression, such as a smile. Nonetheless, involuntary facial cues known as micro-expressions may be leaked, revealing the hidden emotion. As research shows that most people are lacking in deception-detection skills, training has been suggested. The present study compared the effectiveness of the Micro-expression Training Tool 2.0, and its revised version, the METT 3.0 in recognizing concealed emotions using a pre- and post-test masking smile

detection task and eye-tracking. Results revealed differences between micro-expressions: smiles comprising cues of fear being more accurately identified than those with signs of anger. Results also revealed improvement in recognition of genuinely happy smiles following practice, but no effect for either training tool. These results have significant implications for future training protocols.

Email: Mélanie Perron, mperron@laurentienne.ca

(1064)

Disruptive Effects of Angry Faces. DEAN PURCELL, *Oakland University*. — When pictures of two affectively toned faces are presented, one closely following the other, and observers judge if the emotions of the two faces are the same or different, angry first faces disrupt performance delaying responding and increasing error rates. With a 305 ms interval between the onsets of the first and second face angry first faces produced 25.7 percent errors while with happy first faces the errors dropped to 11.34 percent. Single presentations of angry and happy faces yielded error rates of 4.3 percent and 1.8 percent respectively. We conjectured that high error rates when judging the affect of two faces resulted from an angry first face interfering with classification of the emotion of the second face. We demonstrate here that such interfering effects passively dissipate by 15 percentage points when increasing the interval between the onsets of the first and second faces by 300 ms.

Email: Dean Purcell, purcell@oakland.edu

(1065)

A MEG Study of the Gender Differences in Processing Emotion Expressions and Identity of Faces. SHIH-TSENG HUANG, *National Chung-Cheng University*, DAISY HUNG, *National Central University*, OVID J.-L. TZENG, *Academia Sinica*, DENISE H. WU, *National Central University*, PEI-SHU TSAI, *National Changhua University of Education*, MING-CHUN LEE, *National Chung-Cheng University*. — Sixteen young adults participated and viewed 560 trials of Caucasian adult faces in MEG. In the identity task, participants were asked to pay attention to face identity of a pair of faces regardless of expressions. In the emotion task, for each given trial, the participants were asked to judge if the second face is showing the "same" or "different" emotion of the first face. The results found that the brain activation of person identity task was significant higher than those of the emotion task at 90ms and 170ms. The activations of the second faces were higher than those of the first faces. It was found an interaction of gender of the pictures and the same-Different trials at 90ms. In the same trials, the brain activation of identity task was higher than the emotion task. In the different trials, male pictures higher on the first face than on the second face. It was also found interaction effects suggesting significant higher activations in processing male pictures than processing female pictures of emotion task in BA 20 & 21 at 90ms and 170ms. Results

found a difference in early processes between the emotion and identity tasks with task specificity brain activations and possible gender effects.

Email: Shih-Tseng Huang, huangtina1123@gmail.com

• COGNITIVE AGING I •

(1066)

The Effect of Electro-Acustimulation and Acupuncture on Visual Attention of the Elderly. YI-CHEN CHEN, *Buddhist Tzu Chi General Hospital*, SHIAU-HUA LIU, *National Dong-Hwu University, Taiwan*. — Cognitive aging has become a critical issue recently. Some studies have shown that the acupuncture could elevate the cognitive function on Alzheimer's disease (Zhu, et al, 2010; Zeng, Salvage & Jenner, 2013). But how acupuncture works specifically on the visual attention of the elderly is still unknown. The aim of the present study was to evaluate the impact of acupoint stimulation on the efficiency of three attention networks of the elderly, alerting, orienting, and executive control proposed by Posner and Petersen (1990). Seventy-five elderly participants were randomly divided into three groups, acupuncture (A) group, electro-acustimulation (EA) group and sham-electro-acustimulation (SEA) group. The participants had to perform the Attention Network Test child-friendly version, proposed by Rueda, et al. (2004), before and after 15mins acupoint stimulation. Our results demonstrated that the EA can facilitate the alerting network of the elderly, while the A and SEA had no effect on the attention network.

Email: Shiau-Hua Liu, shliu@mail.ndhu.edu.tw

(1067)

Loss of Inhibition in Older Adults – Does It Really Exist? An Experimental Dissociation of Inhibitory and Memory Retrieval Processes. CARINA GIESEN and KLAUS ROTHERMUND, *Friedrich-Schiller-Universität Jena*. — It is commonly assumed that inhibitory functioning decreases with age, though empirical evidence is mixed. These inconsistencies possibly stem from methodological artifacts: Inhibition is typically assessed with the negative priming paradigm which confounds inhibition and episodic retrieval. Both processes can be dissociated with a sequential distractor repetition paradigm (Giesen, Frings, & Rothermund, 2012). In our study, we employed this paradigm to investigate age differences regarding inhibition and retrieval processes: Old (60-78 yrs) and young (17-27 yrs) adults identified target letters that were flanked by distractors (DFD). Inhibitory processes were preserved in older adults, who showed reliable distractor repetition benefits; however, a significant loss of inhibition was apparent for old (65+) compared to young (60-64) seniors. No age differences were found for episodic retrieval processes that were indexed by an interaction of distractor repetition and response relation. Findings highlight the importance of dissociating processes underlying age-related cognitive changes.

Email: Carina Giesen, carina.giesen@uni-jena.de

(1068)

The Effect of Aging on Visual Working Memory During Change Detection: Behavioral Performance and Dynamic Neural Field Model Results. MATTHEW COSTELLO, *Indiana University South Bend*, AARON BUSS, *University of Tennessee*, SARAH RATKIEWICZ and KRISTA REAM, *Indiana University South Bend*. — Change detection research has revealed key limitations to visual working memory (VWM), although few such studies have been extended to older adults. The current study explores age-related differences in change detection with a behavioral task administered to younger and older adults. Performance results indicate 1) age-related decline in performance with increasing set size indicative of VWM demands; 2) older adults displayed a response bias towards same decisions, an effect mediated by VWM; 3) increasing perceptual salience of targets improved performance, but with greater effect on the younger adults. Performance data was simulated using a dynamic neural field (DNF) model composed of interactive perceptual and working memory fields. DNF models have been used to explain VWM development in early childhood through strengthening of excitatory and inhibitory interactions. The model suggests that the same-bias seen with older adults may reflect an imbalance in excitation and inhibition levels resulting from similar developmental mechanisms.
Email: Matthew Costello, mccostel@iusb.edu

(1069)

Is Cognitive Functioning Important for Quality in Ageing? MARKUS B.T. NYSTRÖM and DANIEL ERIKSSON SÖRMAN, *Umeå University*, LARS-GORAN NILSSON, *Stockholm University*. — Well-being and happiness are two important aspects of quality in ageing. By using a large scale memory data base (the Betula study) the importance of cognitive status (episodic memory) for an individual's subjective notion of well-being and happiness were investigated, both among middle- and old aged individuals. When a number of factors where controlled for (e.g., physical health, psycho-social aspects), results indicated no relationships between cognitive status and well-being or happiness, in any age group. However, data suggested that subjective experience of memory capacity seems to play an important role. Further, being married, having low levels of stress, and not having sleeping problems, also seem to be associated with both well-being and happiness. The result suggests that other factors, rather than cognitive status, plays a substantial roll in the quality of ageing. Future studies would benefit from using longitudinal data to be able to investigate these relationships over time.
Email: Daniel Eriksson Sörman,
daniel.erikssonsorman@psy.umu.se

(1070)

The Effects of Aging on Self Reference in Memory and Mind Wandering. JONATHAN JACKSON and ANGELA GUTCHESS, *Brandeis University*. — Thinking about the self when trying to remember information is helpful in young and older adults. In older adults, these self-referential processes are poorly understood, limiting the efficacy of this encoding strategy. Research has shown that a self-referential memory encoding strategy benefits memory. Mind-wandering, in contrast to the self-referential encoding benefit, detracts from accurate cognitive performance. Although self-referential encoding and mind wandering processes both make use of self-relevant thinking, it is unclear how these processes interact, particularly through the lens of cognitive aging. In two experiments, we explored how self-referential memory encoding, relative to control conditions, affects reports of off-task thought in young and older adults. We found that task conditions that encouraged self-referential processing decreased mind-wandering reports in young but not older adults, even after controlling for subjective reports of task engagement. The data suggest that self-referential memory encoding and mind wandering share a common cognitive mechanism, but that access to this resource may become decoupled as a function of age.
Email: Jonathan Jackson, jonathan.d.jackson@gmail.com

(1071)

Theory of Mind and Self Projection in Older Adults. SHOSHANA JARVIS, JAMES DELAPPE, SAMANTHA MARTINEZ, JUAN RAMOS and JEREMY MILLER, *Willamette University*. — The current study compared performance of healthy older adults and young adults on measures of episodic memory, prospection, and theory of mind (Buckner & Carroll, 2007). Episodic memory and prospection were measured using an autobiographical interview in which the participants were asked to remember or imagine events that either had happened in the past or could happen in the future. Theory of mind was measured by asking participants to make judgments regarding the intentions of characters described in stories that involved cognitive, affective, or ironic components. The results demonstrated a general effect of aging: older adult participants showed declines on each of these measures compared to younger adults. In contrast with past literature (Wang & Su, 2013), declines in older adult theory of mind ability were observed across all story types, suggesting that impairments in theory of mind associated with aging may be more global then previously suggested.
Email: Jeremy Miller, millerj@willamette.edu

(1072)

Deficits of Memory Awareness in Amnestic Mild Cognitive Impairment. ANTHONY RYALS, JONATHAN O'NEIL and JOEL VOSS, *Northwestern University Feinberg School of Medicine*. — There is a pressing need for behavioral tests that predict further cognitive decline early in pre-Alzheimer's amnestic mild cognitive impairment (aMCI). This decline may be associated with lack of awareness of poor memory performance. Previous findings suggest distinctions between global versus item-by-item measures of memory awareness, yet these distinct measures have not been compared in aMCI. The present study included data from 15 older adults with aMCI diagnoses (ages 61-88) and 15 age-matched controls. Participants completed 18 specialized tests indexing old/new verbal and visual recognition memory and awareness of memory performance. Item-by-item memory awareness was assessed using judgments of learning (JOLs), retrospective

confidence judgments (RCJs), and "feeling of knowing" judgments (FOKs). Global-level awareness was assessed using prospective and retrospective estimates. Comparisons of aMCI to controls are presented with respect to test sensitivity to aMCI and the efficacy of discriminating aMCI from control subjects based on each memory awareness measure.
Email: Anthony Ryals, anthony.ryals@northwestern.edu

(1073)
The Relationship between Older Adults' Subjective Age and Cognitive Functioning. MATTHEW HUGHES and LISA GERACI, *Texas A&M University*, MARGIE LACHMAN, *Brandeis University*. — How old one feels, one's subjective age, has been shown to predict important psychological and health outcomes. However, few studies have examined the relationship between subjective age and cognitive performance. The current studies investigated whether older adults' subjective age is associated with current cognitive performance, and whether manipulating subjective age would affect cognitive performance. Results showed that subjective age is associated with some types of cognitive abilities. And, consistent with prior research (Hughes, Geraci, & De Forrest, 2013), our experimental manipulation affected participants' subjective age. In addition, results showed that the experimental group who had an increase in subjective age had decreased performance on some cognitive tests. Participants who felt older were also less confident in their performance than those who felt younger. Results suggest that subjective age may be related to cognitive functioning as well as physical and psychological well-being.
Email: Matthew Hughes, mhughes13@tamu.edu

(1074)
The Role of Stereotype Threat in Older Adults' Associative Memory Deficit. MATT BRUBAKER and MOSHE NAVEH-BENJAMIN, *University of Missouri*. — Stereotype threat has been shown to negatively affect a wide variety of cognitive tasks, including memory performance of older adults. However, to date these effects of stereotype threat on older adults' memory performance have only been shown using tests of item memory. The question remains whether associative memory will be affected by stereotype threat more than item memory. The current study tested this using an item-associative recognition memory paradigm while manipulating stereotype threat within-subject. Results showed a larger effect of stereotype threat on older adults' associative memory performance compared to their item memory performance, suggesting that reducing stereotype threat might be one way to reduce older adults' associative memory deficit.
Email: Matt Brubaker, msb2pc@mizzou.edu

(1075)
Orthographic Neighborhood Effects in Older Adults. GINA GLANC, *Texas A&M University, Corpus Christi*. — In three previous studies, manipulations of orthographic neighborhood size and orienting task were used to differentiate between item-specific and relational processing in young adults in standard recognition tasks (Glanc & Greene, 2007; 2009; 2012). The current study attempts to investigate

memory deficits in older adults using similar manipulations. Experiment 1 manipulated orthographic neighborhood size within an item recognition task. Young adults demonstrated a standard mirror effect, showing more accurate performance for low-N words. No such effect was found in older adults, possibly indicating a deficit in item-specific processing. Experiment 2 included an orienting task during study to emphasize a specific type of processing. While younger adults' performance was influenced by orienting task, older adults showed consistently better performance for High-N words. These results suggest that older adults show a deficit in item-specific processing, relying more on relational processing regardless of task.
Email: Gina Glanc, gina.glanc@tamucc.edu

(1076)
Pattern Separation and Pattern Completion in Aging and Dementia. KATHERINE INGRAM and JOHN WIXTED, *University of California, San Diego*. — Memory complaints in an aging population are commonplace, and they are often the primary complaint in demented populations. Understanding the nature of the memory complaint in these different populations is vital to our understanding of the progression from healthy aging to mild cognitive impairment to Alzheimer's disease. There is a small but growing body of literature indicating that pattern separation may be the core memory ability that is negatively impacted by aging. The research described here aims to fill this gap in knowledge by examining pattern separation in healthy aging, mild cognitive impairment, and Alzheimer's disease using a procedure first refined and tested in the young adult population. Establishing whether performance on tasks requiring pattern separation is differentially impaired (instead of reflecting a general memory impairment) is challenging. To address this issue, we used ROC analysis to measure memory performance more precisely than it has been measured in prior research.
Email: John Wixted, jwixted@ucsd.edu

(1077)
The Effect of Age on Visual Working Memory for Features and Conjunctions. STEPHEN RHODES and MARIO A. PARRA, *University of Edinburgh*, NELSON COWAN, *University of Missouri*, ROBERT LOGIE, *University of Edinburgh*. — The ability to hold information in visual working memory (VWM) declines considerably across the adult lifespan. The role of feature binding deficits in this decline remains unclear. Some studies have found that the effect of age on change detection performance is equivalent for both features and conjunctions (or bindings), whereas others have reported a disproportionate effect of age on VWM for conjunctions. The present work further assesses conditions under which VWM for conjunctions has been found to be more age-sensitive than individual features. Across several experiments, using both colour-shape and colour-location conjunctions, we find little evidence that age disproportionately affects VWM for bound features relative to individual features. These findings are discussed in reference

to associative deficits in long-term memory, with focus on the difference between relational and conjunctive binding mechanisms.

Email: Stephen Rhodes, s.rhodes@sms.ed.ac.uk

(1078)

Age-Related Differences in Simple and Complex Spans in Online Samples. CYNTHIA FLORES, DUNG BUI, LINDSEY LILIENTHAL, JOEL MYERSON and SANDRA HALE, *Washington University*. — Recruiting and testing older adults in the laboratory can consume valuable time and resources. The current study examines whether data on older adults can be collected online through Amazon Mechanical Turk (mTurk). Although mTurk has been demonstrated to be a fast and cost-efficient method for collecting data from younger adults, it is unclear whether cognitive aging can be studied online. The current experiment examined age-related declines in spatial working memory using simple and complex span tasks. Contrary to the age-related executive deficit hypothesis, our results confirm previous findings that simple and complex spans decline at equivalent rates between ages 19-74. The present results demonstrate that older adults can be recruited through mTurk, and that the age-related differences observed online are similar to those in laboratory settings. Additionally, our results provide further support for a similar underlying structure of working memory abilities in older and younger adults.

Email: Cynthia Flores, c.flores@wustl.edu

(1079)

Invulnerable Implicit Memory? Replication of 17 Years of Priming 10+ Years After. DAVID MITCHELL, CORWIN L. KELLY and SANDI C. NELSON, *Kennesaw State University*. — We endeavored to replicate Mitchell's (2006) finding of implicit memory priming following a 17-year interval. Our subjects, who had seen word and picture stimuli in 1999 (M age = 18.9), were retested after 11-14 years (M interval = 12.9; M age = 31.8). Via an online program (Qualtrics), we administrered four implicit memory tasks: picture fragment identification, word fragment completion, word stem completion, and category examplar generation. Relative to control subjects (matched on age, education, and Shipley vocabulary scores), longitudinal subjects revealed better performance on all four tasks, although most comparisons did not achieve standard statistical significance. Longitudinal subjects' explicit memory ranged from amnesia (ironically, I do not remember this project, but happy to help) to true hyper-specific instances (I remember calling the picture of a pineapple a piña).

Email: David Mitchell, dmitch37@kennesaw.edu

• WORKING MEMORY I •

(1080)

Less Effective Executive Functioning After Being Sleep Deprived. HAYKUHI ZHAMHARYAN and TEYA RUTHERFORD, *University of California, Irvine* (Sponsored by Susanne Jaeggi). — This research project focuses on the relation between sleep deprivation in college students and their executive functioning skills such as working memory, reasoning, task flexibility, planning and problem solving. 200 undergraduate students were asked to self-report on amount of sleep and were then given tasks to measure cognitive functioning, most specifically, executive functions. The four tasks used for the proposed study were N-Back, Simple Stroop, Tower of Hanoi, and Hearts & Flowers. Initial analyses show that although amount of sleep is not associated with number of total moves taken when solving the Tower of Hanoi, students who sleep more on average and slept more before taking the test were less likely to give up or to exceed the 15-minute time-limit while solving the task. Analyses in relation to the other executive functions tasks are ongoing. Understanding how sleep is associated with cognitive functioning may help treat deficits in executive functions.

Email: Haykuhi Zhamharyan, hzhamhar@uci.edu

(1081)

Is There a Relationship Between Task-Switching and Working Memory Capacity? CHRISTOPHER DRAHEIM, KENNY HICKS and RANDALL ENGLE, *Georgia Institute of Technology* (Sponsored by Francis Durso). — Task-switching is an important aspect of cognitive control and is considered to be a hallmark measure of executive functioning. Researchers agree that the mechanisms underlying task-switching ability heavily depend on working memory, suggesting a positive relationship between WMC and task-switching performance. However, studies investigating WMC and task-switching have not consistently shown this relationship. One concern is the traditional use of latency (RT) switch costs as the sole dependent variable, thus ignoring accuracy. In this study, we reanalyzed multiple datasets that found no relationship between WMC and task-switching using a recently proposed procedure that combines RT and accuracy into a single composite score. Using this procedure, we consistently found a strong positive relationship between task-switching and WMC that had been hypothesized but not shown in the literature. We conclude that when accuracy is not high and stable across participants and conditions, measures that incorporate both RT and accuracy are more appropriate.

Email: Christopher Draheim, cdraheim90@gmail.com

(1082)

Mental Juggling: When Does Task Switching Affect Reading Comprehension? KIT CHO, JEANETTE ALTARRIBA and MAXIMILIAN POMPIEL, *University at Albany, SUNY* (Sponsored by Ludmila Isurin). — We investigated whether or not engaging in a secondary task affects reading comprehension. Participants read prose passages for which they were periodically interrupted with trivia questions (Experiments 1 and 2), or math problems (Experiment 2), or had no interruptions (control). Interruptions due to the secondary task did not impair performance on a reading comprehension test that assessed factual knowledge (Experiments 1 and 2) and conceptual knowledge (Experiment 2), nor did the interruptions result in increased reading time relative to the control condition. When the

secondary task required participants to remember a string of numbers (Experiment 3), thereby increasing cognitive load, performance on the reading comprehension task decreased while the time spent reading the passage increased relative to the control condition. Results suggest that task switching per se does not impair reading comprehension.
Email: Kit Cho, kitwcho@gmail.com

(1083)

Switch Costs and the Focus of Attention. CHRIS BLUME and NELSON COWAN, *University of Missouri*. — Object switch costs have been taken to index items in the focus of attention (e.g., Oberauer, 2005). They refer to savings in reaction time (RT) when a target object to which a response must be made is the same as the target object in the previous trial, compared to trials in which there is a switch to a different target object. It has been presumed that switch costs occur because each target object remains in the focus until there is a need to switch to a different target. Here we show, however, that object switch costs can increase as the number of repetitions of a target object increase from 1 to 3 before a possible switch. If switch costs solely reflect presence of an object in the focus of attention, then presence in that focus would appear to be gradated rather than all-or-none. Additional interpretation of the data comes from a separate examination of switch and no-switch trials across different numbers of repetitions. These data are inconsistent with a single-item focus of attention because of two specific patterns of data: a shorter RT for non-switching trials when going from 1 to 2 repetitions, and a longer RT for switching trials going from 2 to 3 repetitions.
Email: Christopher L. Blume, clbkvf@mail.missouri.edu

(1084)

Automatic Object Files: The Location but not the Features of Visual Cues Are Automatically Encoded Into Working Memory. HUI CHEN and BRAD P. WYBLE, *The Pennsylvania State University*. — Although it is well known that visual cues affect the perception of subsequent visual stimuli, little is known about how the cues themselves are processed. The present study investigated what information about a visual cue is stored in memory in terms of both location ("where" is the cue) and features ("what" are the features of the cue). In spatial-cueing experiments participants performed several trials of reporting a target letter and then answered a surprise question about the cue (e.g., the location or color of the cue) in the last trial. The results showed that participants could accurately report the location of the cue in the surprise test, but were very poor in reporting the features of cue (e.g. color and identity). More importantly, several control experiments demonstrated that the prevalence of location over feature information was unaffected by the task relevance of location or features
Email: Hui Chen, psychenhui@gmail.com

(1085)

Examining Speed of Visual Working Memory Shows Evidence for Two Search Processes. AMANDA GILCHRIST, *Cottey College*, NELSON COWAN, *University of Missouri*. — A popular procedure for investigating working memory processes has been the visual change-detection task. Models of performance in that procedure, however, tend to be based on performance accuracy and to treat working memory search as a one-step process. To better understand how memory search proceeds in this task, we examined reaction time in two experiments. Contrary to current models of visual working memory capacity, our data point to a two-stage search process: a fast first step to check for the novelty of the probe and, in the absence of such novelty, a second, slower step to search exhaustively for a match between the test probe and a memory representation. In addition to these results, we observed that participants tended not to use location information provided by the probe that could circumvent a full search process. These results suggest that current models of visual working meory processing that are based on this task require further revision and exploration.
Email: Amanda Gilchrist, agilchrist@cottey.edu

(1086)

On the Role of Rehearsal in Directed Forgetting Within Working Memory. SARA FESTINI and PATRICIA REUTER-LORENZ, *University of Michigan*. — Directed forgetting within working memory involves attempting to forget representations that are currently held in mind. We examined the role of rehearsal in this form of directed forgetting by testing the influence of articulatory suppression on directed forgetting efficiency, and by assessing the ability of people to perform forgetting without to-be-remembered competitors to rehearse. In Experiment 1, articulatory suppression interfered with directed forgetting, increasing false alarms to to-be-forgotten probes in working memory and decreasing the long-term directed forgetting effect. Experiment 2 demonstrated equivalent forgetting regardless of whether or not participants were required to simultaneously rehearse to-be-remembered items. Experiment 3 confirmed that articulatory suppression interfered with directed forgetting even without to-be-remembered competitors. These experiments suggest that directed forgetting in working memory may require an active control process that is limited by articulatory suppression, and that the demand to remember a concurrent memory set is unnecessary for this control process to work.
Email: Sara Festini, sfestini@umich.edu

(1087)

Working Memory Confidence and Accuracy as Predictors of Reading, Spelling and Numeracy. KERRY CHALMERS, EMILY FREEMAN and FRINI KARAYANIDIS, *University of Newcastle, Australia*. — The relationship between working memory and achievement in reading, mathematics and spelling was examined in 74 Year 4 children (mean age 9 years 10 months). Working memory was assessed using a newly developed online test comprising five levels of increasing difficulty. Confidence, accuracy and response times were recorded. Children also completed tests of

reading, mathematics and spelling. Parent ratings of executive function were also obtained. Results for the working memory test showed that both confidence and accuracy decreased as difficulty increased, whereas the difference between confidence and accuracy increased with level of difficulty. The relationship between response time and accuracy was curvilinear. Working memory accuracy predicted reading, spelling and math achievement scores, whereas confidence predicted math scores only. Working memory accuracy was related to inhibition and working memory as assessed by parent ratings of executive function. Future work will examine the predictive validity of the working memory test for academic performance and executive functioning.
Email: Kerry Chalmers, kerry.chalmers@newcastle.edu.au

(1088)

High-Spans Show Bigger Gains From Training WMC Than Low-Spans. JEFFREY FOSTER, TYLER L. HARRISON, KENNY L. HICKS, CHRISTOPHER DRAHEIM and RANDALL ENGLE, *Georgia Institute of Technology* (Sponsored by Linda Henkel). — Recent research suggests that training people on tasks that measure a variety of cognitive abilities—such as working memory capacity (WMC)—can transfer to improvements on other tasks that measure similar, and sometimes different, cognitive abilities. But who benefits the most from training? More to the point, is it people with high or low cognitive abilities that improve the most? We asked subjects with either high or low WMC to complete training in one of three training groups: a working memory group, an updating group, and an active-control group. Subjects also completed a battery of cognitive tasks before, half-way through, and after the training sessions. One critical finding shows that only high spans showed consistent improvements in the WMC and updating training tasks. In both of these groups, low spans showed only minor improvements on the trained tasks. In other words, high spans benefited the most from training.
Email: Jeffrey Foster, jeff.foster@gatech.edu

(1089)

Concurrent Inhibition and Facilitation by the Contents of Visual Working Memory During Visual Search. BLAIRE DUBE and APRIL BASCIANO, *University of Guelph*, STEPHEN EMRICH, *Brock University*, NASEEM AL-AIDROOS, *University of Guelph*. — Visual working memory (VWM) can guide attention during visual search in two seemingly opposing ways: It records distractors processed during search allowing them to be subsequently inhibited, and it stores the identity of the search target, facilitating search stimuli that share features with this target template. Can VWM simultaneously support both processes? In Experiment 1, subjects searched for a target that changed every trial; a condition that leads the target template to be encoded in VWM. Further, a subset of distractors was previewed before the target on each trial, allowing us to measure the capacity of distractor inhibition and confirm that it is limited by VWM. In Experiment 2, we further demonstrated that this visual search is particularly slowed by the appearance of distractor singletons that match task-irrelevant features of the target

template. These findings suggest that VWM concurrently inhibits previewed distractors while guiding search toward target-matching stimuli.
Email: Naseem Al-Aidroos, naseem@uoguelph.ca

(1091)

Working Memory Span Tests and Phonological Similarity Effects. DAVID COPELAND, *University of Nevada, Las Vegas*, NICOLE BIES-HERNANDEZ, *Northern Arizona University*, KATHLEEN LARSON, *University of Nevada, Las Vegas*. — A classic finding with working memory is that target items that are phonologically similar tend to produce worse recall performance (Conrad & Hull, 1964). However, research (e.g., Camos, Mora, & Barrouillet, 2013) has demonstrated that the phonological similarity decrement can be eliminated by using articulatory suppression. In addition, there is even evidence that using meaningful context as articulatory suppression (e.g., sensible sentences, as used in the reading span) can lead to phonological similarity facilitation (e.g., Copeland & Radvansky, 2001). The goal of this study was to examine this contextual explanation further by manipulating the meaningfulness of the processing information in complex working memory span tests. This was done by using sensible sentences, nonsense words, math problems, or a combination. As expected, phonological similarity facilitation was not always observed, particularly when using math problems. However, the patterns across the experiments were not always consistent with the context-based explanation.
Email: Nicole Bies-Hernandez,
nicole.bies-hernandez@nau.edu

(1092)

Utilizing Cognitive Training to Enhance Low Working Memory Capacity. JASON REIMER, EUGENE WONG, VANESSA CARLOS, BEN A. MILLER, MEAGHAN R. ROMO, MINA S. SELIM and KEVIN ROSALES, *California State University, San Bernardino*. — A recent study demonstrated that working memory (WM) training is ineffective for young adults (Redick et al., 2013). The purpose of the present study was to examine whether this finding could be extended to young adults who possess relatively low working memory capacity (WMC). In this study, college students who received 21 hours of training on a set of adaptive, WM-based cognitive exercises were compared to students who received a comparable amount of training on a set of adaptive, non-WM-based cognitive exercises. All participants were pre- and post-tested on multiple measures of fluid intelligence, memory span, and WMC. The results indicated that there was positive transfer of training to measures of WMC. Additionally, there was some evidence of far transfer to measures of fluid intelligence. These results provide evidence that WM training may be beneficial for individuals who possess deficits in WMC. Implications of these results will be discussed.
Email: Jason Reimer, jreimer@csusb.edu

• METAMEMORY/METACOGNITION I •

(1093)

Judgments of Learning as Memory Modifiers. NICHOLAS SODERSTROM and COLIN CLARK, *University of California, Los Angeles*, VERED HALAMISH, *University of Haifa*, ELIZABETH BJORK, *University of California, Los Angeles*. — A frequent procedure used to study how individuals monitor their own learning is to solicit judgments of learning (JOLs). In two experiments, we addressed the accuracy of a tacit assumption in such research—namely, that JOLs do not affect the learning process per se. In Experiment 1, two groups of participants studied paired associates for the same duration—one group made JOLs while the other group did not—before taking a test. JOLs enhanced memory for related, but not unrelated, pairs, suggesting that JOLs strengthen pre-existing cue-target relationships. Replicating and extending these results, Experiment 2 found that the generation effect can be significantly attenuated by requiring JOLs for read items. Thus, in two experiments, the mere act of making a JOL affected that which it is intended to assess by strengthening the information upon which the JOL is based and, therefore, cannot be viewed as an inconsequential act.
Email: Nicholas Soderstrom, nsoderstrom@psych.ucla.edu

(1094)

The Effect of Motoric Fluency on Metamemory. JONATHAN SUSSER, NEIL MULLIGAN and KELLY GIOVANELLO, *University of North Carolina at Chapel Hill.* — Prior research has demonstrated that certain types of fluency can influence memory predictions, with more fluent processing being associated with greater memory confidence. However, no study has examined whether this pattern extends to fluency of producing information. The current study investigated the effect of a motoric fluency manipulation of hand dominance on judgments of learning (JOLs) and memory performance. Participants predicted better memory for fluently-written than non-fluently-written stimuli despite no differences in actual recall. A questionnaire-based study suggested that the effect of motoric fluency on predictions was not due to peoples' beliefs about memory. These findings are consistent with other fluency effects on JOLs.
Email: Jonathan Susser, josusser@unc.edu

(1095)

How Do Time of Day and Activity Levels Influence Memory and Metacognitive Accuracy? JOSEPH BASSILI and WILLIAM KELEMEN, *Texas State University, San Marcos.* — College students' recall can be influenced by physical activity (Salas, Minakata, & Kelemen, 2011) as well as time of day (Hourihan & Benjamin, 2014). In addition, global judgments of learning (JOLs) tend to be higher in the afternoon compared with the morning (Hourihan & Benjamin, 2014). We sought to extend these findings by examining the effect of naturally occurring physical activity in combination with time of day. Participants completed either a morning or afternoon session and wore a physiological sensor for 2 hours prior to the task. Participants studied 30 English nouns, provided both item-by-item and global JOLs, and finally completed a recall test. In contrast to past findings, participants tested in the morning tended to show higher recall scores compared with those tested in the afternoon. Time of day did not influence JOL magnitude.
Email: Joseph Bassili, jjb109@txstate.edu

(1096)

When People's Judgments of Learning (JOLs) Are Extremely Accurate at Predicting Subsequent Recall: The Displaced-JOL Effect. DUNG BUI, MARY PYC and HEATHER BAILEY, *Washington University in St. Louis.* — Judgments of learning (JOL) made after a delay are more accurate at predicting recall than JOLs made immediately after learning (the delayed-JOL-effect), presumably because delayed JOLs require retrieval from secondary memory, whereas immediate JOLs do not. However, it is possible that immediate JOLs may be equally accurate if intervening secondary task demands require retrieval from secondary memory. In this study, participants learned word-pairs and provided immediate or delayed JOLs. In Experiment 1, a secondary task did not increase accuracy of immediate JOLs. In Experiments 2-4, when secondary task difficulty was increased, the accuracy of immediate JOLs increased. Specifically, accuracy of immediate JOLs with an intervening secondary task was equal to that of delayed JOLs. Furthermore, immediate JOLs with an intervening secondary task were more accurate than without one, demonstrating that the delayed-JOL-effect can be obtained without a delay.
Email: Dung Bui, dcbui@wustl.edu

(1097)

Ingroup and Outgroup Perceptions Affect Judgments of Another's Learning. ELIAS THEODOSIS, JESSICA J. ANDREWS and DAVID RAPP, *Northwestern University.* — When making judgments of another's learning (JOALs), individuals utilize processes analogous to those involved in judging their own learning. Whether these judgments change as a function of identifications with evaluative targets remains an open question. We tested whether group membership affects the processes utilized to judge another's learning. Participants studied word pairs while making judgments of their own learning. They subsequently observed and judged the learning of an ingroup or outgroup target (instantiated using race and gender) studying the same word pairs. Different patterns of JOALs emerged based on similarities between participants and targets. As previously reported, when targets were similar to participants, longer study times for targets were associated with learning difficulty. In contrast, when targets differed from participants by both race and gender, longer study times were associated with greater learning. To date, accounts of JOALs have ignored such social influences in their analyses of metacognitive evaluations.
Email: David Rapp, rapp@northwestern.edu

(1098)

Recollection and Familiarity Affect Episodic Feeling-of-Knowing: Evidence Using an Online Remember-Know Procedure. MICHEL ISINGRINI, *University François-Rabelais*, MATHILDE SACHER, FLORIAN GOUGEON and LAURENCE TACONNAT, *University of Tours.* — In three

experiments, using a cue-target word pair memory task, we examined the hypothesis that feeling-of-knowing (FOK) about the unrecalled target is influenced by recollection or familiarity. An online remember-know-no memory procedure was combined with the episodic FOK procedure allowing to differentiate three measures of FOK – recollection-based, familiarity-based, and no memory-based. Results indicate that both recollection and familiarity, about the learning episode, lead to above-chance level FOK accuracy (Exp. 1, 2) and FOK magnitude (Exp. 2, 3). Consistent with the noncriterial recollection hypothesis of episodic FOK, results show that the influence of recollection on FOK accuracy and magnitude is significantly greater than that of familiarity. Correlation analyses involving executive functioning (Exp. 2) and division of attention at encoding (Exp. 3) confirmed that memory noncriterial recollection is a more demanding resource process than familiarity, and interestingly, that it is FOK judgment familiarity-based that appear more resource dependent than FOK judgment recollection-based.
Email: Michel Isingrini, isingrini@univ-tours.fr

(1099)
Valence and Arousal Effects in Judgments of Learning and Recall. KATHLEEN HOURIHAN, *Memorial University of Newfoundland*, SCOTT FRAUNDORF, *University of Pittsburgh*, AARON BENJAMIN, *University of Illinois*. — Emotional words are generally recalled better than neutral words. Emotional content can be specified primarily along two dimensions: valence and arousal. Research examining memory for emotional words generally allows valence and arousal factors to co-vary in item selection, and arousal is generally emphasized as the more important factor in recall performance. The present study aimed to provide a systematic comparison of how valence and arousal contribute independently and interactively to both memory and metamemory. In Experiment 1, valence (holding arousal constant at a neutral level) influenced both recall predictions and performance. In Experiment 2, arousal (holding valence constant at a neutral level) influenced recall predictions but not performance. Experiment 3 tested participants with items from the full range of valence and arousal to explore the interactive influences of these two factors on memory and metamemory.
Email: Kathleen Hourihan, khourihan@mun.ca

(1100)
Improving Metacognitive Control by Reducing Task Demands. MEEYEON LEE and AYANNA THOMAS, *Tufts University*, JOHN BULEVICH, *Stockton College*. — Older adults are able to predict future memory performance to the same extent as younger adults, but often demonstrate deficits in control. In present study, we test the hypothesis that age-related deficits in metacognitive control emerge, because in standard experimental settings, self-initiated strategies to improve learning and retention often occur at the end of a sequence of resource-demanding cognitive tasks. As such, older adults, who may have access to fewer cognitive resources than their younger counterparts, may demonstrate deficits in strategic control. In a series of experiments, we systematically varied the cognitive demand of each phase of a metacognitive task. That is, the demands of initial learning, monitoring, and control all varied. We found that reducing demands on tasks earlier in the sequence improved strategic control in older adults.
Email: John Bulevich, bulevich@gmail.com

(1101)
Adults' Judgments of Reading Comprehension Ability. ERIKA FULTON, *Georgia Institute of Technology* (Sponsored by Christopher Hertzog). — Metacomprehension—judging comprehension of texts—is understudied despite being relevant to success in school, work, and social information exchange. I developed a new paradigm that required participants to read 6 expository passages and judge their ability to state the themes of, answer questions about, and summarize them as if doing so for a professor or an acquaintance. Confidence levels decreased from predictions to postdictions on all tasks and mirrored participants' change in beliefs about comprehension more generally, as measured by the Metacomprehension Scale (Moore et al., 1997). In some cases, participants summarizing for an acquaintance were more confident and performed better at test, but did not show superior metacomprehension. This is the first study to report differences in metacomprehension confidence due to summary audience, and to report immediate changes in confidence and beliefs about reading comprehension using a text summarization task.
Email: Erika Fulton, efulton3@gatech.edu

(1102)
Directed Forgetting and Value-Based Remembering: When Learning Goals Conflict. SARAH DELOZIER and MATTHEW RHODES, *Colorado State University*. — How is memory affected when it becomes necessary to forget important information? Prior work on such directed forgetting suggests that individuals are effective at intentionally forgetting information but has rarely considered the value of that information. Indeed, high-value information is often better-remembered than low-value information. Accordingly, we used a list-method directed forgetting paradigm to investigate directed forgetting for high-value and low-value information. Participants studied a list of unrelated words, each of which was associated with a high or low number that designated its value. Next, participants received instructions to remember or forget this list and then learned a second list of words. Results of two experiments indicated that participants given a forget instruction exhibited less forgetting of high-value relative to low-value information. Overall, these data indicate that memory performance may be affected by conflicting learning goals and suggest potential limitations to intentional forgetting.
Email: Matthew Rhodes, matthew.rhodes@colostate.edu

(1103)
Dissociative Effects of Directed Forgetting on Global Judgments of Learning. NATHANIEL FOSTER and JOHN DUNLOSKY, *Kent State University*, LILI SAHAKYAN, *University of North Carolina*. — Directed forgetting (DF) magnitude has been shown to increase when participants use

controlled, forgetting strategies (Foster & Sahakyan, 2011). Because control often depends on metacognitive monitoring, it is important to understand whether instructions to forget affect judgments of learning (JOLs). One study has demonstrated sensitivity of item-level JOLs to item-method DF (Friedman & Castel, 2011). We investigated the sensitivity of list-level, or global, JOLs to list-method DF. Participants studied two lists of words: List 1 was cued to be forgotten or remembered, but List 2 was always cued to be remembered. JOLs were collected following both cues. Across three experiments, outcomes supported the following conclusions: (a) JOLs were sensitive to DF benefits only when they were collected after List 2 study, (b) JOL sensitivity to DF costs was diminished or completely absent, but (c) JOL sensitivity to costs emerged when participants made JOLs for both remembering and forgetting scenarios.
Email: Nathaniel Foster, nfoster6@kent.edu

(1104)
The Effects of Conscious and Unconscious Reward-Processing on Self-Regulated Study. ROBERT ARIEL and CHRISTOPHER HERTZOG, *Georgia Institute Of Technology*. — Rewards presumably influence study behavior via strategic agenda-based processes but pupillometry evidence from research on subliminal reward priming indicates that rewards can automatically mobilize attention to encode information. We evaluated the influence of conscious and unconscious reward processing on self-regulated study. Participants were primed subliminally or supraliminally with monetary incentives that indicated how valuable word pairs were to learn for an upcoming test. Participants self-paced their study, made immediate judgments-of-learning (JOLs), were tested, and then reported the strategy they used to study each pair. Throughout the experiment, participants' pupil diameters were recorded. Participants' study time, JOLs, pupil diameter, and use of effective encoding strategies were all higher for pairs primed supraliminally with a high reward value than pairs primed with a low reward value, but did not differ for subliminally primed pairs. These results indicate that value must be processed explicitly to motivate use of strategic regulatory processes during study.
Email: Robert Ariel, robert.ariel@psych.gatech.edu

(1105)
The Impact of the Comparative Difficulty of Test Questions on Metacognition and Corrected Scores for Formula-Scored Exams. MICHELLE ARNOLD, KRISTIN GRAHAM and SINEAD HOLLINGWORTH-HUGHES, *Flinders University*. — On a formula-scored exam, such as the SAT Reasoning Test, students receive points and penalties for correct and incorrect answers, respectively, but they can avoid the penalty by withholding (leaving blank) answers they believe are incorrect/guesses. However, test-takers have difficulty strategically regulating their accuracy, which can impact their performance; for example, they often set an overly conservative metacognitive response bias that lowers corrected scores due to the withholding of high-quality (i.e., correct) answers (Arnold, Higham, & Martín-Luengo, 2013). The goal of the current experiments was to extend

that work by exploring whether the comparative difficulty of surrounding test questions (i.e., easy vs. hard) impacts metacognitive response bias for medium-difficulty test questions. Comparative difficulty had no influence on ability to choose correct answers for medium questions, but it did affect willingness to report answers. Importantly, this difference carried over to corrected scores, which has implications for interpreting formula-scored test performance.
Email: Michelle Arnold, michelle.arnold@Flinders.edu.au

• **HUMAN LEARNING AND INSTRUCTION I** •

(1106)
Effectiveness of Learner-Regulated Study Sequence. DAVID BRAITHWAITE, PAULO CARVALHO, JOSHUA DE LEEUW and ROBERT GOLDSTONE, *Indiana University*. — Study sequence can have a profound impact on learning. Previous research has often shown advantages for interleaved over blocked study, though the reverse has also been found. Learners typically prefer blocking even in situations for which interleaving is superior. The present study investigated learner regulation of study sequence, and its effects on learning, in an ecologically valid context: university students using an online tutorial relevant to an exam that counted toward their course grades. The majority of participants blocked study by problem category, and this tendency was positively associated with subsequent exam performance. The results suggest that preference for blocking may be adaptive under some circumstances, and highlight the importance of identifying task environments under which different study sequences are most effective.
Email: Robert Goldstone, rgoldsto@indiana.edu

(1107)
Learning Categories From Exemplars: Can a Hybrid Schedule be Superior to Pure Interleaving or Blocking—and What do Learners Think? VERONICA YAN, GAYAN SENEVIRATNA, NICHOLAS SODERSTROM, ELIZABETH BJORK and ROBERT BJORK, *University of California, Los Angeles*. — Learning categories from exemplars requires encoding both similarities within a given category—fostered by studying exemplars blocked by category—and differences between different categories—fostered by interleaving exemplars from the to-be-learned categories. We examined whether hybrid schedules that combine interleaving and blocking might foster both virtues and whether participants might prefer such schedules. In Experiment 1, participants studied 6 or 12 paintings by each of 12 artists via a purely blocked or interleaved schedule or via one of three hybrid schedules (blocked-to-interleaved, interleaved-to-blocked, or miniblocks). Blocking was the least effective for learning and no hybrid schedules exceeded pure interleaving; miniblocks and blocked-to-interleaved schedules, however, yielded performance not significantly different from that obtained with pure interleaving. Experiments 2 and 3 explored whether participants would use these effective hybrid schedules

when planning their own study and what factors (number of exemplars/category, prior experience) might reduce the tendency to use purely blocked schedules.
Email: Veronica Yan, veronicayan@ucla.edu

(1108)
Are the Benefits of Interleaving the Exemplars of To-Be-Learned Categories Modulated by the Relatedness of the Juxtaposed Exemplars? MICHAEL A. GARCIA, ELIZABETH BJORK and ROBERT BJORK, *University of California, Los Angeles*. — The optimization of category induction—discovering what ties together exemplars of a category—is of both theoretical and pedagogical importance. Recent work has shown that category induction is facilitated by interleaving the exemplars of to-be-learned categories (Kornell & Bjork, 2008), but the processes underlying this benefit remain in dispute (e.g., Wahlheim, Dunlosky, & Jacoby, 2011; Birnbaum, Kornell, Bjork, & Bjork, 2013). The benefits of interleaved practice appear due, at least in part, to the opportunities interleaving provides for discriminative contrast between exemplars of different categories (Kang & Pashler, 2012). What remains unclear is whether the nature of such across-category comparisons affects the interleaving benefit. Our research focuses on whether the interleaving benefit persists when participants are studying exemplars from unrelated domains (e.g., comparing painters to species of animals).
Email: Robert Bjork, rabjork@psych.ucla.edu

(1109)
Abstracting a Schema From Comparing and Retrieving a Series of Cases. MICAH GOLDWATER, *Northwestern University*, KENNETH KURTZ, *SUNY Binghamton*, JEFFREY LOEWENSTEIN, *University of Illinois at Urbana-Champaign*, CHARLES LUDOWICI, *University of Sydney*. — This research examines how schemas are abstracted from series of example cases. Previous research indicates that schema quality is improved and transfer more likely when novice learners are encouraged to compare cases relative to considering cases separately. Other research has shown practicing the retrieval of learning materials (compared to studying them) is beneficial for long term retention. Often to show the power of these manipulations few learning examples are used, but to obtain expert-level knowledge learners engage with many more than just one or two cases. Here, we examine how these successful learning strategies 1. change the representation of both the cases themselves and the schema that is abstracted from them as learners progress through the series, and 2. how this progression supports spontaneous analogical transfer to novel cases over a lengthy delay. In addition, we examine a "transfer-test effect" wherein an immediate test of transfer fosters further transfer across a delay.
Email: Micah Goldwater, micahbg@gmail.com

(1110)
The Effects of Relational Reasoning on Category Learning. CLINT A. JENSEN, *University of Wisconsin, Madison*, EVANGELIA G. CHRYSIKOU, *University of Kansas*. — Research on relational reasoning suggests that analogical

associations can extend previously learned categories of information to new and, at times, initially abstract ideas. This study examined whether prior exposure to a relational reasoning task can influence participants' performance on either classification (i.e., assignment of a label based on known features) or inference (i.e., prediction of a feature based on known label and additional features) learning. Additionally, we explored the impact of presenting semantically-related distractors during relational reasoning, to examine whether potentially more difficult analogical associations may encourage or impede category learning. In line with past research, analyses of reaction time and accuracy measures revealed, overall, superior performance for the inference relative to the classification task. Exposure to relational reasoning enhanced classification learning, but only in the presence of semantically related distractors. We discuss these results in the context of different, and possibly competing, learning systems supporting inference and classification tasks.
Email: Clint A. Jensen, jensen.clint@gmail.com

(1111)
Does Observing the Instructor Draw Diagrams Improve Learning From Multimedia Messages? LOGAN FIORELLA and RICHARD MAYER, *University of California, Santa Barbara*. — In two experiments, participants viewed a short video-based lesson about how the Doppler effect works. Some students viewed already-drawn diagrams while listening to a concurrent oral explanation (control group), whereas other students listened to the same explanation while viewing the instructor actually draw the diagrams (draw group). Results of Experiment 1—in which the instructor's body was visible throughout the lesson—indicated that watching the instructor draw diagrams led to significantly better transfer test performance than the control group for learners with low prior knowledge (d = .63). In Experiment 2—in which only the instructor's hand was visible throughout the lesson—the draw group significantly outperformed the control group on the transfer test, regardless of prior knowledge (d = .52). Overall, these results are consistent with the proposal that observing an instructor draw diagrams may prime deeper cognitive processing in the learner, thereby improving transfer performance.
Email: Logan Fiorella, fiorella@psych.ucsb.edu

(1112)
Testing Early and Often: The Presence or Absence of the First Test in an Interpolated Sequence Determines the Effectiveness of Subsequent Learning. KARL SZPUNAR, HELEN JING and DANIEL SCHACTER, *Harvard University*. — We have previously demonstrated that interpolating a video-recorded lecture with memory tests helped students to avoid mind wandering and improve learning. In the present study, we set out to evaluate the role of the first test in an interpolated sequence. Three groups of students learned from a 20-minute Statistics lecture that was parceled into four 5-minute segments. One group of students was tested after all four segments (4-test group), one group was only tested after segments two through four (3-test group), and one group

was only tested after the fourth segment (1-test group). As with our prior findings, students in the 4-test group showed reduced mind wandering and improved learning as compared to students in the 1-test group. Notably, students in the 3-test group demonstrated similar levels of mind wandering and learning to the 1-test group. Testing early in the study sequence had important consequences for later learning.
Email: Karl Szpunar, szpunar@wjh.harvard.edu

(1113)

Improving Academic Learning From Computer-Based Narrative Games. CELESTE PILEGARD and RICHARD MAYER, *University of California, Santa Barbara*. — Previous research has shown that students who learn from a slideshow outperform students who learn the same material from a game (Adams et al., 2012). Students may miss a game's instructional objective in favor of its narrative objective. The current experiment involved an intervention to help students focus on the instructional objective of games. College students played a narrative first-person computer game about finding lost artwork. The instructional goal concerned how wet cell batteries work, which was needed to open a door. The worksheet group was asked to write an explanation of how wet cell batteries work before playing the game and also completed a simple worksheet about what they learned about wet cell batteries while playing the game. The control group played the game only. The worksheet group outperformed the control on the post-game explanation (d = 0.92), comprehension (d = 0.67), and transfer tests (d = 0.74).
Email: Richard Mayer, mayer@psych.ucsb.edu

(1114)

Just Enough Just-in-Time Hints to Optimize Recall. MATTHEW HAYS, *HaysLab*, MICHAEL GARCIA, *University of California, Los Angeles*, JASON FINLEY, *Washington University in St. Louis*, ROBERT BJORK, *University of California, Los Angeles*. — Just about anyone can learn by trying to answer a question on a flash card and then flipping it over—even if they cannot produce the correct response (Hays, Kornell, & Bjork, 2013). Of course, successfully retrieving information further improves recall (e.g., Roediger & Karpicke, 2006), and more difficult retrievals are even more powerful (e.g., Modigliani, 1976). The goal of computerized flash cards, then, should be to provide the least amount of assistance necessary for successful retrieval. We constructed such a program, which adds assistance during flash-card practice only when the learner needs it ("just in time") and only until the learner is successful ("just enough"). We compared the effect of these dynamic hints to static flash cards and other adaptive assistance algorithms (e.g., Hays, Finley, Bjork, Benjamin, & Walker, 2013).
Email: Matthew Hays, matt@hayslab.com

(1115)

Spacing and Modality Effect in Foreign Language Learning. WILLIAM HUFFMAN and SOWON HAHN, *University of Oklahoma*. — In two experiments, we investigated the effectiveness of repeated retrieval practice, keyword method, and rote learning of German vocabulary by native English speakers. We further explored the impact of learning methods in combination with the varied spacing and stimulus presentation modality. In both Experiments 1 and 2, the repeated retrieval practice condition showed the best recall accuracies, supporting the testing effect. Results from Experiment 1 also showed a significant interaction between the method of learning and spacing such that spacing effect increased effectiveness of keyword and rote learning methods. In Experiment 2, stimuli were presented either visually or with an additional auditory component. Compared to the visual-only presentation condition, the added auditory presentation only benefited the keyword method. The present study discusses the role of learning methods, stimulus presentation spacing, and stimulus presentation modality in foreign language learning.
Email: William Huffman, whuffman.ou@gmail.com

(1116)

The Impact of Longhand and Laptop Note-Taking on Classroom Performance. MICHAEL FRIEDMAN, SAMUEL MOULTON and HUNTER GEHLBACH, *Harvard University*. — As laptop use in college classrooms becomes more common, researchers have begun to investigate the potential costs and benefits of laptop use on student learning. While laptop use may reduce the cognitive resources required for creating notes relative to longhand note-taking (Bui et al., 2013), students are more likely to shallowly transcribe content and multi-task during class when using a laptop to take notes (Mueller & Oppenheimer, 2014). The current study explored student laptop and longhand practices in note-taking, and their impact on course performance. Following each of two exams for a general education course, students reported what method of note-taking they used for the course (longhand, laptop, etc.), and also made metacognitive predictions about their exam performance. The results show an advantage for longhand note-taking over laptop note-taking on exam performance, final course grades, calibration accuracy, and reported difficulty of the exams. Implications for future research and recommendations for student learning are discussed.
Email: Michael Friedman, michael_friedman@harvard.edu

(1117)

The Improve-to-Stay (ITS) Schedule for Learning: A Subject-Adaptive Regimen for Scheduling Practice. JOSH FIECHTER and AARON BENJAMIN, *University of Illinois*. — The gold standard practice schedule for learning multiple related skills is random practice, which involves random interleaving of the to-be-acquired skills. However, there are reasons to believe that such a schedule may sometimes be too challenging at the beginning of learning, particularly for unskilled performers. The Improve-to-Stay (ITS) practice schedule, introduced here, is a subject-adaptive schedule that switches between tasks only when the subject fails to improve on past performance. The probability of switching between tasks thus follows a learning curve, resulting in increasingly randomized practice with experience. In a series of experiments, subjects learned to type three keyboard patterns, each with a unique goal typing time. Subjects practiced on either a random practice schedule, a blocked practice schedule,

or an ITS schedule. The ITS schedule promoted retention as effectively as or even better than random practice, providing evidence for a highly effective schedule that is applicable to a wide range of learner skillsets.
Email: Aaron Benjamin, asbenjam@illinois.edu

(1118)
"Match" or "No Match"? Learning to Identify Unfamiliar People. RACHEL SEARSTON and JASON TANGEN, *University of Queensland*. — Learning and instruction research has typically relied on stimuli geared towards education in schools or material intended to be memorized (e.g., word pair associations). Outside of medical education, few studies have been based on the skill acquisition of visual stimuli, or have explored how people learn categorization and identification tasks in applied fields of expertise. Here, we report the results from several experiments—using fingerprint identification as a testbed—designed to assess and improve comparative visual expertise. We show, for example, that feedback, simultaneously juxtaposing matching and non-matching fingerprint pairs, and category labels (e.g., "match", "no match") are powerful ways to boost learning among absolute novices, particularly for highly similar, non-matching fingerprint pairs. This research takes a first step towards understanding how best to acquire expertise in identifying unfamiliar people.
Email: Rachel Searston, rachel.searston@gmail.com

(1119)
Deep Structure Similarities of Guided Cognition Homework for Literature and Mathematics. WILLIAM WHITTEN II, MITCHELL RABINOWITZ and SANDRA E. WHITTEN, *Fordham University*. — Guided Cognition improves learning from homework by structuring study tasks to engage students in specific, observable cognitive events that elicit underlying learning-effective cognitive processes. We identified cognitive events that occur in classrooms and have correlates in the experimental literature, then designed some into homework. Guided Cognition homework has been found to improve seventh-grade students' abilities to comprehend and recall literature and also to improve seventh-grade students' abilities to interpret and work mathematics story problems. On the surface, students are performing much different tasks when studying literature and mathematics, yet the Guided Cognition style homework facilitates learning in these very different content domains. We will show literature-specific and mathematics-specific homework design frames for cognitive events and will show, through logical analysis, that the deep structures (cognitive processes) can be similar even though the surface structures (cognitive events) appear very different across these content domains.
Email: William B. Whitten, II, whitten@fordham.edu

• COGNITIVE CONTROL I •

(1120)
Viewers Like Predictive Cues. KEI KURATOMI and KAZUHITO YOSHIZAKI, *Aichi Shukutoku University*. — The purpose of this study investigated whether preference for cue followed by target stimulus is modulated by predictability of the cue. We used a Posner-type pre-cueing paradigm in which participants were required to identify the location of target presented at left or right visual-field. We prepared two types of cue. More specifically, a target appears on the location of cue's direction with high probability (75% cue) or with low probability (25% cue). Immediately after each experimental block, viewers were asked to rate the goodness of the cues. We used gaze cues in Experiment 1 and arrows cues in Experiment 2. The results, which were common to two experiments, showed that response times were not modulated by the cue type, whereas preference for the 75% cue was higher than that for the 25% cue. These results suggested that preference for the cue was modulated by predictability of the cue.
Email: Kei Kuratomi, skurattis@gmail.com

(1121)
Effect of Task-Type on Switching in Multisensory Environments. CHRISTINA WASYLYSHYN, *Naval Research Laboratory*. — The majority of task-switching research has focused on shifting attention between multiple tasks in the same modality (i.e., visual). However, recent neuropsychological research suggests that switching between tasks in the same perceptual modality may produce larger performance costs than switching between tasks in different modalities. Moreover, different brain areas are thought to be associated with processing different types of tasks. "Where" pathways are associated with tasks involving spatial cognition or location, and "what" pathways with tasks involving classification or identity. This study examines the interactions of "what" and "where" tasks in audio-visual task-switching and compares two conditions: switching between 1) two "what" tasks and 2) a "where" and a "what" task. Results indicate participants benefited on trials when the task switched if the sensory modality of the task also switched in the "where/ what" condition (cost = 3.15 ms), but not in the two "what" tasks condition (cost = 60.39 ms).
Email: Christina Wasylyshyn, christina.wasylyshyn@nrl.navy.mil

(1122)
The Inhibitory-Spillover-Effect: Controlling the Bladder Makes Better Liars. IRIS BLANDON-GITLIN, *California State University, Fullerton*, ELISE FENN and KATHY PEZDEK, *Claremont Graduate University*. — The Inhibitory-Spillover-Effect occurs when performance in one self-control task facilitates performance in another self-control task. In two experiments we investigated this effect on a deception task. Deceiving others often requires increased access to inhibitory control processes. We hypothesized that inducing liars to control urination urgency (physical inhibition) would facilitate control during deceptive interviews (cognitive inhibition). Participants drank small (low-control) or large

(high-control) amounts of water. Next, they lied or told the truth to an interviewer. Third-party observers assessed the presence of verbal and non-verbal cues and made true/lie judgments. In the high-control, but not the low-control condition, liars displayed significantly fewer behavioral cues to deception, more behavioral cues signaling truth, and provided longer and more complex accounts than truth tellers. Accuracy detecting liars in the high-control condition was significantly impaired, with observers revealing a bias toward perceiving liars as truth-tellers. Complex deceptive behaviors were facilitated by the Inhibitory-Spillover-Effect.
Email: Iris Blandon-Gitlin, iblandon-gitlin@fullerton.edu

(1123)
Top-Down and Bottom-Up Control of Oculomotor Responses in Dual Tasks. ALEKSANDRA PIECZYKOLAN, *Universität Würzburg*, LYNN HUESTEGGE, *RWTH Aachen University*. — For a long time, empirical research suggested that oculomotor control is largely unaffected by additional response demands in other effector modalities. However, recent research suggested that although saccade control appears to be prioritized among other simultaneously executed response modalities, oculomotor performance decrements can still remain substantial. In the present study, we examined the timeline of oculomotor performance decrements in dual tasks by manipulating the inter-stimulus interval between an oculomotor and a manual reaction task (psychological refractory period (PRP) paradigm). While Experiment 1 involved a variable stimulus order, in Experiment 2 the stimulus for the manual response always preceded the stimulus for the saccade. Results indicated that saccade performance strongly suffers from the additional execution of a manual response in close temporal proximity (PRP effect). An analysis of response order revealed that variable stimulus order in Experiment 1 triggered a strategic prioritization of saccades over manual responses when compared to the fixed stimulus order in Experiment 2. The results suggest an interaction of bottom-up and top-down control of oculomotor responses in dual-task situations.
Email: Aleksandra Pieczykolan, aleksandra.pieczykolan@uni-wuerzburg.de

(1124)
Time of Day Optimum Affects the Reliability of Cognitive Control. FRANZISKA PLESSOW, *Harvard Medical School*, ELISABETH COHORS-FRESENBORG and CLEMENS KIRSCHBAUM, *Dresden University of Technology*, JIN FAN, *Queens College, City University of New York*, RICO FISCHER, *Dresden University of Technology*. — Cognitive control enables adaptive, goal-directed information processing and behavior in situations of uncertainty. We would therefore expect that cognitive control is fully available at all times, yet this has not been defined. To address this, sixty-eight participants with either a morning or an evening chronotype performed a task with a parametrical manipulation of cognitive control demands (Majority Function Task) in both their individual daytime optimum and disoptimum on two consecutive days. Performance was worse in daytime disoptima compared to daytime optima. Furthermore, the impact of individual

daytime disoptima on task performance increased with higher cognitive control demands. These findings highlight that cognitive control fluctuates with individual circadian rhythms.
Email: Franziska Plessow, fplessow@bidmc.harvard.edu

(1125)
Perceptual Load Is Not a Structural Limit in Attentive Processing: The Case of Performance Under Pressure. ALEJANDRO LLERAS, *University of Illinois*, HENGQING CHU, *Yahoo!*, SIMONA BUETTI, *University of Illinois*. — The Load Theory of Attention proposes that "perceptual load" is a critical factor in determining attentional processing of foil stimuli: when perceptual load in the display is low, there is sufficient attentional resources to process both the target and the foil stimuli; whereas when perceptual load in the display is high, there are no left-over attentional resources to process the foils. As a result, under low load, there are large foil-target congruency effects, whereas under high load, there are none. Here we provide evidence that this apparently structural limit on attention is not so. When participants are asked to perform a typical perceptual load task under performance pressure (when response speed is stressed and there are monetary costs associated with failure), the effect of perceptual load on performance disappears: identical congruency effects are found under high and low load displays, comparable to low-load effects obtained under no pressure. In contrast, performance pressure does not seem to affect attentional capture. The results are interpreted within a new framework of attention and foil-related interference, and the effect of pressure on the executive system.
Email: Alejandro Lleras, alejandrolleras@gmail.com

(1126)
Contingency Learning in Stroop Is Task Conflict Independent. YULIA LEVIN and JOSEPH TZELGOV, *Ben Gurion University of Negev*. — The item-specific proportion congruent effect (ISPC) demonstrates that the higher the probability of a specific word to appear in an incongruent color, the smaller its Stroop interference (Jacoby et al., 2003; Jacoby et al., 1999). The ISPC has been interpreted as evidence that reading of specific items can be controlled (Blais et al., 2007; Bugg et al., 2011; Bugg et al., 2008). Alternatively, the contingency learning account (Schmidt & Besner, 2008; Schmidt et al., 2007) claims that the ISPC does not represent control, but rather associative, not driven by conflict, learning of word-response contingencies. It has been shown that contingency learning is independent of informational conflict. However, task conflict also contributes to Stroop interference. We provide evidence for the independence of contingency learning from task conflict. Such evidence is necessary to claim that contingency learning is not triggered by conflict (and therefore, is not part of the control system).
Email: Yulia Levin, levinyulia@gmail.com

(1127)
List-Level Control and Item-Level Control in the Stroop Task. GAL DADON and AVISHAI HENIK, *Ben Gurion University of the Negev*. — The Stroop task (i.e., naming ink

color of printed words) is one of the most researched tasks in psychology. The resulting congruency effect can be affected by list-level (general strategy) and item-level (trial-by-trial strategy) control. Recent studies suggested item-level control might be the sole player in the Stroop task. We aimed to examine this suggestion. We divided 4 colors into 2 color sets and manipulated the proportion of neutral trials in one of the sets. We combined the manipulated set with the other color set that had an equal proportion of congruent, neutral and incongruent trials, thereby creating a mostly neutral block and a minimally neutral block. Combining color sets and manipulating the number of neutral trials in the same design allowed us to examine the 2 control mechanisms. Results suggest both list-level and item-level control mechanisms can be manifested in the Stroop task and can interact, depending on context. Additional analyses suggest the list-level effect might develop with time during task performance.
Email: Avishai Henik, henik@bgu.ac.il

(1128)
Computational Model of Inhibitory Cognitive Control in Cross-Task Context. SANG-HO LEE and YANG SEOK CHO, *Korea University*. — Recent models of cognitive control have been developed to account for congruency modulation effects, such as the Gratton effect and item-specific proportion congruent (ISPC) effect. However, these models fail to simulate shared cognitive control processes between different congruencies that have been reported by extensive studies. We propose an alternative model that assumes shared cognitive control across different congruencies as a function of dimensional overlap. Applied to several combinations of congruencies with different degrees of dimensional overlap, the simulation results were consistent with the previous findings in cross-task experiments showing sequential modulation between two different congruencies with overlapping dimensions. In addition, we systematically manipulated the relative dominance between facilitation and inhibition which have not been specifically defined in previous models. The results showed that various congruency modulation effects are more precisely explained by the inhibition of task irrelevant dimension.
Email: Sang-Ho Lee, leearctu@gmail.com

(1129)
Isolating the Role of Expectations in Modulations of Stroop Interference. EMILY COHEN-SHIKORA, DIANA SELMECZY and JULIE BUGG, *Washington University in St. Louis* (Sponsored by Janet Duchek). — Cognitive control involves suppressing irrelevant information in order to focus on relevant information. Theoretically, modulations of Stroop interference may reflect experience-driven adjustments in cognitive control and/or expectation-driven adjustments. In the current study we investigated the unique role of expectations while holding experience constant during a color-naming Stroop task. Participants were given short lists that included 50% congruent (e.g., RED in red ink) and 50% incongruent (e.g., RED in blue ink) stimuli. These lists were preceded by precues that indicated the congruency of the

upcoming list, thereby establishing an explicit expectation. Critically, the majority of precues were misleading and instructed participants that lists would be 80% congruent or 80% incongruent. Results revealed a significant effect of precued expectations despite identical list experience, a pattern that we replicated in a second experiment. The findings implicate a unique role for expectations in modulating Stroop interference.
Email: Emily Cohen-Shikora, emily.cohenshikora@gmail.com

(1130)
The ISPC Effect Interacts With the SOA Between Relevant and Irrelevant Stroop Dimensions. NART BEDIN ATALAY, *TOBB University of Economy and Technology*, MINE MISIRLISOY, *Middle East Technical University*. — The item-specific proportion congruency (ISPC) effect is demonstrated by a smaller Stroop interference for mostly-incongruent items compared to mostly-congruent items. There is a debate regarding the contribution of item-specific control vs. stimulus-response learning to the ISPC effect. Bugg and Hutchison (2013) argued while stimulus-response contingency learning contributed to the ISPC effect in a 2-set design, the absence of high-contingency responses in a 4-set design promoted the use of item-specific control. Provided different processes are responsible for the ISPC effects observed in 2- vs. 4-set designs, a stimulus onset asynchrony (SOA) manipulation between the relevant and irrelevant Stroop dimensions is expected to yield different patterns of results for the observed ISPC effects. SOA was manipulated in two experiments using 2- vs. 4-item sets. The ISPC effect changed with set size. However, the SOA manipulation did not yield different patterns of results for the observed ISPC effects for 2- and 4-item sets.
Email: Mine Misirlisoy, mmine@metu.edu.tr

(1131)
Sequential Congruency Effect Investigated With Visual White Noise. ASLI BAHAR INAN, *Atilim University*, NART BEDIN ATALAY, *TOBB University of Economy and Technology*. — Sequential congruency effect (SCE) is the reduction in size of the congruency effect following incongruent compared to congruent trials. Removing feature repetition in successive trials does not eliminate SCE (Kerns et al., 2004). However, SCE has not been observed when the contextual features, which have no obvious relation with congruency effect itself, alternates in successive trials (Spapé & Hommel , 2008). In our study, we investigated whether context alternation would eliminate SCE when feature repetition in consecutive trials was removed. We examined SCE with 8-item vocal Flanker (Experiment 1) and Stroop (Experiment 2) tasks. Stimuli were presented either with or without visual white noise, randomly alternating between trials. After analyzing trials without feature repetition, we observed the effect of context repetition, the SCE effect, but no interaction between them. Our results showed that context alternation did not change SCE when feature repetition is removed.
Email: Nart Bedin Atalay, nartbedin@gmail.com

(1132)

Dramatic Reductions in Dual-Task Costs When Tasks Can Be Kept Separate. KIMBERLY HALVORSON, *Metropolitan State University*, ELIOT HAZELTINE, *University of Iowa*. — In some cases, dual-task costs are greatly reduced or even eliminated when both tasks use highly-compatible S-R pairs and the appropriate task structure (e.g., Greenwald, 2003; Halvorson et al., 2013). According to Greenwald (2003), these tasks avoid costs because the stimuli automatically activate the correct response without engaging the performance-limiting bottleneck stage. In two experiments we used four colored circles as stimuli for a visual-manual task, two of which were designated target colors. The only difference between the two experiments was the mappings. In the spatial condition, participants indicated on which side (left or right) one of the target colors appeared. In the identification condition, targets were mapped to distinct response keys and participants indicated which color was present. When paired with an AV shadowing task, dual-task costs were only observed in the identification condition. In this case, selecting the correct response required activation of a verbal label in both the VM and AV tasks. This suggests that costs are not reduced by automatic activation of responses, but by keeping the tasks separate; dual-task costs can be avoided when the tasks engage distinct modality-based systems.
Email: Kimberly Halvorson, kimberly.halvorson@metrostate.edu

(1133)

Can People Strategically Mind-Wander? PAUL SELI, JEFFREY WAMMES and DANIEL SMILEK, *University of Waterloo* (Sponsored by Derek Besner). — We tested the possibility that, while completing tasks with varying demands, people might mind-wander at strategic moments. Specifically, we tested whether people (1) mind-wander more during low-demand periods when doing so would not incur performance costs, and (2) mind wander less during high-demand periods when mind-wandering might lead to performance costs. To test this possibility, we developed a modified version of the Sustained-Attention to Response Task in which infrequent high-demand target trials were presented in a predictable manner, separated by long periods of frequent low-demand non-target trials. During the task, participants were intermittently presented experience-sampling probes to determine whether they were mind-wandering or focused on the task. During stretches of low-demanding trials, mind-wandering rates were relatively high (60%). However, just prior to the presentation of the predictable targets, participants' mind-wandering rates decreased substantially (to 20%), suggesting that people adjust their mind-wandering rates in a strategic manner.
Email: Paul Seli, paulseli@gmail.com

(1134)

Individual Differences in Cognitive Effort Discounting and Demand Avoidance. ANDREW WESTBROOK and TODD BRAVER, *Washington University in St. Louis* (Sponsored by Deanna Barch). — Individual variation in the subjective value of cognitive effort may constitute a pervasive, underappreciated confound in studies that putatively assess cognitive capacity. Yet, objective measures of subjective cognitive effort are lacking. Recently, we have shown that a behavioral economic framework, operationalizing effort as the discounting of monetary rewards for cognitively demanding tasks, is a reliable individual difference predictor. Specifically, effort discounting predicts variance in: a) a personality trait measure of cognitive motivation (Need for Cognition), b) working-memory performance under high-load conditions, beyond baseline capacity, and c) task-switching performance costs. A similar performance-based approach has examined cognitive demand avoidance in terms of subtle biases during a free-choice paradigm. In direct comparison, we find a surprising lack of correlation between demand avoidance and effort discounting. A follow-up study suggested that such a correlation might be limited by failure of some individuals to discern subtle differences in effort demands within the free-choice paradigm.
Email: Andrew Westbrook, jawestbrook@wustl.edu

• ATTENTION I •

(1135)

The Influence of Task Set and Endogenous Cueing on the Time Course of Exogenous Orienting. GERALD MCDONNELL and MICHAEL DODD, *University of Nebraska-Lincoln* (Sponsored by John Flowers). — Previous research has established that exogenous cues result in early facilitation and later inhibition at cued locations. The present experiments examined the characteristics of these attentional effects when the cue is relevant to a secondary memory task. In Experiment 1, participants completed a standard Posner cueing task while holding in memory a colored placeholder that either matched or did not match the subsequent color of the exogenous cue. Surprisingly, facilitation was only observed at late SOAs (800ms) and was preceded by IOR at intermediate SOAs (500ms; these effects replicated when decreasing the difficulty of the memory test and utilizing different SOAs). In Experiment 2, when participants maintained in memory an irrelevant arrow cue while responding to a target preceded by an exogenous cue, standard exogenous IOR and facilitation effects were observed independent of arrow validity. The present experiments provide important insight into the interaction between working memory and attentional orienting.
Email: Gerald McDonnell, gmcdonnell@huskers.unl.edu

(1136)

Timecourse and Representational Basis of Contingent Response Inhibition. LEELAND ROGERS and REBECCA GARRISON, *Villanova University*, BRIAN ANDERSON, *Johns Hopkins University*, CHARLES FOLK, *Villanova University*. — Using a go-no go version of the flankers task, Anderson and Folk (2013) recently showed that whereas flankers presented in a "go" color produce typical response compatibility effects, "no go" colored flankers produce reverse compatibility effects,

a pattern suggesting that automatic response inhibition is contingent on top-down set. Here we explore both the timecourse and representational basis of the effect. The first experiment replicated Anderson and Folk but systematically varied the SOA between flanker presentation and target. Reverse compatibility effects declined systematically with decreasing SOA, suggesting that contingent response inhibition accrues more slowly than the process of responding to targets, requiring at least 200 ms to influence subsequent information processing. In a second experiment the flankers themselves were uncolored, but appeared inside "go" or "no go" colored boxes. Reverse compatibility effects were effectively eliminated under these conditions, suggesting that contingent response inhibition is based on object level representations.
Email: Leeland Rogers, leeland.rogers@gmail.com

(1137)
Unintentional Cueing and Relatedness Effects When Color Defines the Target Word. VERONICA DARK, *Iowa State University*. — Subjects reported the blue word target in a pair of briefly presented, masked words. One word was associatively (semantically) related to a preceding context word and one word was cued by a pair of arrows 150 msec prior to pair onset. Neither relatedness nor cueing predicted the target and subjects were instructed to ignore both. A confidence judgment was provided after each target report. More related than unrelated targets were reported. More cued than uncued targets were reported. Compared to baseline report of blue targets in the absence of cues and related contexts, there was benefit when the target was both cued and related and cost when the target was uncued and unrelated. The costs and benefits were offset when the target was unrelated but cued or related but uncued, suggesting that selective attention has both spatial and semantic components. Subjects were more confident in their responses to related targets.
Email: Veronica Dark, vjdark@iastate.edu

(1138)
No Evidence for Object-Based Oculomotor Inhibition of Return: Abrams and Dobkins (1994) Revisited. RALPH S. REDDEN, MATTHEW D. HILCHEY and RAYMOND KLEIN, *Dalhousie University*. — Intermixing central, directional arrow targets with the peripheral targets typically used in the Posnerian spatial cueing paradigm offers a useful diagnostic for ascertaining the relative contributions of output and input processes to oculomotor inhibition of return (IOR). Here, we use this diagnostic to determine whether object-based oculomotor IOR comprises output or input processes. Peripheral cuing was combined with motion of the cued and uncued objects and at the end of a trial a saccade was executed in response to a peripheral or central arrow target. Whereas there was evidence for oculomotor IOR at the cued location, there was no trace of IOR at the cued object. We thereafter precisely replicated the seminal experiment for object-based oculomotor IOR (Abrams & Dobkins, 1994; Experiment 4); there was no evidence of an effect. The findings, when considered alongside the literature on object-based IOR in

tasks requiring manual responses, suggest that input-based "IOR" remaps dynamically into object-based coordinates whereas output-based IOR does not.
Email: Raymond Klein, ray.klein@dal.ca

(1139)
Deviance Distraction Is Contingent on Stimuli Being Presented Within the Same Modality. ERIK MARSJA and GREGORY NEELY, *Umeå University*, FABRICE PARMENTIER, *University of Balearic Islands*, JESSICA KORNING LJUNGBERG, *Umeå University*. — Sudden and unexpected changes in the auditory and visual channel are known to capture attention. This attention capture has been shown to negatively impact performance in an ongoing task (i.e., deviance distraction). In three experiments we examined if deviant stimuli presented in a different modality than a standard stimuli caused distraction in a visual categorization task, using a multi-sensory oddball task. In two experiments a deviant sound was presented (20 % of trials) against 80 % vibrotactile standard trials. In one the standard was omitted on deviating sound trials, while in the other the standard and deviants were presented simultaneously. In the third experiment the standard vibration was omitted in 20 % of the trials without any presentation of a deviant sound. Results showed distraction by deviating sounds (p < .05), but not when standard vibrations were presented simultaneously (p > .05). Interestingly, the omission of a standard vibration showed distraction (p < .05). In conclusion, deviance distraction might be bound to within rather than between modalities.
Email: Erik Marsja, erik.marsja@psy.umu.se

(1140)
Are You Engaged? The Effects of Interesting and Boring Auditory Material on Physiological and Subjective Responses. WILLIAM HORREY and MARY LESCH, *Liberty Mutual Research Institute for Safety*, ANGELA GARABET and RAMMOHAN MAIKALA, *Liberty Mutual*. — Does interesting material elicit a different physiological response than boring material? A study was carried out to explore the concept of "engagement" and its impact on pupillometry, cerebral oxygenation (CO), heart rate (HR), and subjective ratings. 44 participants listened to short audio clips gathered from online news sources, classified as either boring or interesting and objectively matched by reading difficulty. Participants listened whilst continuously rating the items according to their level of interest using a dial controller. Measures of pupil diameter, CO (using near-infrared spectroscopy, NIRS) and HR were recorded for subsets of participants (N = 12 for each). Subjective ratings clearly distinguished between boring and interesting stimuli and, in some cases, interacted with level of difficulty. Measures of CO varied by engagement and HR varied by difficulty. Analysis of pupil diameter is ongoing. A driving simulator study using the same audio files and physiological measures is also underway.
Email: William Horrey, william.horrey@libertymutual.com

(1141)
Temporal Expectation Modulates the Flexibility of Object-Based Attentional Selection. ANTHONY W. SALI, SUSAN M. COURTNEY and STEVEN YANTIS, *Johns Hopkins University*. — The statistical regularities of an environment influence the preparation of spatial attentional control (Sali et al., Psychonomics 2013). However, in previous demonstrations, learning may have influenced both motor planning of a saccadic eye movement as well as motor-independent control processes. We therefore tested whether statistical structure also modulates object-based attentional selection of spatially superimposed stimuli. Visual cues following a variable delay signaled participants to select the same object type (either a face or house) as they had on the previous trial or to switch to the opposite object type. Participants indicated either the gender or number of stories of the attended object. The relative cost in response time to switch between object types was smaller at a delay that was associated with mostly switch cues in the past than at a delay associated with mostly hold cues. Our results suggest that statistical regularities also influence preparatory control of object-based selection.
Email: Anthony W. Sali, asali1@jhu.edu

(1142)
The Timecourse of Attention to Statistical Regularities in New Visual Environments. MARIA GIAMMARCO, BRENDON SAMUELS, MARK J. FENSKE and NASEEM AL-AIDROOS, *University of Guelph*. — Although natural visual environments are complex, we can understand them with ease. This efficiency is partly supported by learning and exploiting the statistical regularities within our environment. For example, learning that yellow traffic lights precede red ones helps you to stop your car in time and avoid accidents. Learning such regularities typically occurs unconsciously, yet does require attention. In the present study we investigated the timecourse of attention to regularities when subjects are exposed to new environments; both during and following learning. Participants viewed displays containing statistically-ordered stimuli in one location, and randomly-ordered stimuli in another, while we continuously measured attention using an eye-tracker. Biases towards regularity emerged quickly and dissipated over time, suggesting they are sensitive to the stage of learning. As well, after introducing new stimuli, biases to the previously structured location re-emerged almost instantly. These results demonstrate a sophisticated interplay between attention and learning in new environments.
Email: Maria Giammarco, agiammar@uoguelph.ca

(1143)
Memory-Driven Attentional Capture Reveals Waxing and Waning in Working Memory Activation. EDYTA SASIN, ADDIE JOHNSON and MARK NIEUWENSTEIN, *University of Groningen*. — Previous research has shown that actively holding information in working memory (WM) results in attentional capture by matching stimuli. Recently, we found that capture can also be driven by residual WM activation resulting from previous processing (Sasin, Nieuwenstein & Johnson, submitted). Here, we compared the capture effects produced by residual and active WM maintenance,

and we examined how these capture effects are influenced by an intermediate secondary task. Participants performed a memory or animacy judgment task for a word that was followed in half the trials by an intermediate secondary task, which was in turn followed by an RSVP target identification task in which a picture of the word could be shown just prior to the target. While the animacy task produced a capture effect only in the absence of the intermediate task, the memory task led to a capture effect regardless of the presence of the secondary task.
Email: Edyta Sasin, edytasasin@gmail.com

(1144)
Set-Specific Capture Effects Are Reduced by Associative Memory, but Flexible Task-Switching Is Not Improved. KATHERINE MOORE, *Elmhurst College*, ELIZABETH WIEMERS, *Purdue University*. — Contingent attentional capture costs are doubled or tripled under certain conditions when participants maintain more than one search goal at a time (e.g., search for green letters and orange letters.) Such set-specific capture occurs when participants must switch between multiple concurrent goals, because on a single trial the distractor (e.g., a green digit) is related to one search goal, and the target (e.g., an orange letter) matches another. We examined whether such set-specific capture effects could be attenuated through training. In Experiment 1, trained participants experienced mostly trials involving a goal switch while participants in a control group experienced few of these trials. Upon test, trained participants produced greatly reduced set-specific capture effects compared to controls and pre-test levels. However, in two additional experiments, the training effects did not transfer to a new color context or even a new target color, indicating that they were very specific, involving low-level associative memory. We concluded that set-specific capture is pervasive and largely immutable, even with practice.
Email: Katherine Moore, katherine.moore@elmhurst.edu

(1145)
Dilution and Selective Attention Rely on Partially Independent Mechanisms. HANNA BENONI and NURIT GRONAU, *Open University of Israel*. — The perceptual load of selective attention (Lavie, 1995), stipulates that distractor interference can be avoided only in high perceptual load presentations, when target processing exhausts all of attentional resources. An opposition to this account is the dilution account (Benoni & Tsal, 2010; Tsal & Benoni, 2010). According to this account, the additional items in high load presentations compete with distractor representation independently to load, consequently enabling efficient selectivity. In order to explore the mechanism underlying dilution, in the present study we manipulated orthogonally dilution and orienting of attention. We found that while attention and dilution both affect distractor processing, these two factors do not seem to interact. Our findings suggest that the mechanisms of dilution and selective attention may be mediated by partially independent mechanisms.
Email: Hanna Benoni, hannib@bezeqint.net

(1146)

Visual Attention to Social and Featural Cues in Viewing Dynamic Scenes. SAMUEL HARDING and BENNETT BERTENTHAL, *Indiana University* (Sponsored by Linda Smith). — Visual perception begins with basic featural elements such as contrast, color, and motion which combine to form high-level contextual and semantic information. Salience models of visual attention suggest that these low-level features are often sufficient for predicting visual attention to static scenes, but less is known about the success of these models for predicting performance with dynamic scenes. In an eye tracking study, adults freely viewed dynamic videos of object-directed actions performed by another. Using an information-theoretic approach, we found differential success in the predictive capabilities of salience and socially informed models. Viewer's fixations could be estimated using only visual salience (spatial and temporal dimensions), and while better than chance, the addition of socially relevant information improved prediction, indicating that exogenous visual calls for attention can be suppressed by deliberate social goals such as joint attention.
Email: Samuel Harding, hardinsm@indiana.edu

(1147)

Perceptual Identity Uncertainty and the Stages of Object-Based Attention: A Prioritization Account. ANDREW COLLEGIO, *George Washington University*, SIMEON KAKPOVI, *Montgomery Blair High School*, ALANA WHITMAN, *Brown University*, SARAH SHOMSTEIN, *George Washington University*. — Two theoretical mechanisms have been proposed to account for object-based attentional benefit: (1) Attentional Spreading, proposing automatic spreading of attention within an attended object; (2) Attentional Prioritization, suggesting prioritization of locations within an already attended object, mediated by target certainty. We argue that uncertainty across multiple domains (spatial, configural, perceptual) drives object-based selection via attentional prioritization, rather than attentional spreading. Using a task in which flanking letters appeared on the same- or a different-object as the target, we tested different levels of target-based perceptual identity uncertainty using three levels of uncertainty: high, moderate, and low. Configural uncertainty was manipulated by varying both the colors and configuration of objects with an expectation that segmentation cues will modulate flanker interference. We observed object-based effects only in the presence of both perceptual identity uncertainty and configural uncertainty, indicating that high uncertainty is sufficient to induce object representations to guide attention.
Email: Andrew Collegio, ajcollegio@email.gwu.edu

(1148)

Social Facilitation of the Face Composite Effect. TERESA GARCIA-MARQUES, *ISPA - Instituto Universitario*, ALEXANDRE FERNANDES, RICARDO FONSECA and MARILIA PRADA, *ISPA* (Sponsored by Leonel Garcia-Marques). — The "Composite Face Effect" (CFE, the higher difficulty in recognizing top-halves of familiar faces combined with the aligned bottom-half of a different face, relatively to when the same face parts are misaligned; Young et al., 1987), has been explained as derived from the early selection processes that influence allocation of attention (Kimchi, 2010) and not from the late process of interference's monitoring (Richler, et al., 2009). The "Social Facilitation Effect" (SFE, the differences in processing of individuals in isolation compared to individual in co-action) has been accounted in terms of attentional mechanisms (Baron, 1986). Huguet et al. (1999) have argued that these effects result from an increased monitoring of undesirable influences in presence of others. Our data show that the CFE increases in the presence of others challenges the above explanations, suggesting that either the CFE is due to interference or SFE does not increase monitoring.
Email: Teresa Garcia-Marques, gmarques@ispa.pt

(1149)

Dyslexia Tug-of-War: Dyslexic Tendencies in a Healthy Population Degrade Accuracy on the Attention Network Test and Simultaneously Speed and Slow Response Times in Navon Tasks. IGOR DOLGOV, LEE ANNA COVEY and C. BROOKS VOLKMAN, *New Mexico State University*. — The current study explored the relationship between healthy college students' self-reported dyslexic and autistic tendencies and their performance on global/local processing tasks. Participants completed the classic divided and selective attention Navon tasks as well as the Attention Network Test, and then the dyslexia (DQ) and autism (AQ-50) assessment inventories. Scores on the self-report measures were utilized to form average tendency, dyslexic tendency, and autistic tendency groups. Results showed that DQ scores covaried positively with response times in the Navon tasks. Counterintuitively, when statistically accounting for this significant relationship, the dyslexic tendency group was generally observed to perform statistically faster than the average tendency group. While no response time differences were observed in the Attention Network Test, the dyslexic tendency group was significantly less accurate. The autism tendency group never differed from the others. The findings novelly illustrate disparate local/global processing cognitive styles in a normal population.
Email: Igor Dolgov, id@nmsu.edu

(1150)

The Irrelevant Sound Effect: Is Content Irrelevant? JOSH DORSI, LAWRENCE D. ROSENBLUM, JAMES W. DIAS, DOMINIQUE SIMMONS and THERESA COOK, *University of California, Riverside*, OKSANA LALEKO, *SUNY New Paltz*. — The Irrelevant Sound Effect (ISE) is the finding that serial recall accuracy of visually presented items, is impaired by the presence of background speech (Colle & Welsh 1976). While speech is more disruptive than non-speech backgrounds, ISE is assumed to be stable across different speech backgrounds (Jones, Miles, & Page, 1990). Two experiments address this assumption. Experiment 1 found that within monolinguals, certain foreign speech backgrounds were more disruptive than backgrounds of native speech. Experiment 2 addressed the inconsistent finding that word frequency affects ISE (e.g. Buchner & Erdfelder 2005, but see Elliot & Briganti 2012),

by comparing disruption caused by words that varied in both frequency and phonetic neighborhood density. Results indicate that an interaction between frequency and density could account for the inconsistency in this finding. Results of both experiments are interpreted with respect to contributions of attention in ISE.
Email: Josh Dorsi, jdorsi56@gmail.com

(1151)
Eye Gaze Direction Modulates Attention to Faces. CAITLIN LISCHER and BENNETT BERTENTHAL, *Indiana University*. — It is well established that people show a bias to look toward faces in simple arrays as well as complex social scenes. Yet, this bias has not been tested in dynamic scenes when the direction of gaze is continuously changing. We tested participants' spontaneous viewing of 16 dynamic videos showing an actor who appeared to be talking to the viewer while demonstrating object-directed actions. Visual attention was measured with a Tobii eye tracker. The results revealed that the actor's eye gaze direction systematically influenced where participants directed their attention, i.e., increased looking to faces during direct gaze and increased looking to objects during averted gaze. Although this tendency to shift attention from faces to objects could be learned from extensive experience over years of social interaction, converging findings with infants suggests that gaze direction during face-to-face interactions begins to modulate social attention by the end of the first year.
Email: Caitlin Lischer, clischer@indiana.edu

• LETTER AND WORD PROCESSING I •

(1152)
Does L2 Phonological Encoding Change With Proficiency? Evidence for a Fundamental Unit Change for Highly Proficient Japanese-English Bilinguals. MARIKO NAKAYAMA, *Waseda University*, RINUS VERDONSCHOT, *Nagoya University*, KEISUKE IDA, *Waseda University*, SACHIKO KINOSHITA, *Macquarie University*. — Recently it has been revealed that that the way phonology is constructed differs across languages. Dutch/English speakers are suggested to incrementally cluster phonemes into a metrical frame, whereas Mandarin Chinese speakers use syllables and Japanese speakers use moras. Here we are concerned with the question how bilinguals construct phonology in their second language when their two languages have different phonological unit sizes. A previous study reported that highly proficient Chinese-English bilinguals use phonemes, not syllables, in L2-English word production. Using Japanese-English bilinguals, the present study examined whether or not the acquisition of phoneme-size units is modulated by bilinguals' L2 proficiency. Replicating previous findings, highly proficient Japanese-English bilinguals produced significant onset priming effect with English stimuli indicating that they employ phonemes, not moras, for L2 word production. Most importantly,

however, low proficient Japanese-English bilinguals did not show significant onset priming indicating that proficiency may influence phonological unit grain size.
Email: Mariko Nakayama, mariko_nakayama@aoni.waseda.jp

(1153)
Do Young Readers Have Fast Access to Abstract Lexical Representations? Evidence From Masked Priming. MARÍA JIMÉNEZ and MANUEL PEREA, *Universitat de València*, PABLO GOMEZ, *DePaul University*. — While there is consensus that adult readers have fast access to abstract letter/word representations, the developmental trajectory of such access has not yet been mapped out. To examine whether developmental readers have rapid access to abstract representations during the early stages of word processing, we conducted a masked priming experiment with two groups of young readers (third/fifth graders) and a group of young adults. We selected two types of words: i) words composed of cross-case letters that are visually dissimilar (DIS words; arte/ARTE); and ii) words composed of cross-case letters that are visually similar (SIM words; bici/BICI [Spanish for bike]). For university students and fifth graders, response times for DIS and SIM words were very similar in the matched- and mismatched identity priming conditions, which in turn produced shorter responses than the unrelated condition. In contrast, the pattern of data of the third graders with the DIS words was suggestive of a lack of rapid access to abstract representations. These findings have relevant implications for developmental models of visual-word recognition and for the use of masked priming experiments with developmental readers.
Email: Manuel Perea, mperea@uv.es

(1154)
Reliability of Masked Repetition and Semantic Priming Effects. LUUAN CHIN TAN and MELVIN YAP, *National University of Singapore*. — Despite the robustness of the semantic priming effect, the consistency or reliability of semantic priming effects within individuals is surprisingly low (Stolz, Besner, & Carr, 2005). In contrast, repetition priming effects appear to be far more reliable across a range of conditions (Waechter, Stolz, & Besner, 2010). Although Stolz and colleagues attribute the low reliability associated with semantic priming to uncoordinated processes in semantic memory, their use of unmasked priming paradigms makes it unclear the extent to which reliability (or the lack thereof) in priming reflects strategic processes. The present study focuses on the reliability of the automatic mechanisms that putatively support semantic and repetition priming. Specifically, we examine the reliability of semantic and repetition priming in the same participant when primes are heavily masked. We also explore how individual differences in masked repetition and semantic priming are associated with variability in vocabulary knowledge and spelling performance.
Email: Melvin Yap, melvin@nus.edu.sg

(1155)

What's in a Sandwich (Prime)? JAMES ADELMAN and ILIYANA TRIFONOVA, *University of Warwick*. — The orthographic component of visual word recognition is often studied by using a nonword masked prime stimulus in lexical decision. Prime stimuli that are highly related to word targets typically produce facilitation compared to unrelated prime stimuli, but weakly related primes do not, limiting the utility of the paradigm. Lupker and Davis (2009) showed that a 33ms preview of the target before the prime — termed the sandwich priming technique — allows for facilitation across a broader range of prime-target similarities. Their explanation is that the preview stimulus pre-activates the target so that other words cannot be strongly activated by the prime, which would otherwise produce lateral inhibition preventing priming of the target. If so, a preview stimulus word other than the target should have the opposite effect of preventing priming of the target. Three experiments show that priming is instead preserved when a non-identical preview stimulus is used. An alternative account is proposed: In the standard paradigm, weakly related and unrelated primes all hit a floor in activation of the target, but a preview modifies the starting point in activation to be further from floor, allowing differences to emerge.
Email: James Adelman, j.s.adelman@warwick.ac.uk

(1156)

Lexical Decision in Real Time: A Mouse Tracking Study. JESSE HARRIS, *University of California, Los Angeles*. — Many low-level factors impact ease of lexical decision (Balota et al., 2007). We studied lexical decision on words and pseudowords as modulated by two such factors: (i) orthographic neighborhood size (dense neighborhoods often facilitate retrieval), and (ii) the presence of a single high-frequency neighbor (high frequency competitors inhibit decision). Subjects (N=48) made a lexical decision while their mouse movements were tracked. Curve area and trajectory were compared between conditions. In contrast with expectations from previous literature, dense neighborhoods resulted in greater mouse trajectory deflections for both words and pseudowords. However, as confirmed by a separate reaction time study (N=48), this penalty was effectively driven by the presence of a high frequency neighbor. The facilitatory effect of dense neighborhoods seems to disappear in the absence of a high frequency neighbor, suggesting a late stage competition of frequent candidates, but providing no evidence for an early, low-level boost for orthographically similar words.
Email: Jesse Harris, jesse.harris@pomona.edu

(1157)

Disentangling Stimulus-Driven and Decision Processes in Lexical Decision Performance. MELISSA PRINCE, *The University of Sydney*, ANDREW HEATHCOTE, *University of Newcastle*, COLIN DAVIS, *University of Bristol*, SALLY ANDREWS, *University of Sydney*. — The lexical decision task (LDT) has been widely used to index the speed of lexical retrieval, but performance is also influenced by decision processes. This project applies mathematical modeling to estimate the relative contribution of these processes to LDT performance. The study simultaneously examined two manipulations that have reliable effects on the ease of lexical classification: masked repetition priming, and the nature of the nonword distractors. The Linear Ballistic Accumulator (LBA) model was used to assess the relative contribution of stimulus-driven and decisional processes to the effects of repetition priming and nonword environment. If the facilitatory masked repetition priming effect is due to faster encoding of the target's stimulus properties (i.e., a 'savings effect'), it should manifest on the LBA's nondecision time parameter (ter). In contrast, effects of nonword environment would be expected to manifest on parameters relating to the decision threshold and the quality of evidence obtained from a stimulus. Patterns of additivity and interaction between these factors contribute to distinguishing between current models of lexical access.
Email: Melissa Prince, melissa.prince@sydney.edu.au

(1158)

ERP Markers of Morphological Decomposition. JOANNA MORRIS, *Hampshire College*. — Recent studies on morphological processing have shown evidence for a form of automatic morpho-orthographic decomposition operating early in visual word recognition that is sensitive to the superficial morphological structure of strings, i.e. the simultaneous presence of a root and an affix. However, the evidence for morpho-orthographic decomposition comes primarily from items with a root+suffix structure, while other forms of morphological structure have been less widely examined. In this study, participants made lexical decisions to prefixed pseudowords while we measured ERP responses to look for evidence of decomposition related neural activity early in the time course of word recognition. We found early (~250 ms) effects of prefixation, with more negative responses to non-prefixed pseudowords (dirbell, dirgell) relative to those with prefixes (disbell, disgell). Following this, at around 400 ms, we found effects of stem legality with more negative responses to non-prefixed pseudowords with legal embedded stems (dirbell) compared to pseudowords with no morphological structure (dirgell). These data are interpreted within an interactive activation processing framework.
Email: Joanna Morris, jmorris@hampshire.edu

(1159)

Does Reading in Hindi Support the Orthographic Depth Hypothesis? ANURAG RIMZHIM, *Central Connecticut State University & Haskins Laboratories*, CAROL A. FOWLER, *University of Connecticut*, LEONARD KATZ, *Haskins Labs*. — The orthographic depth hypothesis (ODH; Katz & Frost, 1992) has been influential in understanding how skilled reading is influenced by the degree of transparency (depth) in the mapping between print and sound. In the ODH, naming words in a shallower versus a deeper orthography involves less lexical processing, because the mapping between the orthography and phonology can be achieved without first identifying the words. Therefore, in a shallower orthography, the effect of word familiarity (a lexical variable) should be weaker in naming than lexical decision. We present results of skilled reading in the transparent Hindi orthography and show significant and equivalent effects of familiarity in

naming and lexical decision. We also compare naming with and without nonwords in the stimulus set. Although Hindi is shallow in letter-phoneme mapping, it is deeper in its nonlinear representation of letters and in violation of syllable boundaries in the grouping of letters into akshars.
Email: Anurag Rimzhim, arimzhim@gmail.com

(1160)
Prosodic Handwriting: Stroop-Like Interference Between Production and Semantics. ANTHONY BARNHART and DIANA JENKINS, *Northern Arizona University*. — Although the claims of graphology continue to be unsupported by empirical evidence, people can actively communicate emotional content in the way that they produce handwritten words (Loewenthal, 1975). However, no research has explored whether these cues are automatically recognized by the reader. Just as the emotional state of a speaker can be inferred based on prosody (i.e., qualities of voice inflection), we may be sensitive to emotional qualities of a writer when reading their handwriting. The current research explores this possibility through an adaptation of the Stroop task wherein participants read aloud emotion words (related to happiness and anger) that were either produced to convey a matching or an opposing emotion. If this "prosodic" information is automatically activated when reading, it should interfere with naming when there is a mismatch between the emotion underlying a word's production and its semantics.
Email: Anthony Barnhart, anthony.barnhart@nau.edu

(1161)
Response Modality and Time Exposure Duration in a Stroop-Like Task. PILAR TEJERO, MARÍA JIMÉNEZ and MANUEL PEREA, *Universitat de València*. — To what degree the processing of a printed stimulus is modulated by task requirements? The present experiments employed a Stroop-like paradigm with high-frequency/low-frequency/very-low-frequency noncolor words, pseudowords, and consonant strings displayed in blue or orange. We examined the impact of stimulus duration (unlimited vs. 100 ms), response modality (naming the ink color vs. pressing a different button for each color), and type of stimulus on response times. In the vocal version of the task, responses were faster to consonant strings than to the other types of stimuli, whereas stimulus duration did not play a role. In the manual version, responses were faster when the stimuli were presented for unlimited time, whereas type of stimulus did not play a role. Therefore, the processing of printed stimuli is critically dependent on small variations in task requirements. This is consistent with Bayesian models of word recognition (Norris & Kinoshita, 2008).
Email: Pilar Tejero, pilar.tejero@uv.es

(1162)
Misidentification of Orthographic Neighbors During Oral Reading. JULIE GREGG and ALBRECHT INHOFF, *Binghamton University, SUNY*. — Although even skilled readers make errors when reading, this phenomenon is seldom directly examined. This study investigated the effects of contextual congruency and neighborhood frequency on word misidentification during oral reading. Sentences consisted of a target word which was a higher or lower frequency member of an orthographic neighbor pair, pretarget context that biased toward the higher frequency member, and posttarget context that was congruent, neutral, or incongruent with the target word. Misidentification of the target word occurred on 3% of trials, and low-to-high frequency misidentifications were significantly more likely than the reverse. Further, for lower frequency target words, errors were more likely when posttarget context was incongruent with the target word and congruent with its neighbor. These results suggest that a lower frequency word is often misidentified as its higher frequency neighbor, and that readers may integrate contextual information beyond the target word during word identification in oral reading.
Email: Julie Gregg, jgregg3@binghamton.edu

(1163)
Processing Words Of Out Order During Reading: Evidence for Serial and Parallel Models. MICHAEL A. ESKENAZI and JOCELYN FOLK, *Kent State University*. — In English, word order plays a large role in drawing meaning from a text. However parallel processing models of eye movement control (e.g. SWIFT) propose that words can be processed out of order, whereas serial processing models (e.g. EZ Reader) propose that words are always processed in their canonical order. If words are processed out of order there may be a higher order processing cost of re-organizing them to maintain meaning. Participants read sentences with transposed and un-transposed words embedded in them while their eye movements were monitored. We found a fixation time cost of reading words out of order, consistent with a cost of re-organizing through parallel processing. However, the majority of participants had significantly disrupted reading patterns with more regressions to transposed word regions, consistent with a serial processing account. Findings will be discussed in terms of how serial and parallel processing models can account for the data.
Email: Jocelyn Folk, jfolk@kent.edu

(1164)
Information-Processing Architectures in Reading: An Investigative Application of the Systems Factorial Technology. KYLE ZIMMER, *Grand Valley State University*, JAMES TOWNSEND, *Indiana University*, MARIO FIFIC, *Grand Valley State University*. — For years, psycholinguists have been debating over the mental architecture associated with various processes that take place in the context of processing human language. Today, some of the most prominent psycholinguistic reading models disagree over whether the reading of adjacent words occurs in a parallel or serial fashion. The Systems Factorial Technology (SFT) is a rigorous and highly diagnostic methodology that has been used to draw similar distinctions in visual search, categorization, face perception, and other areas commonly studied by cognitive psychologists. The methodology allows us to determine within subjects: a) the mental architecture of two processes (serial or parallel), b) a stopping rule (self-terminating or exhaustive), and c) process dependency. In the

current study we applied the new SFT method to test the serial and parallel hypotheses in the processing of adjacent words in a self-paced reading task.

Email: Kyle Zimmer, zimmekyl@mail.gvsu.edu

• BILINGUALISM I •

(1165)

Tracking Multiple Structures: An Insight Into the Primacy Effect. FEDERICA BULGARELLI and DANIEL WEISS, *Pennsylvania State University*. — A fundamental challenge of statistical learning is to determine whether variance observed in the input signals a change in the underlying structure. Interestingly, when learners encounter two consecutive statistical inputs, they only learn the first structure unless exposure to the second is tripled or includes a correlated contextual cue (Gebhart, Aslin, & Newport, 2009). In two experiments, we explored the conditions under which both structures can be acquired. Learners who switched to the second input immediately after mastering the first were more likely to learn both, whereas those who continued to receive input in the first structure were more likely to remain entrenched, exhibiting the primacy effect. Further, the ability to learn both structures correlated with performance on a Flanker task, suggesting that the first input may need to be inhibited to acquire the second structure. We relate our findings to the challenges of real world language learning and bilingualism.

Email: Federica Bulgarelli, fub113@psu.edu

(1166)

Examining Native Language Performance to Test a New Hypothesis About Second Language Learning. KINSEY BICE, BRITNEY MASSIMINO and JUDITH KROLL, *Pennsylvania State University*. — An enduring question about late second language (L2) learning is why there are apparent constraints on the ability of adult learners to understand and speak the L2. Past research suggests that these constraints reflect characteristics of adult learners and the nature of the language learning contexts. In the present study we test the hypothesis that acquiring the ability to regulate the native language (L1) may be important in achieving L2 proficiency. We report behavioral and ERP data on native English speakers learning Spanish as an L2 in a classroom or language immersion context in tasks of lexical comprehension and production. The initial results suggest that more proficient L2 learners may be more likely to reveal costs associated with the influence of the L2 on the L1. Costs to L1 are particularly evident in language production when learners are immersed in the L2, a context that promotes new language learning.

Email: Judith Kroll, jfk7@psu.edu

(1167)

The Influence of Bilingualism on Statistical Word Learning. TIMOTHY J. POEPSEL and DANIEL WEISS, *Pennsylvania State University*. — Statistical learning (SL) is a fundamental component of language acquisition, yet to date, relatively

few studies have examined whether these abilities differ in bilinguals. Bilingual learners may more readily anticipate that variance encountered in novel statistical input might signal the presence of multiple underlying causal models. Consequently, we compared English monolinguals with Chinese-English bilinguals in a cross-situational statistical word learning paradigm, in which learners were familiarized to both one-to-one and two-to-one word-object mappings and tested at three points during the experiment to establish a trajectory of learning. Monolinguals and bilinguals did not differ in their learning of one-to-one mappings, although bilinguals acquired two-to-one mappings more quickly and with greater proficiency than monolinguals .These results suggest that the fundamental SL mechanism may not be affected by language experience, but that bilinguals, due to their language experience, may more readily anticipate and accommodate new structures in linguistic input.

Email: Daniel Weiss, djw21@psu.edu

(1168)

Psycholinguistic Forecast of Nonnative Language Comprehension Achievement. AINA CASAPONSA, MANUEL CARREIRAS, ENEKO ANTÓN, ALEJANDRO PÉREZ and JON ANDONI DUNABEITIA, *Basque Center on Cognition, Brain and Language*. — The relationship between learners' individual differences at a cognitive level and their degree of nonnative language achievement has become a hot topic in recent years. General cognitive skills play an important role in nonnative language acquisition and consolidation, contributing to explain individual differences in nonnative language comprehension. However, little is known about psycholinguistic measures that, along with domain-general cognitive skills, could be used to effectively explain individual differences in nonnative language processing. We explored how the degree of reliance on cross-language similarity (as measured by the cognate effect) together with working memory capacity and non-verbal intelligence contribute to reading comprehension achievement in a nonnative language in a group of 150 English adult learners. Results showed that not only domain-general cognitive skills predict effective nonnative language comprehension, but critically that also a psycholinguistic measure such as the cognate effect can be used to understand and predict individual differences in nonnative language achievement.

Email: Aina Casaponsa, a.casaponsa@bcbl.eu

(1169)

Symmetry and Asymmetry: Working Memory and Language Proficiency in Bilinguals. ILEANA RATIU and TAMIKO AZUMA, *Arizona State University*. — This study examined the relationship between working memory (WM) and language proficiency in approximately 200 bilingual speakers. Participants completed a modified version of the Language Experience and Proficiency Questionnaire (Marian et al., 2007) and a non-verbal complex WM span task, the Symmetry Span (Unsworth et al., 2005). Overall, WM span predicted multiple measures of second language proficiency, but the strength of the relationship differed across subgroups

of bilinguals. The findings suggest that the relationship between WM and language proficiency in bilinguals may be mediated by multiple aspects of bilingual experience.
Email: Tamiko Azuma, azuma@asu.edu

(1170)

Multilingual vs. Monolingual Concept Acquisition: Which Is Stronger? ENEKO ANTÓN, *Basque Center on Cognition, Brain and Language*, GUILLAUME THIERRY, *Bangor University*, MANUEL CARREIRAS and JON ANDONI DUNABEITIA, *Basque Center on Cognition, Brain and Language*. — In bilingual societies formal schooling is in one-language-one-subject manner, because traditional education assumes that only one language should be used during the tuition of an academic subject to prevent from any possible incorrect conceptual representation, consequence of mixing languages. This study investigates whether the use of two vehicular languages as compared to a single one harms the integration of new concepts, or whether the regular mixing of two languages during instruction should be favored. Spanish-Basque bilingual adults and children were tested in various experiments in which they had to learn some novel concepts represented by unknown objects associated with definitions of common objects. Half of the subjects of each group received the concepts in a single-language context while the other half received them in a dual-language context. Indirect and direct measurements of learning, conceptual representation and integration were collected. No significant differences were found between the results from participants in single- and in dual-language contexts, yielding the conclusion that mixing languages provides learners with enhanced communicative skills in the full absence of any detriment in concept acquisition.
Email: Eneko Antón, e.anton@bcbl.eu

(1171)

Bilingualism Modulates Dual Mechanisms of Cognitive Control: Behavioral and ERP Evidence. JULIA MORALES, M. TERESA BAJO and CAROLINA YUDES, *Universidad de Granada*, CARLOS GOMEZ-ARIZA, *Universidad de Jaén*. — Recent theories suggest that bilingualism modulates the dynamic combination of monitoring and inhibitory processes to deal with conflict or interference. In Experiment 1, we explored this idea by comparing monolinguals and highly proficient bilinguals in the AX-CPT. This task requires adjusting proactive (monitoring) and reactive (inhibition) control to achieve efficient performance. In Experiment 2, we further investigated the effect by recording ERPS during AX-CPT performance. Behavioral results showed that bilinguals outperformed monolinguals in conditions with higher requirements of control adjustment, which was supported by correlations with the stop-signal reaction time. In addition, the ERP components suggested that bilingualism modulates conflict monitoring, response inhibition and error monitoring components of control (as indexed by the N2 and P3a elicited by the probe and the ERN following mistakes, respectively). Thus, bilinguals seem to exert higher reactive control than monolinguals but only when they need to overcome the

competing cue-information. Our findings support the idea that a better understanding of the cognitive benefits of bilingualism must consider a multi-component perspective.
Email: M. Julia Morales, mjulia@ugr.es

(1172)

Bilingual Advantage in Inhibition Control? Evidence From Chinese-English Late Bilinguals. ANYA YU, *National Central University*, OVID TZENG, *Academia Sinica*, DAISY L. HUNG and DENISE WU, *National Central University*. — Whether bilinguals have an advantage in inhibition control, such as better incongruent trial performance on the color Stroop task than monolinguals remains a controversial topic in the literature. We tested 40 Chinese-English late bilinguals of varying English proficiencies with a number-size Stroop task in both their L1 and L2 to examine whether the bilinguals' L2 proficiency correlates with their task performance and Stroop interference. The results revealed that the bilinguals' English proficiency, measured by the English RAN test and MiNT, predicted their response times on the numerical magnitude judgment in L2 in the Stroop task as expected. However, their L2 proficiency did not correlate with the Stroop interference in either size or numerical magnitude judgment in either L1 or L2. Further research would be needed to determine whether late bilinguals with greater variability in L2 proficiency exhibit an advantage in inhibition control.
Email: Denise Wu, denisewu@cc.ncu.edu.tw

(1173)

Second Language Immersion and the Time Course of Bilingual Inhibitory Processing: Evidence From Word Durations. MELINDA FRICKE, *Pennsylvania State University*, SUSANNE SCHARF, *University of Freiburg*, MARÍA CRUZ MARTÍN, ELEONORA ROSSI and JUDITH KROLL, *Pennsylvania State University*. — Bilinguals activate both languages in speech production, even when they intend to speak one language alone. One hypothesis is that the more dominant of the two languages is inhibited to enable speech planning in the less dominant language. Evidence for this position has thus far typically come from naming latencies and neurocognitive measures (ERPs, fMRI).In this study, we ask whether word durations – a measure of articulation speed – also reflect inhibitory processing, and whether such effects always co-occur with inhibition in naming latencies. Data collection is still under way, but preliminary analyses indicate a qualitatively different pattern of inhibition for speakers immersed in the L2 as compared to the non-immersed groups. Examining word duration in conjunction with naming latencies provides crucial data concerning the time course of inhibitory processes, and our preliminary results indicate that the speaking context may play an important role in modulating these processes.
Email: Melinda Fricke, mdf18@psu.edu

(1174)

Linking Comprehension and Production in Bilinguals. EVA VAN ASSCHE and WOUTER DUYCK, *Ghent University*, TAMAR GOLLAN, *University of California, San Diego*. — In the present study, we investigated whether bilinguals rely on

the same lexical systems for reading and speaking using the frequency effect. For example, will frequently reading a word make it easier to later speak the same word? The stimuli were two sets of L2 high- (e.g., horse) and low-frequency words (e.g., parrot). On three consecutive days, Dutch-English bilinguals were trained in reading one set of words in a lexical decision task and in speaking the other set of words in a picture naming task. We observed strong frequency effects in both tasks that quickly diminished after repeated presentation. In the test experiment, the words that were trained in lexical decision were tested in picture naming and vice versa. The results showed that the size of these frequency effects was significantly different from the first presentation results indicating strong links between the comprehension and production system of bilinguals.
Email: Eva Van Assche, eva.vanassche@ugent.be

(1175)

Inhibitory Control in Second Language Production: Evidence From Learners. RHONDA MCCLAIN, DANIEL BLOODGOOD, ELEONORA ROSSI and JUDITH KROLL, *Pennsylvania State University*. — The present study asks whether second (L2) language learners, who have yet not attained high levels of proficiency, inhibit their L1 after speaking the L2. Learners in an L2 immersion environment and in ordinary L2 classrooms were tested. Past studies (Guo et al., 2011; Misra et al., 2012; Van Assche et al., 2013) have reported evidence for both local and global inhibitory processes. For learners, relative to proficient L2 speakers, we predicted that regulation of the L1 would be particularly important to enable speech planning in the L2. Participants named pictures in English only or in English before and after Spanish naming. They also performed a semantic verbal fluency task. Inhibition of the L1 was seen following picture naming in L2 for all learners but immersed learners revealed a cost in L1 verbal fluency relative to classroom learners. We consider the implications for models of inhibitory control during L2 learning.
Email: Rhonda McClain, rhondam1@gmail.com

(1176)

Word Translation Processes Across Childhood and Adolescence. JON ANDONI DUNABEITIA, LELA IVAZ, AINA CASAPONSA and MANUEL CARREIRAS, *Basque Center on Cognition, Brain and Language*. — The main goal of the present study was to investigate how the degree of orthographic overlap between translation equivalents influences bilingual word recognition processes at different stages of bilingual reading development. To this end, four groups of Spanish-Basque bilingual children and adolescents were tested in two explicit translation recognition tasks with a large set of items (from Spanish to Basque, and from Basque to Spanish; 700 items per task). Critically, the degree of cross-language similarity (i.e., the cognate status) between the references and the correct targets was manipulated along a continuum, in order to investigate how the reliance on cross-language orthographic overlap varies as a function of the age

of the participants. Our results showed that younger children were significantly much more sensitive to the cognate status of words than adolescents while recognizing translation equivalents. These results are in line with theoretical accounts suggesting that bilingual reading development is characterized by a progressive maturation of the visual-word recognition system that mainly relies on sub-lexical orthographic information at initial stages of reading acquisition.
Email: Jon Andoni Dunabeitia, j.dunabeitia@bcbl.eu

(1177)

Cross-Language Effects in a Picture-Word Matching Task: An ERP Investigation. STEPHANIE MASSOL, *Basque Center on Cognition, Brain and Language*, ELENA BERDASCO, *Universidad del Pais Vasco*, NICOLA MOLINARO, JON ANDONI DUNABEITIA and MANUEL CARREIRAS, *Basque Center on Cognition, Brain and Language*. — This study investigated the similarities and differences between bilinguals' activation of within- and between-language lexico-semantic representations in a monolingual task context. Spanish-Basque bilinguals completed a picture-word matching task while EEG data were recorded. The critical items were pseudowords derived from a set of real Spanish and Basque words that could be either related or unrelated to a set of pictures (e.g., the picture of a dog and the Spanish pseudoword purro , derived from perro). Behavioral results showed a main effect of relatedness, with longer latencies associated with related pseudowords. At the electrophysiological level, an early relatedness effect was found for within-language pseudowords than for between-language pseudowords, whereas a generalized effect of relatedness was found on the N400 component. Overall these results highlighted that words bilinguals' activate words in both languages, even though the context of the study modulates processing, and so suggesting that this cross-language activation is done sequentially.
Email: Stephanie Massol, s.massol@bcbl.eu

(1178)

Moving Hand Reflects Bilingual Transposed-Letter Effects. YU-CHENG LIN, ASHLEY BANGERT and ANA SCHWARTZ, *University of Texas at El Paso*. — Monolingual reading research demonstrates that lexical access is highly flexible in terms of letter-position coding. Transposed-letter (TL) non-words (jugde) activate the lexical representation of their corresponding base words (judge) to a greater degree than the orthographic controls (replaced-letter, jutpe). Using a mouse-tracking paradigm, we examined whether the magnitude of TL effect for bilingual readers would differ for cognates, words that share meaning and a high degree of lexical form across languages. Highly proficient Spanish-English bilinguals performed an English lexical decision on either cognate targets with a high degree of orthographic overlap across languages (actor/actor: +O) and cognates with less orthographic overlap (fruit/fruta: –O). The results demonstrated that bilinguals' mouse trajectories of TL non-word targets were more pulled toward the incorrect responses

when their base words are +O compared to –O. Results suggest that a larger magnitude of TL effect was observed for +O cognates relative to –O cognates.
Email: Yu-Cheng Lin, yclinpsy@gmail.com

(1179)
Understanding Second Language Influence on First Language Word Choice. BARBARA MALT and AMY LEBKUECHER, *Lehigh University*. — Speaking a second language (L2) can influence first language (L1) use. We found previously that Mandarin-English bilinguals immersed in English show an English influence on the names they produce in Mandarin for common household objects. Does this L2 influence reflect an enduring change to underlying L1 lexical representations or an on-line influence of English on word choice in the production task? In the current study, Mandarin-English bilinguals named the same sets of common household objects as previously. However, instead of producing names on their own, they responded to each object by choosing among the names generated by Mandarin-speaking monolinguals. The forced choice task eliminates the need for retrieval from memory and other production processes. Deviations from monolingual choices were still found. These results suggest that bilinguals' underlying lexical knowledge associated with some L1 words may be modified by their exposure to L2.
Email: Barbara Malt, barbara.malt@lehigh.edu

(1180)
Phonological Units of Speech Segmentation in Bilinguals: Fixed or Variable Strategies? ANN BURCHFIELD and ANN BRADLOW, *Northwestern University*. — Previous research suggests that speech-segmentation units vary cross-linguistically (e.g. the syllable is a critical segmentation unit for French but not English and that French-English bilinguals use L1 segmentation strategies for L2 speech (Cutler et al., 1992). Here we ask whether this limit on bilingual flexibility extends to Mandarin-English bilinguals, whose two languages have vastly different phonotactics. Listeners monitored for CV or CVC targets in the context of words with an initial CV or CVC syllable in English (/pɛ/ or /pɛn/ in pe-nny or pen-cil) and Mandarin (/da/ or /dan/ in da-nao or dan-shi). For Mandarin stimuli, both English- and Mandarin-dominant bilinguals were sensitive to matching versus mismatching target and context syllable structures. For English stimuli, no group showed evidence of syllable-based segmentation. These results show variability in bilinguals' segmentation strategies based on task language, suggesting that structural dissimilarity of the two languages promotes bilingual flexibility. Works Cited:1. Cutler, A., Mehler, J., Norris, D., & Segui, J. (1992) The monolingual nature of speech segmentation by bilinguals. Cognitive Psychology, 24, 381-410.
Email: L. Ann Burchfield, ann@u.northwestern.edu

(1181)
Fillers and Elongations in English and Spanish. CYNTHIA CARDON, ALEXANDRA L. DUNN and JEAN E. FOX TREE, *University of California, Santa Cruz*. — The fillers um and uh in English, or em and eh in Spanish, can be used to indicate upcoming delay in talk. Elongations can also be used to indicate upcoming delay. In an earlier study of translations, Spanish weighted bilinguals used more elongations and English weighted bilinguals used more fillers. In the current study of spontaneously produced retellings of a Pink Panther cartoon, we compared the rate of fillers produced by (1) monolingual English speakers, (2) bilingual Spanish-English speakers speaking English, and (2) bilingual Spanish-English speakers speaking Spanish. Rates of filler production across the three conditions were assessed to determine whether filler use was related to whether the speaker was monolingual or bilingual, and whether the speaker was speaking English or Spanish. Keywords: Bilingualism, Language, Spontaneous Speech, Fillers, Elongations
Email: Cynthia Cardon, ccardon@ucsc.edu

(1182)
Bilingual Lexical Access and Sentential Integration. ROBERTO HEREDIA, WUALÚ A. ALTAMIRA and ANNA CIESLICKA, *Texas A&M International University*. — Three Experiments addressed whether bilingual lexical access is selective (i.e., only one meaning is activated) or non-selective (i.e., multiple meanings are activated simultaneously). Experiments 1 and 2 explored context effects in reading interlingual homographs (i.e., words across languages with competing semantic and overlapping orthographies) and cognates (words across languages with similar semantic/orthographic representations). Experiment 3 looked at interlingual homographs embedded in Spanish/English sentences. Using the grammaticality maze task, bilinguals read contextually biased English monolingual sentences (Experiment 1), and contextually unbiased Spanish or bilingual sentences where the critical target followed a conjunctional/adverbial modifier in Spanish/English joining two sentences (Experiment 3). In Experiment 2, using a lexicality maze task, bilinguals read English sentences in which the preceding context was either high or low towards the English meaning of a homograph. The results were suggestive of non-selectivity, exhibiting lexical competition. The results are interpreted in terms of bilingual lexical access models.
Email: Roberto Heredia, rheredia@tamiu.edu

• DECISION MAKING I •

(1183)
Better Together—Understanding Collaborative Decision Making. REBECCA FLOYD, DAVID LESLIE and ROLAND BADDELEY, *University of Bristol*, SIMON FARRELL, *University of Western Australia* (Sponsored by Jeffrey Bowers). — The adage 'two heads are better than one' suggests that when two people agree, the outcome of the joint decision will be more optimal than each individual's evaluation. However, there are varying opinions about whether such benefits exist e.g. 'Wisdom of the Crowd' (Galton, 1907) vs Groupthink (Janis, 1971). Our studies explore the processes underlying this and why such divergent findings arise. Ambiguous stimuli are presented to pairs of participants and they individually give an answer before agreeing a joint answer. Findings suggest

that, broadly, the adage holds. However, looking at pair performance, joint answers were less accurate than those given by the better participant, especially for large discrepancies in participants' abilities at the task. It appears that a weighting of individual estimates in the consensus decision reflects the precision of the initial estimates and we aim to generate a Bayesian model of how personal information is combined.
Email: Rebecca Floyd, rebecca.floyd@bristol.ac.uk

(1184)

Learning to Compete, Coordinate and Cooperate: Social Interaction in Sequential Binary Choice. CHRISTIN SCHULZE and BEN NEWELL, *University of New South Wales*. — Countless decisions, from the trivial to the crucial, are made in complex social contexts while facing uncertain consequences. We examine the role of social interaction for optimal decision making in sequential binary choice tasks with probabilistic outcomes. Applying computational models of learning and decision making, we show that learning in social contexts is not a trivial extension of individual choice because what can be (and is) learned by individual decision makers depends on the choices of others as well as one's own experience. We demonstrate that when competitive dynamics and the salience of behavioral goals are aligned, social interaction facilitates adaptive choice behavior in tasks typically studied under the premise of social isolation. These results provide a novel link between concepts of individual risky choice and strategic decision making under both environmental and social uncertainty.
Email: Christin Schulze, c.schulze@unsw.edu.au

(1185)

Alibi Witnesses: Willingness to Provide False Alibis. MICHAEL TOGLIA, KAREN M. RYNDAK and CHRISTOPHER T. LEONE, *University of North Florida*. — The likelihood of performing altruistic acts may be predicted by the relationship between the recipient and donor. Therefore, the extent to which people would be willing to lie for a defendant should be a function of the degree of biological relationship between the defendant and alibi witness. We presented participants with a murder and a burglary case packet containing a police-report summary and a hypothetical crime scenario. The summary report detailed case facts, evidence collected, and witness statements. Following this reading, participants judged witness' credibility, defendant's guilt and evaluated types of evidence. Next, participants imagined a scenario wherein their father or male friend was pleading with them to be their alibi witness and then agreed or disagreed to provide an alibi. Overall, participants were unwilling to provide false alibis, however, when they were, they did so more often for their father. Legal implications and suggestions for future research are discussed.
Email: Michael Toglia, m.toglia@unf.edu

(1186)

Investigating the Effectiveness of Impact Based Tornado Warnings. MARK CASTEEL, *Pennsylvania State University - York*. — Recently, the National Weather Service implemented a project designed to improve the informativeness of severe weather warnings, with a special emphasis on tornado warnings. A main goal of these Impact Based Warnings (IBWs) is to improve the threat warning process and motivate appropriate responses by using "threat tags" and additional text that provides more warning specificity. The research reported here represents an attempt to empirically investigate the effectiveness of this IBW approach. In two studies, undergraduates adopted the role of a plant manager and read both IBW and non-IBW warnings line-by-line. At three different decision locations, participants made decisions about having the plant shut down and employees shelter in place. The results show that the IBW warnings produced higher likelihoods of closing the plant and sheltering in place, but only after the additional IBW information was presented, supporting the effectiveness of the IBW approach. Implications of the results will be discussed, especially as they pertain to NWS best practices.
Email: Mark Casteel, mac13@psu.edu

(1187)

A Time-Series Eye Fixation Analysis of the Similarity, Attraction, and Compromise Effects in Multi-Attribute Decision Making. TAKASHI TSUZUKI, ITSUKI CHIBA and MASASHI SOMA, *Rikkyo University*. — In multi-attribute decision making, the similarity, attraction, and compromise effects warrant specific investigation as they cause violations of principles in rational choice. To investigate the underlying mechanism of these context effects, we examined information acquisition patterns while recording participants' eye movements. We randomly assigned 96 undergraduates to three context effect conditions. They solved 10 hypothetical purchase problems with three alternatives (the target, competitor, and decoy) described on two attribute dimensions. Although we confirmed significant context effects on choice proportions in the attraction and compromise effect conditions, we found significant attraction effects in the similarity effect condition. In the attraction and compromise effect conditions, a time-series analysis of fixation time on the three alternatives revealed dynamic temporal aspects. Fixation time on the target increased while fixation time on the other two alternatives decreased. Thus, eye-tracking analysis is critical to reveal the mechanisms underlying context effects during decision making.
Email: Takashi Tsuzuki, tsuzuki@rikkyo.ac.jp

(1188)

Groups, Group Members and Individuals: Choices and Impulses in Repeated Risky Decisions. EINAV HART, DÉBORAH MARCIANO-ROMM and EYAL WINTER, *Hebrew University of Jerusalem* (Sponsored by Yaakov Kareev). — Voting groups such as parliaments, judicial panels, corporate boards and committees make highly consequential, repeated, decisions. Yet, little is known about how groups react to past successes and failures when facing a similar decision. Our experiments involved repeated decisions between two gambles; agents were either groups of three members whose final decision is determined via a majority rule, or individuals choosing only for themselves. Surprisingly, groups did not perform better than individuals. Moreover, group members learned more

slowly than individuals. The dynamics of choices over time exhibited by groups, and their members, indicated reactivity to the most recent outcome – to both received and forgone payoffs. Group reactivity was even stronger than individuals'. In group members' reactivity we observed possible influences of increased responsibility, conformism, and pivotality. These forces at play in the decision-making of group members might explain their slower learning, and suggest drawbacks to entrusting groups with making decisions.
Email: Einav Hart, einavi@gmail.com

(1189)

Expectations and Performance Under Stress. MATTHEW DAVIS and ANA FRANCO-WATKINS, *Auburn University*. — Research supports that "enhanced expectations" about one's ability to perform a task under pressure can actually improve performance compared to no expectations. This research investigated whether manipulating expectations resulted in performance differences on a decision task, working memory capacity (WMC) moderation on task performance, and/or differences in subjective ratings of control, effort, and stress. Participants were randomly assigned to receive enhanced or hindering expectations about their expected performance in the presence of a stressor. Participants completed a decision task twice: once under stress, an adaptive time pressure, and once without stress, with no time pressure. Results demonstrate that participants who received enhanced expectations outperformed those that received hindering expectations regarding their projected performance. Consequently, expectations about performance can have beneficial or detrimental consequences in the presence of a stressor.
Email: Matthew Davis, mzd0028@auburn.edu

(1190)

Do You Quit? Resilience as Cognitive Process. ADRIANA ARIZA and CONNIE SHEARS, *Chapman University*. — Why do some individuals bounce back after receiving an unwanted grade on a paper, or heavy as losing a loved one; while others lack this ability? Therein lies a debate over resilience. Is resilience a personality trait (semi-constant throughout the lifespan; Connor & Davidson, 2003), or a cognitive process that changes (Kaplan, 2013)? We hypothesize that if resilience is a malleable process it would increase given a pass condition or decrease given a fail condition. Participants were randomly assigned to complete a maze task that was either solvable or unsolvable. Participants completed a novel pre and post version of the Connor-Davidson Resiliency Scale (CD-RISC). Results indicate that participants' resilience increased under the pass condition and decreased under the fail condition. Results support the malleability of resilience as a cognitive process. Further, this process can be measured by the CD-RISC, which until now has been a clinical measure of personality.
Email: Adriana Ariza, vcadriana@yahoo.com

(1191)

The Effects of Uncertainty Information, Recency and Feedback on Decision Making. SUSAN JOSLYN and JARED LECLERC, *University of Washington*. — Increasing evidence suggests that people make better weather-related decisions when forecasts include probabilistic estimates of uncertainty than when they do not. However, it is unclear if uncertainty estimates help for farther-future decisions, like decisions related to climate change. Participants completed a decision task in which they advised hypothetical farmers about which of two types of crops the farmers should plant based on drought projections. Some participants were shown deterministic projections and other participants were shown projections with drought probability estimates. Additionally, decision feedback and recency of drought occurrence were manipulated between participants to determine whether either factor influenced decisions. Results suggest that participants with uncertainty estimates made better decisions than participants with deterministic projections did. Feedback did not affect decision quality or trust. Results, including the effect of recency, will be discussed in terms of their implications on communicating climate change uncertainty.
Email: Susan Joslyn, susanj@uw.edu

(1192)

Decision Making in Android App Selection: Influence of Risk/Safety Framing. JING CHEN, CHRISTOPHER GATES, NINGHUI LI and ROBERT PROCTOR, *Purdue University* (Sponsored by Peter Urcuioli). — Installing apps on mobile devices could lead to potential privacy risks, including personal-data leakage. These risks can be framed in terms of risk or safety. Participants recruited on Amazon's Mechanical Turk performed tasks in which they chose two Android apps from a list of six. Summary risk/safety information for each app was displayed in the form of five circles, with the number of filled circles specifying increasing risk or safety. This risk/safety index influenced the participants' decisions, particularly when the app had high user ratings and when the decision was framed in terms of safety rather than risk. Participants indicated that they attended more to the index and showed better comprehension of what the index was conveying for safety. The results imply that development of a valid risk/safety index for apps will lead to less risky app-selection decisions by users, particularly if that information is framed as amount of safety.
Email: Jing Chen, chenjing.psy@gmail.com

(1193)

Gamble or Wait? Using Models of Risky and Inter-Temporal Choice to Predict Risk/Delay Trade-Offs. ASHLEY LUCKMAN, CHRIS DONKIN and BEN NEWELL, *University of New South Wales*. — In this paper we attempt to predict choices between risky and delayed outcomes by combining existing models of risky and inter-temporal choice. We presented participants with three types of choices; risky choices, inter-temporal choices and trade-off choices (risk v delay). We used Prospect Theory (PT) and Hyperbolic Discounting (HD) models to account for risky and inter-temporal choices. We then predicted participants' responses in the trade-off choices using various combinations of these models. We also examined whether certain parameters, such as decision weights or discount rates, should vary between choice types. Finally, we explored whether value and choice functions, assumptions common to both PT and HD models, differed between risky and inter-temporal choice. Our results

show that while some participants' trade-off choices are predicted moderately well by combined models with fixed parameters, and common functions, many benefit from allowing discount rate, but not decision weight, parameters to vary between choice types.

Email: Ashley Luckman, a.luckman@unsw.edu.au

(1194)

Sampling of Social Information: Decisions From Experience in Bargaining. NADINE FLEISCHHUT, FLORIAN ARTINGER and RALPH HERTWIG, *Max Planck Institute for Human Development*, KIRSTEN G. VOLZ, *Centre for Integrative Neuroscience, Tübingen*, SEBASTIAN OLSCHEWSKI, *University Basel*. — Whenever we depend on others, the risks we face lie in uncertainty about others behavior. Any information that helps to predict their actions should therefore be instrumental in achieving our goals. The study investigates how much people search for information in a risky bargaining situation (Mini-Ultimatum-games), compared to non-social situations with identical risk (lotteries). Participants could sample how often an offer was previously accepted or rejected. Probabilities and outcomes in lotteries were identical, yet no allocation to another person was made. The key finding is that people sampled considerably less and stopped earlier in the social situation, suggesting that they disregarded probability information and relied on the allocation instead. Environmental analysis revealed the allocation to be a better proxy for risk than outcomes in lotteries. The results offer insights into how and when social information impacts people's behavior—and under which conditions people search for it in the first place.

Email: Nadine Fleischhut, nfleischhut@gmail.com

(1195)

Cognitive Bias and Learning From Experience: Reflective Processes for Reducing Bias. DINA ACKLIN, ROBERT MATHEWS and SEAN MICHAEL LANE, *Louisiana State University*. — While heuristic processing is often useful for quickly ascertaining information in everyday situations, it can lead to inaccuracies when task demands become complex and more systematic processing is required. These inaccuracies are often the result of confirmation bias, in which information that is consistent with our beliefs is noted at the expense of disconfirming evidence. The current decision making literature suggests that highlighting disconfirming evidence – termed negative feedback - might work to engage deliberate, systematic cognitive processes that lead to more accurate information acquisition. Using a probabilistic learning task where feedback is not consistently accurate (Matchmaker), the first experiment examined overcoming confirmation bias by encouraging participants to consider their initial hypotheses from confirming and disconfirming vantages. A second experiment explored the cognitive processes involved in bias strengthening and considered how warnings of feedback error alter the way in which information is interpreted.

Email: Dina Acklin, dina.acklin@gmail.com

(1196)

Linking Personality With Basic Cognition: Need for Closure vs. the Speed-Accuracy Tradeoff. BABETTE RAE and SCOTT BROWN, *University of Newcastle*, MAXIM BUSHMAKIN, *Indiana University*, MARK RUBIN, *University of Newcastle*. — Mathematical models of decision making successfully explain data from a huge range of decisions, from simple perception to memory, consumer choices and health economics, and the models have been used to investigate an equally wide range of effects, such as of aging, workload capacity, alcohol use, and sleep deprivation. A fundamental aspect of decision making in all paradigms is the need to balance speed against caution. Independently, personality psychology has revealed a stable individual trait, termed need for closure (NfC), reflecting the variation between people on their need to finish tasks, for example. We searched for links between peoples' NfC and the way they set their speed-accuracy tradeoffs during a perceptual decision making task. We identified links between the model parameters which govern speed-accuracy tradeoffs and data from a brief NfC survey.

Email: Babette Rae, babette.rae@uon.edu.au

(1197)

Reflective Exploratory Decision-Making in Older Adults. NATHANIEL BLANCO, *University of Texas*, A. ROSS OTTO, *New York University*, KIRSTEN SMAYDA, *University of Texas*, BRADLEY LOVE, *University College London*, W. TODD MADDOX, *University of Texas*. — Normal aging is associated with qualitative changes in decision-making. Older adults show deficits in some reflective decision-making tasks, but in others they exhibit enhanced performance compared to younger adults. Exploration is a key aspect of decision-making for which reflective and reflexive strategies produce qualitatively different behavior, and thus its examination may provide important insight into the cognitive effects of aging. Reflexive strategies lead to unstructured, often suboptimal, exploratory choices. Reflective strategies, conversely, utilize uncertainty about the state of the environment to plan exploratory choices when they are more valuable. We investigate effects of aging on exploratory decision-making by comparing exploration strategies between older and younger adults. We find that older adults are less likely to engage in reflective exploratory strategies, leading to worse performance than younger adults. We propose that cognitive decline associated with normal aging disrupts the use of rich task representations that support optimal exploratory decision-making.

Email: Nathaniel Blanco, nathanblanco@gmail.com

(1198)

Escape Decision-Making Under Real Fire and Simulated Fire Conditions. YANG GAO and HONG LI, *Tsinghua University* (Sponsored by Hua Shu). — The present research aims to compare mice's escaping decision-making under real and simulated fire conditions. The research consists of a training and two main studies. The training aims to train the mice to remember and then forget how to leave a maze. Both of the two main studies adopt 3 (condition: real fire, simulated fire, common) X 2 (memory: remembered and forgotten) mixed design. The dependent variable is escaping

decision-making, which is examined by escaping time and exit choice. The main findings are: (1) Trained mice under real fire condition escape from the fired maze significantly faster than those under simulated fire condition no matter before or after forgetting. (2) Trained mice escape from maze significantly faster than untrained mice under both real and simulated fire conditions. (3) Trained mice under real fire condition tend to choose familiar but smoky exit, but under the other two conditions both prefer to choose unfamiliar and non-smoky exit. In conclusion, trained mice under real fire condition show apparent intuitive decision-making, whereas those under simulated fire condition prefer to analytical decision-making.

Email: Yang Gao, gaoyang2009012361@163.com

(1199)

Memory-Based Decision Making Across the Life Span. ANIKA JOSEF, *Center for Adaptive Rationality*, RUI MATA, YEE LEE SHING, THORSTEN PACHUR and RALPH HERTWIG, *Max Planck Institute for Human Development*. — Episodic memory functioning undergoes profound reorganization over the life span with rapid increases during childhood and steady declines from adulthood to old age. These changes likely affect decision making in situations in which information is not conveniently presented to decision makers but rather needs to be retrieved from memory. We present results of studies investigating the role of memory demands in determining the developmental patterns of memory-based decision making from childhood up into old age. More concretely, we compared a group of children, young and older adults in two decision conditions varying in their memory demand. The studies suggest that age differences in decision performance are moderated by memory demands, with especially older adults showing poorer performance with increasing memory demand. Computational modeling of decision strategies suggests that age differences in both strategy selection and execution may underlie performance differences in memory-based decision making.

Email: Anika Josef, josef@mpib-berlin.mpg.de

(1200)

Looks Like a Bad Sign: Illusory Negative Correlation Between the Outcomes of Choice Options. DEBORAH MARCIANO-ROMM, *The Hebrew University of Jerusalem*, ASSAF ROMM, *Havard University*, SACHA BOURGEOIS-GIRONDE, *Universite Paris II and Institut Jean Nicod*, LEON Y. DEOUELL, *The Hebrew University of Jerusalem* (Sponsored by Ram Frost). — In situations of choice between uncertain options, we often get feedback on the outcomes of both the chosen option and the unchosen option (the alternative). We hypothesized that people see a good (bad) alternative's outcome as a bad (good) sign regarding their own outcome, when the two outcomes are in fact uncorrelated. In three experiments, subjects repeatedly chose between two boxes. In Experiments 1 and 2 the alternative's outcome was presented first, and we assessed the individuals' prediction of their own outcome. We found that even though the two outcomes were uncorrelated, people tended to see a good (bad) alternative outcome as a bad (good) sign. Importantly, this illusory negative correlation

affected subsequent behavior. In Experiment 3, subjects had to predict the alternative outcome after seeing their own. Our results show that the effect disappeared and suggest that this illusory negative correlation is influenced by motivation.

Email: Deborah Marciano-Romm, dvorah.marciano@gmail.com

POSTER SESSION II
Friday Noon
Grand Ballroom, Long Beach Convention Center
Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• AUDITION •

(2001)

An Information-Space Analysis of Perception of Object Length by Sound. DREW ABNEY, *University of California, Merced*, JEFFREY WAGMAN, *Illinois State University*. — Previous research suggests that auditory perception of length is constrained by an object's mechanical properties. The current study further tests this hypothesis by formalizing auditory perceptual learning of length using the theory of direct learning. We investigated whether an information space constructed from variables relevant to perception of length by touch is applicable to perception of length by audition. Participants reported the length of occluded wooden rods dropped onto a hard surface in a pre-test, practice, and post-test. In Experiment 1, veridical feedback (specifying an optimal locus in information space) was provided during practice. In Experiment 2, veridical feedback was provided during the first practice session, and false feedback (specifying a different locus in information space) was provided during a second practice session. In both experiments, participants moved toward the locus specified by feedback. The results suggest that perception of length by touch and by audition have similar informational bases.
Email: Drew Abney, dabney@ucmerced.edu

(2002)

Foreperiod and Range Effects on the Categorization of Brief Time Intervals. VINCENT LAFLAMME and SIMON GRONDIN, *Universite Laval*. — In an interval categorization task, when multiple periods preceding a brief interval to be timed (foreperiods-FPs) are randomly varied within blocks of trials, longer FPs result in longer perceived duration. We tested if the distribution of FPs (range) influences this FP effect. Four FPs were distributed over a 150-, 300-, or 900-ms range, with the mid-point of these distributions remaining the same (1050 ms). The main results indicate that the effect of the length of variable FPs on perceived duration was much stronger in the 900-ms range condition. More specifically, this effect is due to the differences between the shortest FPs. The results also reveal that when FPs are kept constant within blocks of trials, there were more short responses in the 300-ms condition than in the other range conditions. One interpretation of the main results (range effect) is that a wider distribution leads to an increased attentional uncertainty.
Email: Simon Grondin, simon.grondin@psy.ulaval.ca

(2003)

Any Tom, Dick, or Harry Will Do: Hearing One's Own Name Distracts No More Than any Other in a Cross-Modal Oddball Task. JESSICA KORNING LJUNGBERG, *Umeå University*, FABRICE PARMENTIER, *University of Balearic Islands*, ERIK MARSJA, *Umeå University*, DYLAN M.

JONES, *Cardiff University*, GREG NEELY, *Umeå University*. — Research of the distractor value of hearing the own name has shown that this self-referring stimulus captures attention in an involuntary fashion and creates distraction. The behavioral studies are few and the outcomes are not always clear cut. In this study, the distraction by 'own names' compared to control names (controlling for familiarity, gender and number of syllables) or matched neutral words was investigated in 2 experiments using a cross-modal oddball task. Participants completed a visual categorization task while exposed to either a sine wave tone as a standard stimulus (75% of the trials) or unexpected auditory deviants (12.5% trials for each name category in Experiment 1, and 10 % for each name category and for words in Experiment 2). Results showed deviant distraction by exposure to both the irrelevant word, own and the control name compare to the standard tone but no differences were found showing that the own name captured attention and distracted the participants more than an irrelevant word or a control name. The results elucidate the role of the own name as a potent auditory distractor and possible limitations with its theoretical significance for general theories of attention are discussed.
Email: Jessica Korning Ljungberg, jessica.korningljungberg@psy.umu.se

(2004)

Change Deafness for Identity and Location of Environmental Sounds. KELLY DICKERSON, *Binghamton University, SUNY*, JEREMY GASTON, *US Department of the Army*. — Change deafness is the inability of listeners to notice large changes in auditory scenes. Change deafness has been attributed to failures of attention and memory, and while they likely play important roles, current work suggests that informational factors such as sound source similarity and uncertainty can account for specific patterns of change errors. Using an AX same-different task, listeners judged whether a change occured across sequentially presented auditory scenes (1000ms duration, 750ms ISI) and indicated the location of the change. Auditory scenes were constructred from a set of 25 enviornmental sound sources (characterized in a separate study). Results demonstrated that identification and localization errors were influenced by the degree of similarity between the changing sound source and the background. These findings are consistent with speech and music studies demostrating that similarity is an important informational factor influencing performance on complex listening tasks.
Email: Kelly Dickerson, dickersonkelly23@gmail.com

(2005)

Central Auditory Processing Disorders in Children With Specific Language Impairments. SOPHIE DONNADIEU, *Université de Savoie, Laboratoire de Psychologie et Neurocognition (UMR CNRS 5105)*, AURÉLIA RISSO, ESTELLE GILLET-PERRET, MARIE-ANGE N'GUYEN and

FANNY MEUNIER, *Laboratoire L2C2, CNRS - UMR 5304* (Sponsored by Elsa Spinelli). — Central Auditory Processing Disorders refers to difficulties in the processing of central auditory information and potentially interfering with the development of different cognitive functions such as language (ASHA, 2005). This study aimed at investigating if the central auditory processes are specifically impaired in children with Specific Language Impairment (SLI). Six tasks were selected (temporal integration task, frequency discrimination task, identification and recognition of auditory of environmental sounds, auditory stream segregation task and central masking task) to assess central auditory processes in thirty nine children with SLI and compared to developing children. Verbal skills were evaluated on three levels: comprehension, vocabulary and phonological awareness. Results confirmed the central auditory processes we are testing here are specifically impaired in children with SLI. In addition, vocabulary and phonological awareness performances correlated with auditory skills, highlighting links between central auditory processing and language development.
Email: Sophie Donnadieu, sophie.donnadieu@univ-savoie.fr

(2006)

Temporal Dynamics of Learning Birdsong Identification: Does Training Sequence Matter? COURTNEY RICE, BARBARA ANN CHURCH, LESLIE KLYACHMAN and EDUARDO MERCADO III, *University at Buffalo, SUNY*. — Research has demonstrated that progressive training produces the most efficient auditory perceptual learning in simple discrimination tasks, and it has been hypothesized that this advantage reflects gradual representational change (Church et al., 2013). However, others assume it reflects an attentional spotlighting of the relevant feature for the discrimination (Pashler & Mozer, 2013). If the advantage occurs because of the way perceptual representations change, progressive training should also be advantageous for constructing the representations necessary for perceptual identification to occur, and it should be better than anchored training. To answer this question, we assessed perceptual learning in a birdsong identification task following progressive, constant, anchored, and anti-progressive training. Performance in the task improved regardless of training. However, progressive training produced more accurate performance and greater generalization than other conditions, suggesting that it fosters advantageous representational change. The findings are discussed in terms of perceptual learning and the development of perceptual expertise.
Email: Courtney Rice, clrice2@buffalo.edu

(2007)

Individual Differences in the Adaptive Use of Auditory Information. ANDREW LOTTO and KATHY M. CARBONELL, *University of Arizona*. — Listeners differ dramatically in their ability to comprehend speech when the signal is degraded whether due to hearing impairment, extraneous noise or other types of deleterious signal manipulation. One potential source for these differences is individual variation in the ability to determine what characteristics of sound are most informative for a particular perceptual task and to adaptively change the weighting of dimensions to take optimal advantage of the relative informativeness. We will present data from auditory categorization tasks in which the informativeness of the available acoustic cues for accurate categorization is manipulated. The results provide evidence of individual differences in adaptive use of auditory information and give hope for the prospect of developing a measure of auditory flexibility that may be predictive of speech perception performance in challenging listening conditions.
Email: Andrew Lotto, alotto@email.arizona.edu

(2008)

Absolute Pitch Ability Is Not Related to Pitch Discrimination. STEVEN HOLLOWAY, K. JACOB PATTEN and MICHAEL K. MCBEATH, *Arizona State University*. — Absolute pitch is the ability of a listener to accurately identify the scale note name of a single pitch, without an external reference tone. This ability is related to musical training, requires knowledge of scale note names, and has been posited to be related to the ability to detect tonal differences. In contrast, pitch discrimination is the ability to detect minute differences between tones. This ability has not been empirically shown to be related to musical training and does not require knowledge of scale note names. Here, we tested both musically trained and untrained listeners, and we compared their absolute pitch accuracy with their pitch discrimination ability. Our results confirmed that neither years of musical training nor absolute pitch accuracy are related to the ability to discriminate between pitches. These findings support the notion that absolute pitch and pitch discrimination are two distinct and unrelated types of pitch judgment.
Email: Steven Holloway, srh@asu.edu

(2009)

Does Location Matter? Spatial Location and Cross-Modal Stroop. DANIELLE A. LUTFI-PROCTOR and EMILY ELLIOTT, *Louisiana State University*. — Past research has suggested empirical differences between the patterns of findings observed in the classic Stroop task and in a cross-modal variant with visual targets and auditory distractors. The current research explored the underpinnings of these differences, by varying the location of the auditory distractors in the cross-modal paradigm. Typically, in classic Stroop, the target and distractor are in the same spatial location. However, in cross-modal Stroop, the target and distractor are spatially separated, due to the use of headphones or speakers for the presentation of the auditory distractors. This spatial separation between the target and the distractor may be responsible for the observed empirical differences between the two versions of the task. Alternatively, distraction in the auditory modality may hold special properties that make it distinct from visual distraction, regardless of the spatial location. We investigated these options, to gain an understanding of the mechanisms of Stroop interference.
Email: Emily Elliott, eelliott@lsu.edu

(2010)

Sound-Source Perception of Small Arms Fire: The Effects of Hearing Protection Devices on Recognition. JEREMY GASTON, *US Army Research Laboratory*, KATHERINE PEITSCH and STEPHANIE NAGEL, *Towson University*, KELLY DICKERSON, *US Army Research Laboratory*. — An important consideration in the perception of complex natural sound events is how perception may be affected by the use of personal protective equipment (PPE) such as hearing protection devices (HPD's). These types of devices can effectively change the head-related transfer function (HRTF) of the listener, and have been shown to negatively impact localization abilities. These changes should also influence the ability to recognize and identify sound sources. The present study investigated the effects of non-linear HPD's on the recognition of small arms weapons fire. Listeners judged weapon type based on presentations of one and three-shot contexts, for bare-head and HPD conditions. As expected, significantly better performance was observed for bare head conditions, but performance did not differ across one and three-shot firing contexts. These results are discussed in the context of the changes in sound information as a function of HPD use.
Email: Jeremy Gaston, jgaston2@gmail.com

• SPATIAL COGNITION I •

(2011)

Effects of Scale on Sex Differences in a Virtual Water Maze. LACE M. PADILLA, SARAH CREEM-REGEHR, JEANINE K. STEFANUCCI and ELIZABETH CASHDAN, *University of Utah*. — The virtual Morris water maze is a task adapted from the animal spatial cognition literature and has been studied in the context of sex differences in humans. Findings from the standard design suggest that women are more likely to use proximal cues to solve the maze, whereas males tend to rely on distal cues. However, the findings of sex differences are mixed, possibly due to variations in the scale of the space and the cues provided. We explore the question of scale and context by presenting participants with an outdoor virtual Morris water maze that is five times the size of the mazes previously tested. Initial results suggest a male advantage when asked to return to the location of a hidden target. The results are compared to performance in the same virtual environment presented at a smaller scale and to large and smaller environments with varied proximal and distal cues.
Email: Sarah Creem-Regehr, sarah.creem@psych.utah.edu

(2012)

Self-Generated Gestures Selectively Influence Navigation Performance and Spatial Memory. ALEXIA GALATI, *University of Cyprus*, STEVEN M. WEISBERG and NORA S. NEWCOMBE, *Temple University*, MARIOS N. AVRAAMIDES, *University of Cyprus*. — We examined whether the gestures produced while studying route directions facilitate navigation performance and the resulting memory representations for the environment. Thirty-six participants studied route descriptions, producing congruent

gestures for one route and keeping their hands still for another. When participants had gestured at study they made more errors and took longer to navigate the route in a virtual environment than when they hadn't gestured. Despite this surprising decrement in navigation performance, gesturing did not impair memory performance. Instead, at least for one route, participants' memory performance was worse when they couldn't gesture, particularly for participants with lower spatial ability scores. Thus, gesturing intentionally while encoding route descriptions could tax cognitive resources or introduce ambiguities in the initial representation that lead to less accurate and less efficient navigation. Nevertheless, recovering from those navigation errors may improve the resulting memory representation, especially for navigators with low spatial abilities.
Email: Alexia Galati, alexia.galati@gmail.com

(2013)

Characterizing Exploration Behavior in a Large-Scale Desktop Virtual Environment. KYLE GAGNON, JEANINE STEFANUCCI, SARAH CREEM-REGEHR and ELIZABETH CASHDAN, *University of Utah*. — Like many species, humans explore their environment in complex patterns that shape the information available for encoding the spatial layout. In contrast, spatial memory and navigation studies often limit the participant's experience with a space to a single path or view, which is inconsistent with natural exploration. In the current study, participants freely explored a large desktop virtual environment in search of 5 objects, returned to the start, pointed to each object, and then navigated back to the objects. Males exhibited more directional persistence than females (i.e., maintaining a constant heading more frequently), and females had a higher proportion of pauses in their exploration patterns. In addition, more directional persistence in one's exploration predicted more accurate pointing performance. These results emphasize the importance of exploration patterns in spatial memory and navigation.
Email: Jeanine Stefanucci, jeanine.stefanucci@psych.utah.edu

(2014)

Cue Integration During Navigation. LORI SJOLUND and JONATHAN KELLY, *Iowa State University*, TIMOTHY MCNAMARA, *Vanderbilt University*. — Navigation is influenced by body-based self-motion cues that are integrated over time in a process known as path integration, and also by environmental cues such as landmarks and room shape. This project explored whether humans combine path integration and environmental cues when returning to a previously visited location. Participants walked an outbound path in an immersive virtual environment before attempting to return to the path origin. Path integration and an environmental cue were both available during the outbound path, but experimental manipulations created single-cue and dual-cue conditions during the return path, including a dual-cue conflict condition in which the environmental cue was displaced before walking the return path. Response variance when returning to the path origin was reduced on dual-cue compared to single-cue trials. Furthermore, weights assigned

to each cue (inferred through responses on dual-cue conflict trials) were statistically optimal. These findings indicate that humans integrate multiple spatial cues during navigation.
Email: Jonathan Kelly, jonkelly@iastate.edu

(2015)

Remembering What and Where: The Relationship Between Components of Navigation Ability and Working Memory. STEVEN WEISBERG and NORA NEWCOMBE, *Temple University*. — Route integration tasks require participants to learn two separate areas of an environment and then either infer how the areas are positioned with respect to each other, or learn the positioning through experiencing a connecting route. Recent work has shown individual differences both for pointing to locations within one area, and between the two areas. Cluster analyses on the two types of pointing tasks yielded three groups: Integrators, performing well on both types of tasks, Non-Integrators, performing well on the within-route pointing trials but poorly on the between-route trials, and Confused, performing poorly on both. Good and poor navigators engage different working memory processes to encode and store information about large-scale environments. We sought to extend these findings by correlating navigation performance on between- and within-route pointing with verbal and spatial working memory, and whether different navigators associate buildings with the routes on which they first appear. Findings suggest that Integrators and Non-Integrators have superior verbal working memory capacity to the Confused group. Spatial working memory and route-association knowledge declined linearly with overall knowledge of the environment.
Email: Steven Weisberg, smweis@temple.edu

(2016)

Weighted Integration of Landmarks in a One-Dimensional Spatial Search Task. YU DU and NEIL MCMILLAN, *University of Alberta*, CHRISTOPHER MADAN, *Boston College*, MARCIA SPETCH, *University of Alberta*. — Using multiple landmarks can improve the precision of goal localization but can result in conflicting information if any of the landmarks move. We investigated how human adults use multiple landmarks to locate a goal and how they resolve conflicts when landmarks are shifted. Participants searched for a hidden goal location on a line between two distinct landmarks on a computer screen. On baseline trials, the location of the landmarks and goal varied on the screen but the landmarks always appeared in the same locations relative to the goal, with one landmark always closer to the goal. Some baseline trials provided one landmark and some provided both. On probe trials in which the landmark locations were shifted away from the previous-learned goal location, participants' search locations shifted part way toward the nearer landmark. This suggests that participants showed a weighted integration of the two landmarks when they provided conflicting spatial information.
Email: Yu Du, du5@ualberta.ca

(2017)

Distance Perception in Virtual Environments Improves With Visual Feedback and Transfers Across Environments. ZACHARY SIEGEL and JONATHAN KELLY, *Iowa State University*. — Distances in virtual reality tend to be underperceived relative to real world scenes, and consequently, the validity of training or research conducted within virtual environments could be called into question. However, a brief period of walking through the virtual environment with visual feedback causes large improvements in blind walking judgments of egocentric distance. This project examined whether such improvements gained in one virtual environment would carry over to another, novel, virtual environment. Participants performed blind walking distance judgments before and after walking through one virtual environment with continuous visual feedback, and then immediately performed additional blind walking judgments in a second virtual environment. Results show large improvement in distance judgments as a result of walking with visual feedback, and very high transfer of improvement between virtual environments, suggesting that walking through the virtual environment with feedback improves distance perception in virtual reality irrespective of the displayed environmental.
Email: Zachary Siegel, zsiegel@iastate.edu

(2018)

Negative Priming of Spatial Relations. ZACHARY HIMMELBERGER and EDWARD MERRILL, *University of Alabama*. — When participants locate a target in a place that was recently occupied by a distracter, there is often an increase in reaction times relative to a place that was not occupied by a distracter. This is commonly referred to as location negative priming. We conducted two studies to evaluate whether location negative priming was associated with the absolute physical location in a display or if it might be observed for relative locations as well. Across the two studies, participants searched for a target letter presented with distracters that were arranged in triangle shapes and square shapes. We manipulated whether the entire arrangement of stimuli remained in the exact location or moved as a unit, keeping the relative locations and overall configurations the same. Overall, we found strong evidence for the negative priming of relative location in addition to absolute location, although there were some limits to that observation.
Email: Edward Merrill, emerrill@bama.ua.edu

(2019)

Un-Informed Consent: Enhancing Comprehension and Memory. STEPHANIE SANTISTEVAN and RUTH DAY, *Duke University*. — Millions of people sign informed consent forms for research studies every year. However comprehension and memory are often poor and it is difficult to improve them. The current research examined both a standard informed consent form and another version of the same information designed to enhance comprehension and memory (based on well-known principles of cognition). Participants studied one of the versions and then were tested in comprehension and memory tasks. Those who saw the Enhanced version understood and remembered key information such as the

purpose of the study and its potential risks better than those who saw the Standard form. Tests of metacognition were also revealing – the Enhanced group had a more accurate grasp of how well they understood the information. The Standard group had a double disadvantage – they thought they understood the information better than they did, yet their actual knowledge was poor.
Email: Stephanie Santistevan, sjs59@duke.edu

(2020)

The Role of Agency in Visual Perspective Taking. JAMES CLINTON, AIDAN OSTERBY and JOSEPH MAGLIANO, *Northern Illinois University*. — People spontaneously adopt the visual perspectives of others (i.e., understand that their spatial orientation can differ from others) in response to seeing others acting on the social world. We explored social factors that potentially influence the degree to which one engages in visual perspective taking. Specifically, we examined the impact of three social factors on visual perspective taking: the mere presence of an agent, the extent to which that agent acts upon his environment, and the extent to which that agent invites social interaction with the viewer. Experiment 1 replicated Tversky & Hard (2009) such that the presence of an agent increased the proportion of participants that adopted the agent's visual perspective. Experiment 2 found that increasing the level of agent interactivity increased the odds that participants adopted the agent's visual perspective. Our findings demonstrate that the likelihood of visual perspective taking incrementally increases as we perceive increased levels of social interaction.
Email: James Clinton, jclinton@niu.edu

(2021)

Does Movement Experience Influence Navigation Strategy in a Virtual Point-to-Origin Task? ALEXANDRA KITSON, *Simon Fraser University*, DANIEL SPROLL, *Universität Osnabrück*, BERNHARD E. RIECKE, *Simon Fraser University*. — We can navigate and orient ourselves effortlessly through the world, yet navigation becomes cognitively demanding when in a virtual environment. Klatzky and colleagues (1998) discovered a phenomenon connecting spatial updating and spatial representations in different reference frames where, in a point-to-origin paradigm, participants experienced a virtual visual-flow environment. Here, the "turners" used an egocentric reference frame (self-to-object) and the "non-turners" used an allocentric reference frame (object-to-object). One factor of spatial navigation yet to be investigated is the potential influence of movement expertise, and our goal is to determine if there is a correlation with strategy preference. We used a virtual point-to-origin task from a previous study (Sproll, 2013) to collect data from 15 movement experts (dancers). Our results show the preferred strategy of participants is split between non-turners and no preference. Results suggest movement experience is more closely correlated with an allocentric, rather than an egocentric, spatial representation.
Email: Alexandra Kitson, akitson@sfu.ca

(2022)

To Rotate, or Not To Rotate: Strategy Differences in Mental Rotation. AARON L. GARDONY and HOLLY TAYLOR, *Tufts University*, TAD BRUNYE, *Tufts University & U.S. Army*, GEORGE WOLFORD, *Dartmouth College*. — Mental rotation (MR) shows characteristics similar to physical rotation (Gardony, Taylor, & Brunyé, 2014), including often recruiting motor processing. What does a motor strategy for MR afford and what factors bias motor strategy selection? In the present study, participants completed a 3D MR task and matching physical rotation (PR) task utilizing a handheld sensor. During PR, one group rotated figures with the sensor, receiving visual feedback, and the other rotated the sensor in the same direction as their mental rotation without feedback. First, results replicated previous findings; in both cases PR yielded fewer errors than MR and real-time angular disparity converged to a canonical difference rather than a match. Second, we distinguished participants as motoric and non-motoric rotators using their PR data. Motoric rotators made fewer errors than non-motoric in both the MR and PR tasks. These findings suggest that motor strategy selection and physical interaction facilitate mental imagery manipulation.
Email: George Wolford, wolford@dartmouth.edu

(2023)

3-Mountains, Impossible Responses: Blind & Blindfolded More Accurate Than Sighted. HSIN-YI CHAO, *Taiwan Non-Visual Aesthetics Education Association*, JOHN M. KENNEDY, *University of Toronto*. — We point out that in addition to the well-known 4 possible response options in the Piaget 3-Mountains test of spatial cognition, there are 2 impossible options. (The 3 mountains are a cone, a cube and a sphere. There are 4 vantage points (Front, Left, Back, Right). But there are 6 ways to order a cone, a cube and a sphere. 2 orders do not show possible vantage points.) We asked blind, blindfolded and sighted adults to judge the vantage points (Front, Left, Back, Right or Impossible) of the 6 orders. The blind and blindfolded were more accurate than the sighted, though with longer reaction times. Early blind and later blind adults had similar performances. Evidently, blindness does not mean low spatial ability. Of interest, the difficulty of the 6 options was similar across the 3 groups, which suggests the groups were using the same kinds of spatial strategies.
Email: John Kennedy, kennedy@utsc.utoronto.ca

(2024)

Using Space to Understand Time. JENNIFER KOLESARI and LAURA CARLSON, *University of Notre Dame*, BENJAMIN BERGEN, *University of California, San Diego*. — We use space to understand time. For example, judging that one event occurred later than another is facilitated by mentally placing the events on a timeline. Our research examines how this timeline maps onto the parameters of a spatial reference frame, including direction (the axis runs from left to right, or front to back), and origin (defined egocentrically by the body and hands or allocentrically by external space). Participants made temporal judgments of pictures while their hands were horizontally oriented, along a either left/right axis or front/back axis. Hands were crossed or uncrossed. These

manipulations dissociated egocentric and allocentric space, and allowed us to assess the source of the origin. Coding based on space was observed for both the left/right and front/back axes, while the hands made an additional contribution for the left/right axis only, suggesting flexibility in encoding time according to the horizontal axes of a spatial reference frame.
Email: Laura Carlson, lcarlson@nd.edu

(2025)

The Influence of Doorways and Walls on Spatial Memory Formation. JESSE SARGENT, DEVIN KELLIS and DOUG HOWELL, *Francis Marion University*, LAUREN L. RICHMOND and JEFFREY M. ZACKS, *Washington University in St. Louis*. — We asked two questions about how people form mental representations of environmental scale spaces based on route experience. First, can we find behavioral evidence that these representations are organized into regions or chunks? Second, is the accuracy of these representations affected by viewing a route twice in the same direction vs. twice in opposite directions? Participants memorized the locations of target objects named in videos shot by a cameraperson walking around building sized environments. Objectively defined chunks were identified by the experimenters based on environmental features (doorways and boundaries between hallways). In a pointing memory task participants showed lower absolute error for the angles separating within chunk pairs compared to between chunk pairs, controlling for linear path distance between object pairs. There was no effect of the route direction manipulation. Results suggest that doorways and turns can lead to a hierarchical memory representation of an environment after just two viewings.
Email: Jesse Sargent, jquents@gmail.com

• ASSOCIATIVE LEARNING •

(2026)

Functional Hemispheric Asymmetry in Sequence Learning and Consolidation. KAROLINA JANACSEK and LASZLO SKULTETI, *Eotvos Lorand University*, AMBRUS GEZA GERGELY, PAULUS WALTER and ANDREA ANTAL, *Georg-August University of Goettingen*, DEZSO NEMETH, *Eotvos Lorand University*. — Sequence learning is essential in everyday life from childhood to late adulthood; it underlies the acquisition of motor, cognitive, and social skills. Previous studies have shown the involvement of the fronto-striatal circuits in this type of learning. The aim of the present study was to investigate the specific role of the prefrontal cortex (PFC) in sequence learning and consolidation. Healthy young adults performed a probabilistic sequence learning task. Anodal transcranial direct current stimulation over the left or right dorsolateral PFC was applied during the training in order to modify learning-related cortical plasticity in the targeted brain regions by increasing neural excitability. Performance was tested after a 2-hour stabilization and a 24-hour retention period. We found that the higher engagement of the right PFC led to enhanced sequence learning. In contrast, the higher engagement of the left PFC led to a weaker performance after

the 24-hour delay suggesting disturbed consolidation. These results highlight an interhemispheric competition between the underlying memory systems.
Email: Karolina Janacsek, janacsekkarolina@gmail.com

(2027)

Cerebral Bases of Re-Learning: An fMRI Study on Picture-Word Association Learning. PATRICIA ROMAN, *The Pennsylvania State University*, SONJA A. KOTZ, *Max Planck Institute for Human Cognitive and Brain Sciences.* — In the present study, we put forward the concept of re-learning to account for learning situations that cannot be fully explained by traditional learning distinctions such as second-language acquisition. We assume that re-learning is based on the re-arrangement of associative connections within an established network and, most likely, a change in representations that belong to the native language of second language learners. To address this question, we presented picture-words pairs with different levels of relatedness to be learnt. Using mixed-design fMRI and rs-fMRI, we replicated previous results of the language-acquisition literature. However, we failed to find greater activation as repetitions increased. Comparison of pre- and post-learning resting state showed connectivity changes associated with a conflict score, but not with the learning slope. Results suggest, first, that a mechanism similar to that found in other language-acquisition studies might be involved at least in early learning phases; and, second, that executive control is a crucial mechanism involved in re-learning. Future studies will have to focus on the consequences of re-learning on previously acquired representations.
Email: Patricia Roman, per3@psu.edu

(2028)

Effects of Trial Numbers of Forced Swim Procedure on Conditioned Fear Renewal in Rats. HARUKA MIYASHITA, AKIRA KURIHARA and KOSUKE SAWA, *Senshu University* (Sponsored by Sadahiko Nakajima). — Forced swim procedure has been used to build an animal model of mental disorder such as depression and PTSD. The aim of present experiment was to explore that the impact of forced swim procedure on fear retention by context change and whether that fear retention is varied by manipulating the number of forced swim trial. In present study, forced swim procedure for one-day or five-days was conducted before extinction phase in ABA fear renewal. In testing for fear renewal, subjects with one-day forced swim procedure showed attenuated fear extinction and enhanced renewal. On the other hand, five-days forced swim had no impact on fear extinction and renewal. These results suggested that the effect of forced swim procedure have multiple aspects on contextual control and conditioned fear, and that unexpected single forced swim experience strengthens retention of memory about context of acquisition fear response.
Email: Haruka Miyashita, hmiyashita@psy.senshu-u.ac.jp

(2029)

The Relation Between Navigation Strategy and Associative Memory. CHI NGO, NORA NEWCOMBE, INGRID OLSON and STEVEN WEISBERG, *Temple University*. — Previous

studies examining the relationship between navigation strategy and memory have yielded mixed results. Some studies found better memory performance by individuals who use a hippocampal-dependent (place) strategy compared to those who use a caudate-dependent (response) strategy (Bohbot et al., 2011). Other studies have found that navigation experts performed worse than controls on some memory tasks, but not on others (Woollett & Maguire, 2009; 2012). The current study examines how individual differences in navigation strategy relate to two associative memory tasks: object-location (OLT) and face-name tasks (FNT). We found that navigation strategy significantly correlated with OLT, but not with FNT, despite OLT and FNT being significantly correlated. Place strategy, compared to response strategy, was associated with higher OLT performance. Our findings suggest that the hippocampus' role in navigation might relate to its role in associative memory, but only when space is a central aspect of a given memory task.
Email: Ingrid Olson, iolson@temple.edu

(2030)

Time to be Reminded: Reminding and Memory Interference. JACOB H. NEGLEY and COLLEEN KELLEY, *Florida State University*. — Studying multiple items with a shared cue (e.g., A-B, A-D word pairs) typically results in worse memory as compared to studying control items with no shared cues, an interference effect often thought to be the result of response competition. However, recently Wahlheim and Jacoby (2013) have found that when people are reminded of the prior similar pair while studying the second pair, they show memory facilitation rather than memory interference. Here, in a retroactive interference paradigm, we ask whether the likelihood of reminding is increased when presentation time of the potentially interfering material is increased. If so, strengthening memory for the competitor may be offset by the benefits of reminding.
Email: Colleen Kelley, kelley@psy.fsu.edu

(2031)

Noticing Repetition and Detecting Change. JANE KOMSKY and COLLEEN KELLEY, *Florida State University*, LARRY JACOBY, *Washington University*. — A fundamental function of memory is noticing recurring events and detecting changes across time. Asch (1969) described a study where participants learned a list of number-letter pairs to criterion, then learned a second list of pairs. One of the pairs on the new list was repeated from the second list. Only those participants who noticed that the pair was a repetition benefited from the original learning. Participants who did not notice took as many trials to learn the old pair as they did to learn a completely new pair. We attempted to replicate Asch's study, and extended it to a situation where one pair on the new list bears an interference relation to a pair on the original list. Reminding appears to play a critical role in learning.
Email: Jane Komsky, komsky@psy.fsu.edu

(2032)

Variability in Irrelevant Elements Helps Learning in Motor Analog for Reading. TANJA ROEMBKE, MICHAEL FREEDBERG, BOB MCMURRAY and ELIOT HAZELTINE, *University of Iowa*. — Variability in irrelevant elements helps acquisition in statistical learning (Gómez, 2002; Rost & McMurray, 2009). Such principles may impact education. For example, when children learn to read, variability in consonants helps them acquire spelling/sound mappings for vowels (Apfelbaum, Hazeltine and McMurray, 2012). However, school-based work is costly, and existing laboratory paradigms do not always capture the complex quasi-regular and many-to-many mappings of domains like reading, making it difficult to isolate new principles. We developed a motor learning analogue of spelling-to-sound learning. Adults learned to produce three-finger chord responses to four-element visual stimuli. Mappings linking stimuli to button pushes were one-to-one ("consonants"), or quasi-regular ("vowels), mapping one finger to two elements with overlapping sequences. Participants trained with a more variable consonants set performed better on familiar and novel chords than those trained with a less variable consonant set. This finding highlights the benefit of variability for acquiring complex stimulus-response associations, and offers a lab-based analog for exploring learning principles that might benefit education.
Email: Eliot Hazeltine, eliot-hazeltine@uiowa.edu

(2033)

Production Enhances Item, but not Associative, Learning. MARY PYC, *Washington University in St. Louis*, ANGELA JONES, *John Carroll University*. — We investigated the efficacy of the production effect (memorial benefit from reading aloud versus silently) in a paired-associate learning paradigm using a mixed versus pure list design. After studying Lithuanian-English word pairs, participants completed either a cue (Lithuanian), target (English) or associative recognition memory test. As assessed by hits, production enhanced both item (cue and target recognition) as well as associative memory; Lithuanian-English word-pairs read aloud were more accurately recognized than those read silently in mixed lists. However, as assessed by discrimination (hits minus false alarms and d'), production only benefited item memory; no production effect obtained on the associative recognition test. Furthermore, results demonstrated that the benefits of production on item memory were due to both a benefit to aloud items and a cost to silent items.
Email: Mary Pyc, mpyc@wustl.edu

(2034)

Effects of Successive Relearning on Retention: Does Initial Lag Matter? KALIF VAUGHN, *KATHERINE A. RAWSON and JOHN DUNLOSKY, *Kent State University*. — Retrieval practice improves subsequent memory. Numerous factors moderate the benefits of retrieval practice, including initial practice lag (i.e., the number of intervening items between two practice trials for a given item). The benefits of retrieval practice for retention are greater with a longer versus shorter practice lag; however, learning items with longer practice lags

requires more time and effort. If students plan on relearning information later, does the benefit of learning with a longer initial lag persist? In Session 1, participants learned items to criterion with varying practice lags. In subsequent relearning sessions, items were relearned to criterion at a fixed long lag in either 2-day or 1-week intervals. Results demonstrate that the benefits of a longer initial lag do not persist across relearning sessions. If successful relearning is to occur, learning with a longer initial practice lag is not time well spent.
Email: Kalif Vaughn, kalif.e.vaughn@williams.edu

(2035)
Grapheme-Color Synesthetes Demonstrate Superior Encoding. KATIE BANKIERIS and RICHARD ASLIN, *University of Rochester.* — Synesthesia is characterized by the perception of an additional sensory or cognitive stimulus when presented with a primary sensory or cognitive stimulus. Many studies have shown that synesthetes have heightened memory abilities for stimuli within their synesthetic domain but the cognitive mechanisms underlying this superior ability remain unknown. To investigate whether the synesthetic memory advantage stems from encoding, retrieval, and/ or maintenance we employed a 2-day shape-color learning task. We found a significant block effect across days for both synesthetes and controls, demonstrating that both groups learned during the experiment (BS= -.05, FS =29.90, pS <.001; BC= -.08, FC =84.48 , pC <.001). The block-by-group interaction was also significant, with controls' accuracy improving faster than synesthetes' (B = .02, F = 7.68, p < .01). Further analyses indicated that this interaction was due to synesthetes' superior color accuracy compared to controls on only the first two blocks of learning (B = -.21, F = 4.76, p = .05). These results suggest that synesthetes' memory advantage stems from superior encoding rather than retrieval or maintenance.
Email: Katie Bankieris, kbankieris@bcs.rochester.edu

(2036)
Effects of Working Memory Capacity on the Speed and Accuracy of Learning in Reinforcement Learning Models. ADNANE EZ-ZIZI, *University of Bristol*, SIMON FARRELL, *University of Western Australia*, DAVID LESLIE, *University of Bristol.* — Several groups have suggested that working memory (WM) supports reinforcement learning (RL) in partially observable Markovian environments (as captured in tasks such as the n-back and the 12-AX), and that such models could learn how to update and make us of WM contents. In particular, the limited capacity of WM may reflect the "optimal" use of WM, that which carries enough information about the recent history of events, but also constrains the amount of information that must be learned. We simulate a WM-based RL model with different WM capacities and show that there exists a trade-off between learning speed and learning performance: a smaller WM capacity speeds up initial learning, but limits long-run learning. We also show that an agent that gradually allocates its WM resources in response to its errors can better deal with this trade-off, and consider how this model might relate to human performance.
Email: Simon Farrell, simon.farrell@uwa.edu.au

(2037)
When Will You Learn? Evidence of Continuous Associative Learning During Lexical Processing. KEITH APFELBAUM, *Ohio State University*, BOB MCMURRAY, *University of Iowa.* — Learning science has deeply investigated what can be learned via associative learning, how this learning occurs and where it happens in the brain. Still unanswered, however, is when learning occurs during a learning event. Linking a stimulus with other stimuli or with a response requires that the stimulus be recognized and identified. These processes take time, during which multiple candidate representations are often active in parallel. Does learning wait until these processes finish, or does it occur continuously, while multiple representations compete for recognition? In three experiments, we investigated this using a novel word-referent learning task. We manipulated the relative timing of auditory and visual stimuli to control when, during stimulus processing, a participant can learn. When associative targets were available during processing, participants showed evidence of learned associations with competitor stimuli that were coactive during processing. This provides evidence of unsophisticated associative learning mechanisms that operate continuously in time.
Email: Keith Apfelbaum, apfelbaum.3@osu.edu

(2038)
Generalization Along an Attended and Unattended Dimension Following Category Learning in Humans. JESSICA LEE and EVAN LIVESEY, *University of Sydney.* — After discrimination training with stimuli that lie close together on a continuous dimension, animals tend to generalize along the dimension in a manner suggesting stimulus control via surface features of the stimuli, often displaying a peak shift effect. In contrast, humans performing a similar categorization task typically show a pattern of generalization suggestive of stimulus control via a relational rule, especially if participants are able to verbalize a difference between the categories. The current study examined rule- and feature-based generalization following category learning using two concurrent test measures: category judgements and typicality ratings. We additionally investigated whether these measures of category learning were dependent on attention, by directing attention to one of two diagnostic category dimensions. The results suggest that patterns of generalization based on rule- and feature-learning are sensitive to voluntary selective attention.
Email: Jessica Lee, jlee4128@uni.sydney.edu.au

(2039)
Dissociating Top-Down and Bottom-Up Theories of Autism Spectrum Disorders Using Bayesian Models. JOSEPH AUSTERWEIL, *Brown University*, KIRSTIE STANWORTH and ANNA FRANKLIN, *University of Sussex.* — There are many consequences of Autism Spectrum Disorders (ASDs), including effects on learning and the way in which those with ASDs experience the world around them. Two prominent theories of ASDs are a top-down hypothesis, where prior knowledge is underweighted, and a bottom-up hypothesis, where current observations are overweighted. We propose

Bayesian models of each theory for causal learning. The models produce divergent predictions, which we tested in a novel causal learning experiment. There were two phases: (1) a familiarization phase, where prior knowledge about the causal relation is established through experience, and (2) a test phase, where on each trial, an effect is active, the number of potential causes is manipulated, and subjects rate how probable one of the potential causes is to be a cause. The results support the top-down hypothesis: Subjects with ASDs used prior knowledge significantly less than typical participants when learning a rare causal relation.
Email: Joseph Austerweil, joseph_austerweil@brown.edu

(2040)

Are Humans Intuitive Scientists or Associative Learners? JONATHAN ROLISON, *Queen's University Belfast*. — Theorists have proposed that humans reason intuitively in accordance with Bayesian hypothesis testing principles in a manner akin to scientific reasoning. Ritualistic behaviors and superstitious beliefs seemingly contradict a view of humans as intuitive scientists. Such behaviors are more in-line with associative learning principles that can give rise to accidental associations. Subjects engaged with a computer-based slot machine in which the reels were surreptitiously linked by an underlying causal rule. Subjects adopted an associative learning strategy and responded on the basis of reward contingent on their actions. Subjects who were additionally told that a rule underlying the task if learned would maximize their earnings instead adopted a Bayesian hypothesis testing strategy. The contradiction of scientific reasoning and superstition in humans is resolved by the notion that associative processing is default in human cognition upon which intentional hypothesis testing processes must intervene.
Email: Jonathan Rolison, j.rolison@qub.ac.uk

• EMOTION AND COGNITION II •

(2041)

Distinction Between Fear and Surprise: An Interpretation-Independent Test of the Perceptual-Attentional Limitation Hypothesis. JUSTIN CHAMBERLAND and JOEL DICKINSON, *Laurentian University*. — The perceptual limitation hypothesis posits that the reason emotional facial expressions of fear are confused with surprise is due to their visual similarity, resulting from shared action units (AUs 1+2+5+26). However, fear may contain two AUs never encountered in surprise: the brow lower (AU4) and the lip stretcher (AU20). In a task that was independent of 'labelling' processes, the current study measured event-related potentials (ERP) while attention was directed toward the mouth or eyes area. When attention was directed toward the mouth, participants were capable of unconsciously detecting and processing the difference when the face included the activation of just AU20 or both (AU4+20) distinguishing feature(s), respectively. Differences did not reach significance when attention was directed towards the eyes region. This

provides support for the perceptual-attentional limitation hypothesis, suggesting that participants may not be capable of perceiving the difference presented by the brow lower.
Email: Joel Dickinson, jdickinson@laurentian.ca

(2042)

The Lateral Posing Bias in Social Exchange. MATIA OKUBO, KENTA ISHIKAWA, AKIHIRO KOBAYASHI and HIKARU SUZUKI, *Senshu University*. — People tend to turn their left or right cheeks to express or conceal emotions, respectively. It has been shown that perceived facial trustworthiness is positively correlated with the expressed positive emotions. In the present study, we examined the lateral posing biases in the social exchange using a trust game, where participants and their virtual partners trusted or deceived their counterparts to earn monetary reward. Participants (N=32) were asked to pose for a photograph and then performed the trust game. In the photo session, participants were instructed to pose as trustworthy as possible because their photograph would be shown to their partners in the trust game. There was a leftward posing bias, showing the left cheeks to the camera. This bias was weakly predicted by the deception scores in the trust game, suggesting that people deliberately used the left hemiface, which is connected to the emotional side of the brain (i.e., the right hemisphere), more effectively than the right hemiface to exploit others.
Email: Matia Okubo, mokubo@psy.senshu-u.ac.jp

(2044)

Positive Affect Enhances Association-Memory. CHRISTOPHER MADAN, SARAH M. E. SCOTT and ELIZABETH KENSINGER, *Boston College* (Sponsored by Alinda Friedman). — The influence of affect on association-memory is often attributed to arousal, but negative stimuli are typically used to test for these effects. While prior studies of negative affect on association-memory have found impairments, theories suggest that positive affect may have a distinct effect on memory, and may lead to enhanced association-memory. Here we tested participants' memory for pairs of positive and neutral words using cued recall, supplemented with a mathematical model designed to disentangle item- versus association-memory effects that may otherwise confound cued recall performance. In contrast to prior studies using negative stimuli, we found enhanced association-memory due to positive affect. These results provide further evidence that positive information is processed differently than negative and that, when examining association formation, valence as well as arousal must be considered.
Email: Christopher Madan, cmadan@ualberta.ca

(2045)

Effects of Emotion on Qualitative and Quantitative Aspects of Visual Long-Term Memory. WEIWEI ZHANG and WEIZHEN XIE, *University of California-Riverside*. — Emotional feelings modulate various cognitive processes. For example, events tend to be remembered with exceptional details and accuracy under negative emotion (i.e., flashbulb memories). The present study investigated whether this emotional memory effect was driven by qualitative (resolution)

or quantitative (capacity) aspects of memory? In a long-term color recall task, observers tried to memorize sequentially presented colored objects in a study phase and then recalled their colors on a continuous color wheel in a subsequent test phase. In the study phase, each object was memorized under one of three emotion conditions (negative, neutral, or positive) induced with a gray-scale International Affective Picture System picture. We found that, when encoded under negative emotion, long-term memory had enhanced mnemonic resolution. In contrast, the total number of retained objects was comparable across the three emotion conditions. The present findings suggest a novel account for flashbulb memories. That is, negative emotion boosts memory quality.

Email: Weiwei Zhang, weiwei.zhang@ucr.edu

(2046)

Switch Costs Conditionalized on Word Type: Examining the Representation of Concrete, Abstract, and Emotion Words. STEPHANIE KAZANAS and JEANETTE ALTARRIBA, *University at Albany, SUNY*. — The current study used a lexical decision task to investigate the impact of processing a target word (e.g., anger, an emotion word) when the previous word was either matched (e.g., fear, another emotion word) or not matched (e.g., basket, a concrete word; truth, an abstract word) on word type. All words were presented in English and matched on length, frequency, and response time (RT). Neither arousal nor grammatical class affected RTs. Overall, switch costs were highly dependent on the specific word type presented before the target (versus a general match or mismatch). Thus, these word type-specific switch costs are a direct function of the relationship between concrete, abstract, and emotion words. Moreover, an unexpected free recall test found a memory advantage for the emotion words. Results are discussed in terms of the ways in which these word types are stored and processed.

Email: Jeanette Altarriba, jaltarriba@albany.edu

(2047)

Effects of Emotional Experience, Valence, and Arousal in Lexical Decision. PAUL SIAKALUK, P. IAN NEWCOMBE and BRIAN DUFFELS, *University of N. British Columbia*, PENNY PEXMAN, *University of Calgary*. — Using the same stimuli, Kousta, Vinson, and Vigliocco (2009; yes/no LDT) and Yap and Seow (2013; yes/no LDT and go/no-go LDT) reported faster latencies for positive and negative words as compared to neutral words. However, the three types of words were not matched for emotional experience, which is the degree to which a word elicits or evokes an emotional experience (EE; Newcombe et al., 2012), nor for arousal. We collected EE ratings for the positive (M = 4.39), negative (M = 4.31), and neutral words (M = 2.60). Using multiple regression analyses, we observed that EE accounted for the most amount of unique latency variability in both yes/no LDT (sr = -.29, p < .001) and go/no-go LDT (sr = -.31, p < .001). We explain these results using the ideas of situated conceptualization and semantic richness.

Email: Paul Siakaluk, siakaluk@unbc.ca

(2048)

Is Emotion Word Processing Lateralized? Findings From a Hemifield Lexical Decision Task Using Emotion and Emotion Laden Words. JENNIFER MARTIN and JEANETTE ALTARRIBA, *University at Albany, SUNY* (Sponsored by Dana Basnight-Brown). — Research has examined emotion representation across brain hemispheres, but has unsystematically mixed emotion (describing an emotional state; e.g., love) and emotion laden words (simply evoking an emotion; e.g., cancer), despite the fact that processing differences across these word types have been empirically documented. The present study examined words of six types: positive emotion (e.g., happiness), negative emotion (e.g., hatred), positive emotion laden (e.g., blessing), negative emotion laden (e.g., prison), neutral abstract (e.g., chance), and neutral concrete (e.g., basket). Words and nonwords were intermixed in a lexical decision task using hemifield presentation (with chinrest). Results revealed a left hemisphere advantage for most if not all of these word types. Additionally, overall, the mean reaction time for positive words was faster than for negative or neutral words. Results are discussed in light of previous findings that support both left and right hemispheric advantages as a function of valence and arousal.

Email: Jennifer Martin, jennymartin422@gmail.com

(2049)

Love in a Second Language: Affective Processing in Bilingual Speakers. MARTA PONARI, DAVID VINSON and GABRIELLA VIGLIOCCO, *University College of London.* — Effects of emotion on words' processing are well established in monolingual speakers. Studies have further assessed whether affective features of words undergo the same processing in a native and non-native language yielding mixed results: some studies have found differences between L1 and L2 processing, attributed to the fact that a second language (L2) learned late in life would not be processed affectively, because affective associations are established during childhood. Other studies suggest that adult learners show similar effects of emotional features in L1 and L2. Here, in a lexical decision task on tightly matched negative, positive and neutral words, highly proficient English speakers from typologically different L1 showed the same facilitation in processing emotionally valenced words as native English speakers, regardless of age of English acquisition or frequency and context of English use.

Email: Gabriella Vigliocco, g.vigliocco@ucl.ac.uk

• **EYEWITNESS IDENTIFICATION** •

(2050)

Eyewitness Suggestibility in Familiar and Bizarre Crimes. MICHELLE DASSE and CHARLES WEAVER III, *Baylor University*. — We examined whether suggestibility in eyewitnesses is influenced by the familiarity of the crime (does the crime occur in an expected manner, or is it unusual in some way?), or the setting in which the crime takes place (is the environment familiar or bizarre?). Participants witnessed

eight staged incidents presented in eight one minute videos: two ordinary crimes in a familiar environment, two ordinary crimes in a bizarre environment, two bizarre crimes in a familiar environment, and two bizarre crimes in a bizarre environment. After each video, participants recalled the crime and answered six multiple choice questions about the incident. Three of the interview questions asked for accurate information about the crime and three questions included misleading suggestions. A final recognition test consisted of accurate, misleading, and distraction items. Participants were significantly more likely to accept the misleading suggestions about the bizarre crimes; environment did not influence eyewitness suggestibility. Our results suggest the nature of the event itself, and not the context in which it appears, plays an important role in eyewitness memory.
Email: Charles Weaver, III, charles_weaver@baylor.edu

(2051)

Comparing the Efficacy of Expert Testimony and Detailed Jury Instructions Under High and Low Cognitive Load. KARENNA MALAVANTI, *Carson-Newman University*, COURTNEY KURINEC and CHARLES WEAVER III, *Baylor University*. — We investigated jurors' ability to update knowledge following clarifying information about eyewitness memory. In Experiment 1, mock jurors read a trial summary describing the armed robbery of a convenience store and included eyewitness testimony, and rendered a verdict. Jurors then read the New Jersey "Henderson" juror instructions, watched the testimony of a memory expert, or read unrelated material, and rendered verdict. Jurors who received information regarding eyewitness memory (juror instructions or expert testimony) were more likely to vote not guilty at Time 2, indicating mock jurors are able to process initial information and make changes when new information becomes available. In Experiment 2, we used the same paradigm but jurors were under conditions of high cognitive load or low load. Mock jurors who did not receive eyewitness memory information were unlikely to change verdicts over time, however jurors under high load were more likely to vote the defendant guilty. Nonetheless, both low load and high load mock jurors who received eyewitness memory information were more likely to vote not guilty at Time 2, indicating reduced impairment of jurors who received memory information.
Email: Karenna F. Malavanti, Karenna_Malavanti@baylor.edu

(2052)

Proclivity to Choose on Face Recognition Predicts PTC on Lineups. MARIO BALDASSARI, *University of Victoria*, JUSTIN KANTNER, *University of California, Santa Barbara*, D. STEPHEN LINDSAY, *University of Victoria*. — Witnesses sometimes mistakenly identify innocent suspects in lineups from which the real culprit is absent, and those errors can have tragic consequences. Can we estimate in advance witnesses' susceptibility to making such errors (proclivity to choose, or PTC)? Three experiments tested the predictive utility of a face recognition test in which 50% of trials contained one studied face and one non-studied face (Old/New pairs) and 50% of trials contained two non-studied faces (New/New pairs) and subjects responded "Right," "Left," or "Neither." We theorized

that individual's proclivity to choose on the New/New pairs would predict their proclivity to choose on 5 lineups that did not contain the crimes' culprits. We observed the hypothesized relationship in Experiment 1, $r(65) = 0.45$, and Experiment 2, $r(91) = 0.45$, and again with a more naturalistic task order in Experiment 3, $r(78) = 0.37$. We present internal reliability analyses and a function predicting witness accuracy based on PTC, confidence, latency, and age.
Email: Mario Baldassari, mjbldssr@uvic.ca

(2053)

Showups Versus Lineups With Older Adults. SCOTT GRONLUND, *University of Oklahoma*, KYLIE KEY and DANIELLA CASH, *University of Alabama in Huntsville*, JEFFREY NEUSCHATZ, *University of Alabama*, JODI PRICE, *University of Alabama in Huntsville*, STACY A. WETMORE, *University of Oklahoma*. — Past research indicates that showups are an inferior eyewitness identification procedure to lineups, but no study has evaluated this claim for older adults. This study compared identification accuracy of older adults (ages 60 and older) presented with a showup or a lineup. Identification accuracy was higher from a lineup, even if the lineup was biased. Confidence calibration also was better for lineups than showups; specifically, older adults were underconfident when choosing from the lineup but overconfident when choosing from a showup. We also conducted analyses using a younger adult sample to identify performance differences between the two age groups. Surprisingly, ROC analysis revealed that younger adults outperformed older adults only on the lineup. In fact, the older adult witnesses viewing a lineup outperformed the younger adults viewing a showup. Thus, regardless of age, showup performance was worse than that of lineups.
Email: Scott Gronlund, sgronlund@ou.edu

(2054)

Effects of Bystander Temporal Proximity to the Perpetrator on Unconscious Transference. ALEX WOOTEN and CURT CARLSON, *Texas A&M University-Commerce*. — Unconscious transference (UT) occurs if an eyewitness chooses an innocent bystander from a lineup rather than the true perpetrator of a crime. Using a multiple-block face recognition paradigm (Carlson & Gronlund, 2011), we explored whether UT was more or less likely depending on whether the bystander was presented before or after the perpetrator at encoding. We obtained identification decisions and confidence from three different lineup types (bystander-only, perpetrator-only, and bystander-and-perpetrator). Regardless of bystander temporal proximity, there was evidence of UT in bystander-only lineups. However, choosing the bystander was less likely when both bystander and perpetrator were present in the lineup. Phillips et al. (1997) posited that any sense of familiarity with the bystander would be suppressed by a stronger familiarity with the perpetrator. This effect was pronounced for the bystander-after condition, thereby providing one possible boundary condition for UT.
Email: Alex Wooten, alexrwooten@gmail.com

(2055)

Comparative Processes in Simultaneous and Sequential Lineups. MOLLY MORELAND and STEVEN CLARK, *University of California, Riverside*. — Contrary to long-held views among eyewitness identification researchers, the traditional simultaneous lineup has been shown to be diagnostically superior to the sequential lineup that has been adopted by law in several states. The present experiment evaluates the hypothesis that the simultaneous lineup advantage occurs because simultaneous lineups make it easier to make comparisons among lineup members. Participant-witnesses viewed lineups differing in suspect guilt or innocence, lineup presentation format (simultaneous or sequential), and neighboring foil similarity. Similar neighbors surrounded the suspect in the high-similarity neighbor condition, designed to facilitate comparative processes, and dissimilar neighbors surrounded the suspect in the low-similarity neighbor condition. Results showed a small accuracy advantage of simultaneous high-similarity neighbor lineups, measured by d' and ROC analyses. High-similarity neighbors facilitate comparative strategies in simultaneous lineups but not sequential lineups, corroborating recent reports of a simultaneous lineup advantage and contrary to the widespread "sequential superiority" view.
Email: Molly Moreland, mmore010@ucr.edu

(2056)

Showups vs. Lineups: An Exploration Using the WITNESS Model. CHARLES GOODSELL, *Canisius College*, RYAN M. MCADOO and SCOTT GRONLUND, *University of Oklahoma*, JEFFREY NEUSCHATZ, *University of Alabama*, STACY WETMORE, *University of Oklahoma*. — The use of computational models provides several advantages over verbal statements regarding underlying cognitive mechanisms (Hintzman, 1991). We utilized WITNESS (Clark, 2003) in conjunction with receiver operating characteristic (ROC) curves to examine the memory and decision processes in lineup and showup identifications. As originally conceived, the WITNESS model predicts similar levels of performance across the different identification procedures. However, Gronlund et al. (2012) found differential performance across these identification procedures. A modification to WITNESS first proposed by Goodsell et al. (2010) was implemented and allowed the model to match the empirical data. Theoretical implications are discussed.
Email: Charles Goodsell, cgoodsell@canisius.edu

(2057)

Eyewitness Uncertainty and its Effects on Jurors' Decisions. RACHEL DEFRANCO and MARIA ZARAGOZA, *Kent State University*. — Many studies have shown that jurors are heavily swayed by confident witnesses, even though confidence is not always correlated with accuracy (Lindsay, Wells & O'Connor, 1989; Brewer & Burke, 2002; Whitley & Greenberg, 1986). Whereas previous studies have drawn comparisons between jurors' belief in highly confident and unconfident witnesses, the present study assessed whether mock jurors were sensitive to variations in certainty within a single witness. A second question addressed by the present study was whether mock jurors would be more sensitive to some indicators of uncertainty (i.e, overt verbal expressions of doubt) than others (having to be prompted repeatedly to respond). The results showed that participant/jurors' belief in the witness's testimony was highly sensitive to both indicators of uncertainty when judgments were made immediately, but not if they provided belief judgments after one week. The results thus show that memory for witness uncertainty is very short-lived.
Email: Rachel DeFranco, rdefranc@kent.edu

• **HUMAN LEARNING AND INSTRUCTION II** •

(2058)

Exploring the Spacing Effect in Auditory Perceptual Learning. GRACE ONG, BARBARA ANN CHURCH and EDUARDO MERCADO III, *University at Buffalo, SUNY*. — Distributing practice across time benefits memory compared to massed practice. This spacing effect has been found across a number of learning tasks. However, some have claimed that seeming spacing effects in procedural learning are really the result of discriminative contrast (Kang & Pashler, 2012). A series of experiments examined whether spacing benefits auditory perceptual learning when the contrastive properties stay constant. Participants were trained to discriminate birdsongs on the basis of speed. They were trained using progressive training procedures that varied only in the way the blocks of training were spaced keeping contrast constant. We compared three spacing conditions: no-spacing, within-day, and across-day spacing. Across experiments, the results suggest that when discriminative contrast is controlled, only across day spacing benefits perceptual learning. The results are discussed in terms of the theories of learning consolidation, and the need to differentiate consolidation processes from effects of contrastive properties in learning and memory.
Email: Grace Ong, gong2@buffalo.edu

(2059)

Training to Handle Stimuli With Exceptional Response Demands. HAL PASHLER and JONAS LAU, *University of California, San Diego*. — Many human activities require people to respond to rare stimuli that require exceptional responses that could not be predicted from either the person's prior experience or of the current instructions. What kind of training helps in mastering this challenge? To explore this, we had subjects respond with mouseclicks to letters on the computer screen. One type of stimulus required an exceptional response (double rather than single click). Many errors occurred on these exceptional stimuli. We randomly assigned ~400 subjects to one of several training interventions including: (1) auditory warning prior to each exceptional stimulus, (2) ramping down the event rate over training, and (3) feedback. Interventions 2 & 3 improved performance

on exceptional stimuli during a final test phase, whereas Intervention 1 did not. Theoretical and practical implications are discussed.
Email: Hal Pashler, hpashler@ucsd.edu

(2060)

Learning With Concrete and Virtual Manipulatives: Is Perceptual Fidelity Important? ANDREW STULL and MARY HEGARTY, *University of California, Santa Barbara*. — In two intervention studies, concrete and virtual models were examined for teaching diagram translation, important to developing representational competence. Translation accuracy was compared over time for three groups that differed on the type of model (Concrete, Virtual, or none) used to give intervention feedback. Concrete models were manipulated directly by hand but virtual models employed either a lower-fidelity (mouse and keyboard) interface (Study 1) or a higher-fidelity (co-located 3DOF prop with stereo-display) interface (Study 2). In both studies, the model group was significantly more accurate than the control group, which was provided with feedback but without models, but the two model groups were not significantly different. Also, the model group was more accurate than the control when tested 7-days later without models. These results indicate that manipulatives serve as scaffolds rather than as crutches in chemistry learning but that haptic fidelity of the interface is not essential in this task.
Email: Andrew Stull, stull@psych.ucsb.edu

(2061)

A Comparison of Adaptive and Fixed Schedules of Practice in Fact Learning. EVERETT METTLER and PHILIP J. KELLMAN, *University of California, Los Angeles*. — Which practice schedules produce the best learning? Studies of spacing effects have produced mixed evidence as to whether constant or expanding spacing schedules are better. One possibility is that optimal spacing depends on underlying learning strength, which may differ by learners and items. If so, the best schedules may be adaptive ones that determine spacing in relation to each learner's ongoing performance. We compared an adaptive spacing algorithm, Adaptive Response-Time-based Sequencing (ARTS; Mettler, Massey & Kellman, 2011) with fixed schedules of practice in learning geography. In Exp. 1, an adaptive schedule was compared with expanding and equal spacing schedules. In Exp. 2, an adaptive schedule was compared to 'yoked' schedules copied from prior adaptive participants, equating trial characteristics across conditions. In both experiments, adaptive scheduling demonstrated superior learning than fixed schedules at immediate and delayed tests. No evidence was found for differences between equal and expanding spacing. Advantages of adaptive spacing over fixed yoked conditions suggest that the advantages of adaptive spacing were due to adaptations to learning strength of individual items and learners. (Systems that use learner speed and accuracy to sequence learning events are covered by US Patent #7052277, assigned to Insight Learning Technology, Inc. The second author is founder and president of Insight Learning Technology. The first author is a part-time employee of Insight Learning Technology.)
Email: Everett Mettler, mettler@ucla.edu

(2062)

Scheduling Scaffolding: The Amount and Arrangement of Assistance During Training Impacts Test Performance. JONATHAN TULLIS, ROBERT GOLDSTONE and ANDREW HANSON, *Indiana University*. — Various kinds of assistance, including prompts, worked examples, direct instruction, and modeling, are widely provided to learners across educational and training programs. Yet, the effects of assistance during training on long-term learning and transfer are largely debated. In the current experiment, we examined how the extent and schedule of assistance during training on a novel mouse movement task impacted unassisted test performance. Learners received different schedules of assistance during training, including constant assistance, no assistance, probabilistic assistance, alternating assistance, and faded assistance. Constant assistance led to better performance during training than no assistance; however, constant assistance during training resulted in the worst unassisted test performance. Faded assistance during training resulted in the best test performance. This experiment suggests that scaffolding during learning can benefit from fading. Fading may allow learners to internalize assistance and not rely heavily upon a crutch that prohibits successful transfer to unassisted circumstances.
Email: Jonathan Tullis, jonathantullis@gmail.com

(2063)

Prior Math Familiarity Leads to Decreased Performance for Math-Anxious Individuals. IAN MCDONOUGH, *University of Texas at Dallas*, NAE HYUN LEE, *Occidental College*, GERARDO RAMIREZ, *University of California, Los Angeles*. — Students with math anxiety often perform worse in math classes than their non-anxious peers. Math anxious students also avoid taking math classes, thus giving rise to a range of familiarity with math concepts. How does previous math familiarity affect learning of math material? More familiarity with a given topic may reduce levels of math anxiety, thus minimizing the effects of anxiety on learning. Alternatively, familiarity with the material may add pressure in math-anxious students (e.g., they remember the difficulty of the material, or thought their prior experience should help them). To test this idea, online lessons of matrix algebra were provided and familiarity with matrix algebra and math anxiety were assessed. We found that math anxiety led to worse performance, and these decrements were exaggerated for individuals with greater familiarity with matrix algebra. These findings have implications for education; familiarity with math leads to increased choking for math-anxious students.
Email: Ian McDonough, ian.mcdonough@utdallas.edu

(2064)

Intrinsic Motivation to Learn: Can Individual Goals Decrease Susceptibility to the Undermining Effect. HILLARY WEHE and CAROL SEGER, *Colorado State University*. — These studies extended the theory of the undermining effect on motivation to a learning context and examined the interaction with individual goals for learning. The undermining effect suggests that the removal of external rewards can decrease levels of internal motivation. Students possessing learning

goals often appear to be more internally motivated to engage in challenging tasks, whereas, performance goal individuals tend to engage in tasks that confirm their intelligence. Students were assigned to either a reward or non-reward condition and completed a word-learning task. They were allowed to engage in studying the words during a free period. In study one, an undermining effect was found: A greater amount of time was spent studying by individuals in the non-reward group, no matter the personal goals for learning. An interaction between undermining and incoming goal orientation was not significant. In study two, students were given a learning or performance goal for the task. The undermining effect was shifted and there was a significant interaction between assigned goal and time spent studying.

Email: Hillary Wehe, hillaryj@rams.colostate.edu

(2065)

Retrieval Induces Forgetting, But Only When Nontested Items Compete for Retrieval. SARA D. DAVIS, MATTHEW R. ERDMAN and JASON C.K. CHAN, *Iowa State University*. — The mechanism responsible for the phenomenon of retrieval-induced forgetting (RIF) has been the subject of rigorous empirical debate, with some researchers postulating that RIF can be explained by interference, where others claim that RIF is better explained by inhibition (Anderson, 2003). A fundamental assumption of the inhibition account is that nonpracticed (Rp-) items are suppressed because they compete for retrieval during initial testing. In the current study, we manipulated competition in a novel paradigm by having subjects learn the Rp- items either before (High-Competition) or after (Low-Competition) they practiced retrieval of the Rp+ items. We found RIF only when Rp- items were studied before retrieval practice. This finding supports an inhibition account.

Email: Sara Davis, sddavis@iastate.edu

(2066)

The Influence of Early Questions on Learning From Text. CATHERINE FRITZ, *University of Northampton*, VIKKI-LEIGH CROWTHER, NICHOLA BENN and PETER E. MORRIS, *Lancaster University*. — In this research we explored the use of short-answer questions to improve learning from chapter-like texts (3395 words). Experiment 1 investigated the influence of pre-questions on recall from a text passage when tested a week later; two question sets were counterbalanced within the experimental group. Participants with pre-questions scored higher both overall (d = 3.6, 95%CI [2.4, 4.8]) and on novel questions (d = 2.0 [1.6, 2.4]). In Experiment 2, questions were made available either alongside the text (open-book), immediately after studying the text (closed-book) with the opportunity to check answers, or not at all with additional study time. Learning was tested after a week. Overall, closed-book tests produced the highest scores; for closed-book compared with no tests d = 0.8 [0.1, 1.6], for closed- compared with open-book tests d = 0.4 [-0.3, 1.2]. For novel questions, observed differences were small; ds = .2 [-0.6, 0.9] for both comparisons.

Email: Catherine Fritz, catherine.fritz@northampton.ac.uk

(2067)

Relational and Item-Specific Processing in the Spacing Effect. CAROLINA KUEPPER-TETZEL and MARK A. MCDANIEL, *Washington University in St. Louis*. — Many studies have shown that spaced practice is superior for long-lasting memory performance compared to massed practice. However, it is still unclear which processes are promoted by spaced versus massed practice. We examined to what extent massed versus spaced practice fosters relational and item-specific processing of the to-be-learned material. Massed practice may facilitate relational processing of semantically categorized word lists, whereas spaced practice may interrupt relational processing, thereby harming memory performance for such lists. To test this hypothesis, we had participants study and restudy semantically categorized or uncategorized word lists and assessed their memory on a free recall test. Our results confirm that massed practice was, indeed, more beneficial than spaced practice for detecting and using the underlying structure in semantically categorized lists, with the result of boosting memory performance. Thus, massed practice may have its merits when features of the to-be-learned material are taken into consideration.

Email: Carolina E. Kuepper-Tetzel, carolinakt@gmail.com

(2068)

The Efficiency of Self-Paced Study. MARIO DE JONGE, HUIB K. TABBERS, DIANE PECHER and RENE ZEELENBERG, *Erasmus University Rotterdam*.— In a vocabulary learning experiment participants studied lists of Finnish-Dutch word pairs under two imposed fixed presentation rate conditions (12 x 2 s, and 12 x 2 s), a restricted self-paced study condition (where the total study time per item was equated) and a unrestricted self-paced condition (where participants could freely distribute study time over the different items in a list). The total amount of available study time per list was the same for all conditions. We found that the unrestricted self-paced condition resulted in superior recall performance compared to the imposed fixed presentation rate conditions and the restricted self-paced condition. These results replicate previous findings and show that learners can allocate study time effectively during multitrial self-paced learning. When learners are forced to indiscriminately use an equal amount of study time for all items in a list, their recall performance will deteriorate.

Email: Diane Pecher, pecher@fsw.eur.nl

(2070)

Educational Lesson Formats: The Appeal of Animated Videos Versus Illustrated Texts. MATTHEW JACOVINA, ERICA SNOW, LAURA ALLEN, ROD ROSCOE and DANIELLE MCNAMARA, *Arizona State University*. — Educators face the challenge of making lesson content interesting and appealing without distracting from instructional goals (Mayer, 2014). In the current study, we examined how different instructional formats for writing strategy lessons influenced students' learning, perceptions of lesson quality, and perceptions of lesson appeal. Ninety-six undergraduates completed two writing strategy lessons, one presented as a traditional

illustrated text and one presented as an animated video. After completing each lesson, students answered strategy knowledge questions. In the final phase of the study, students were asked to directly compare the strengths and weaknesses of the two lesson formats. Performance on strategy questions was generally equivalent across conditions. However, students reported that the animated lesson videos were more useful, appealing, interesting, and easier to understand than the illustrated texts. Importantly, these findings suggest that animated lesson videos foster positive perceptions of lesson content without any detriment to learning.
Email: Matthew Jacovina, mjacovin@asu.edu

(2071)
Does Control Matter?: Agency in a Game-Based Intelligent Tutoring System. ERICA SNOW, LAURA K. ALLEN, MATHEW E. JACOVINA and DANIELLE MCNAMARA, *Arizona State University*. — When students exhibit control and employ a strategic plan of action over a situation they are said to be demonstrating agency (Bandura, 2001). The current work investigated how 75 college students' agency manifested in their choice patterns within the game-based system iSTART-2 and its ultimate influence on self-explanation quality. Students who demonstrated controlled choice patterns generated higher-quality self-explanations compared to students who exhibited random choice patterns. These findings are hypothesized to be the result of students' agency rather than the selection of any optimal choice patterns. In a follow-up study, we tested this hypothesis by removing 69 students' ability to exert agency and randomly assigning them a choice pattern (controlled or random) within iSTART-2. These results revealed no differences in self-explanation quality between the groups assigned to random and controlled choice patterns. Together, these findings suggest that agency is an important component of students' success within adaptive environments.
Email: Erica Snow, Erica.L.Snow@asu.edu

(2072)
"Choose Your Own Adventure" in Cognition 101: A Blending of Traditional and Alternative Pedagogical Structures. ELISABETH PLORAN, *Hofstra University*. — There is increased emphasis on college education, including pressure for the majority of high school students to attend a four-year school. Unfortunately, as more students enter universities they might not otherwise have attended, a greater proportion are unprepared or poorly matched to the traditional lecture and exam style of content delivery and assessment. How does one maintain high standards for achievement while not requiring the same traditional methods? The work presented here will discuss a new assignment format in which students may select from a "menu" of options that contains a variety of assignment types. Those students who excel in a traditional lecture/exam format can choose to continue on that path. However, those students who need alternate methods to demonstrate competence may do so through

writing assignments, discussion points, and other endeavors. The resulting distribution of grades, number of assignments completed, and overall quality of work will be discussed.
Email: Elisabeth Ploran, elisabeth.j.ploran@hofstra.edu

(2073)
Subgoal Labels in Worked Examples, but not General Text, Aid Statistics Learning. LAUREN MARGULIEUX and RICHARD CATRAMBONE, *Georgia Institute of Technology*. — Subgoal labels have been used in statistics education to help learners identify structural features of worked examples and improve problem solving. Statistics materials, in addition to worked examples (i.e., instruction for solving specific problems), typically include general instructional text (i.e., instruction for solving a class of problems). A study in programming education suggested that learners who receive subgoal labels in both types of instruction solve problems better than those who do not (Margulieux & Catrambone, 2014). The present study attempted to replicate these results in statistics but found that subgoal labels in general text had no effect; subgoal labels in worked examples solely predicted performance. One possible explanation is that the programming procedures examined were more complex than the statistics procedures. As a result, students studying statistics might have needed only examples, which are typically preferred by learners, while those studying programming might have needed both examples and general text.
Email: Lauren Margulieux, l.marg@gatech.edu

• WORKING MEMORY II •

(2074)
Inferring the Loss Function of Visual Working Memory. CHRIS SIMS, *Drexel University*. — Most models of visual working memory (VWM) assume memories are noise-corrupted versions of perceptual signals. However, this additive noise assumption oversimplifies the problem. When memory errors are costly, it is possible to reduce the probability of certain errors, but this comes at the expense of increasing the probability of others. This is a direct consequence of results in information theory. Thus, implicit in VWM is the construct of a loss function describing the relative cost of making different types of memory errors. Loss functions feature prominently in motor control, but have not been studied in VWM. By applying inverse decision theory, it is possible to infer the empirical loss function of VWM. The function obtained is substantially different from that implicitly assumed by existing models. Incorporating the construct of a loss function allows for a superior fit to empirical data, while enriching the theoretical vocabulary for understanding and explaining VWM.
Email: Chris Sims, chris.sims@drexel.edu

(2075)
Testing a Model of Visual Working Memory: Can Extra Features Be Stored Without Cost? GARRETT SWAN and BRAD WYBLE, *Pennsylvania State University*. — Are stimuli in visual working memory represented in a resource pool or in slots? A prediction of slot models is that there will be no cost to retrieval precision when adding features to an object, which has been controversial (Fougnie et al., 2010; Vogel et al., 2001). To resolve this controversy, we have developed a straightforward method to measure the cost of an additional feature within subject while keeping the sensory stimuli constant. Subjects were shown a colored arrow, and for block 1, responded to only one feature (color or direction) by selecting a value on a circle. In block 2, subjects could be asked about either feature. We found a significant and robust cost in precision when comparing block 1 and block 2. These results are consistent with predictions of the Binding Pool model, which stores discrete items in a resource pool through feature conjunction (Swan & Wyble, 2014).
Email: Garrett Swan, gsp.swan@gmail.com

(2076)
Inducing Proactive and Reactive Control Shifts in the AX-CPT. MICHAEL CHOW, *Princeton University*, CORENTIN GONTHIER, *University of Grenoble*, BROOKE MACNAMARA and ANDREW CONWAY, *Princeton University*, TODD S. BRAVER, *Washington University*. — The Dual Mechanisms of Control (DMC) framework postulates that cognitive control can be flexibly deployed in two distinct modes: proactive and reactive. DMC is supported by behavioral and neural data from patient populations and healthy controls. For example, prior work using the AX-CPT indicates that strategic training enhances utilization of proactive control in specific populations, such as the elderly. Here we tested for similar effects in healthy young adults. First, in AX-CPT, training effects were most prominent as performance decrements (AY trials). Second, an AX-CPT variant including no-go trials induced a shift towards reactive control, resulting in a performance decrement (BX trials). The no-go variant was also more sensitive to training, as evidenced by performance improvements (BX trials) as well as decrements (AY trials). These results demonstrate that cognitive control mode is sensitive to subtle task manipulations, even in young adults, and provide further support for the DMC framework.
Email: Michael Chow, machow@princeton.edu

(2077)
Not Like the Others: Attention Has No Effect on Short-Term Memory for Continuous Information. TIMOTHY RICKER and EVIE VERGAUWE, *University of Missouri-Columbia*. — The last two decades of research have revealed that attention plays a major role in the maintenance of short-term memory representations in the face of interference and the passage of time. Up till this point, the role of attention in short-term maintenance has almost exclusively been investigated using categorical memory stimuli, or continuous memory stimuli for which a categorical encoding strategy is easily applied. In the present work we investigate the role of attention in maintenance of truly continuous information. We find that although continuous information is forgotten as a function of the passage of time, it is not affected by manipulations of attention. Neither manipulations of memory consolidation time, an attention demanding process, nor the level of cognitive load, a measure of the availability of attention, have any effect on memory for continuous angle information. The impact of this finding on conceptions of short-term memory maintenance is discussed.
Email: Timothy Ricker, rickert@missouri.edu

(2078)
The Roles of Working Memory Capacity and Working Memory Load on the Simon Effect. JASON TSUKAHARA, and HIDEYA KOSHINO, *California State University, San Bernardino*. — Previous studies have reported that high working memory capacity (WMC) shows smaller interference effects than low WMC in interference tasks including the Stroop and flanker tasks. However, research has also shown that working memory load (WML) reduced or eliminated Simon effects. These findings are explained from a response-discrimination account which states that interference in the Simon task requires working memory to represent spatial and response codes. In this study, we investigated effects of WMC and WML on a Simon task. Results showed that the Simon effect was smaller for the high WMC than for low WMC group without any WML. However, WML eliminated the Simon effect for high WMC group whereas WML reduced but not eliminated the Simon effect for the low WMC group. The roles of WMC and WML on the Simon effect will be discussed.
Email: Jason Tsukahara, tsukahara.jason@me.com

(2079)
Short-Term Memory for ASL Fingerspelling and Print. ZED SEVCIKOVA SEHYR and KAREN EMMOREY, *San Diego State University*. — We investigated how printed and fingerspelled words are coded in short-term memory (STM) for deaf signers. Hearing people recode print into a phonological code for STM, but evidence for phonological coding in deaf readers is mixed. American Sign Language (ASL) also represents orthography with fingerspelling, but it is unclear how fingerspelling is coded in STM. 20 deaf signers and 20 hearing non-signers performed an immediate serial recall task with printed words and another 20 signers with fingerspelled words. Wordlists were manipulated for phonological and manual (fingerspelling) similarity. Both groups displayed a phonological similarity effect for printed words. Deaf signers also showed a phonological similarity effect for fingerspelled words, but there was no manual similarity effect. A follow up study will assess whether a manual similarity effect can be observed with a different similarity metric. Overall, the results suggest that fingerspelling is recoded into a speech-based phonological code in STM.
Email: Zed Sevcikova Sehyr, zsevcikova@mail.sdsu.edu

(2080)
Further Insights to 7-Year-Olds' Working Memory: Decay and Load Interactions with Attentional Control. ANDRIA SHIMI and GAIA SCERIF, *University of Oxford* (Sponsored by Alexia Galati). — Visual working memory (VWM) is limited

in capacity, and differentially so over the lifespan. Recent findings have shown that differences in the ability to use top-down attention to enhance maintenance are an important factor for understanding developmental improvements in VWM (Shimi, Nobre, Astle, & Scerif, 2014). In a series of complementary experiments, we explored whether additional factors that have previously been suggested (in isolation) to constrain VMM in children, i.e., decay and load, interact with attentional control during maintenance and limit 7-year-olds' VWM capacity even more. Results showed that 7-year-olds apply top-down biases when they are required to maintain in VWM a higher memory load, however, these biases are constrained by time. These results suggest that in addition to capacity and attentional control limits, memory load and time constrain 7-year-olds' VWM further. These findings advance our knowledge about the mechanisms driving improvements in VMM limits.
Email: Andria Shimi, andria.shimi@psy.ox.ac.uk

(2081)

Binding What and Where: Changing Strategies Across the Lifespan. RUIZHI DAI, AYANNA THOMAS and HOLLY TAYLOR, *Tufts University*. — Efficient working memory is dependent on the interplay between binding and strategic operations. Whereas dynamic binding mechanisms develop early in life, and show an accelerated decline in old age, strategic operations mature in adulthood and remain relatively stable across the lifespan. This common finding suggests that observed deficits in visuo-spatial working memory (VSWM) tasks demonstrated in children and older adults may be rooted in different underlying mechanisms. The present study examined the relationship between strategic operations and binding across the lifespan in a VSWM task. Three age groups were compared: children, young adults, and older adults. Participants were presented with 5x5 grids that contained objects from the same or from different semantic categories. Grids were either spatial organized to form a global shape or unorganized. We found that spatial organization or semantic association biased memory differently across age groups, suggesting age-related changes in strategic operations in this memory task.
Email: Holly Taylor, holly.taylor@tufts.edu

(2082)

Age-Related Differences in Visuospatial Rehearsal and the Effects of Environmental Support. LINDSEY LILIENTHAL, JOEL MYERSON, RICHARD A. ABRAMS and SANDRA HALE, *Washington University in St. Louis*. — Although it has been hypothesized that environmental support for memory differentially benefits older adults, research has focused on encoding and/or retrieval and has mostly examined verbal memory. In contrast, the present study investigated the role of environmental support in rehearsal of to-be-remembered locations. Young and older adults performed a visuospatial memory task, with retention-interval duration and support for rehearsal manipulated across conditions. When no support was provided (the screen was blank during retention intervals), both groups remembered fewer locations when retention intervals were longer, suggesting

that visuospatial information decays over time. When support was provided (the array of possible locations remained visible during retention intervals, providing potential targets for eye movements), older adults no longer showed decay of visuospatial information. However, young adults not only did not show decay, they actually remembered more locations following longer retention intervals, suggesting that age-related differences in visuospatial memory reflect important differences in rehearsal.
Email: Lindsey Lilienthal, lcdavies@wustl.edu

(2083)

Individual Differences in Stereotype Threat: The Role of Working Memory Capacity. LATASHA R. HOLDEN and ANDREW CONWAY, *Princeton University*. — Stereotype threat effects occur when stigmatized individuals are primed with a negative stereotype and subsequently underperform on a task relative to a control group. Since its introduction into the psychological literature, stereotype threat has become one of the most widely studied topics in the field of social psychology. Here we investigate this social psychological phenomenon from a cognitive perspective. To date, most investigations of stereotype threat have focused on group-level effects, neglecting potentially important individual differences that may mediate and/or moderate the effect. Our aim was to address the extent to which individual differences in working memory capacity mediate and/or moderate stereotype threat effects of gender on math and race on general cognitive ability. Preliminary results favor a moderation model but this outcome may be specific to our sample. More work is needed to determine the extent to which our model generalizes to other samples and to other stereotyped groups.
Email: Andrew Conway, aconway@princeton.edu

(2084)

Brief Mindfulness Meditation Training Reduces Stress-Related Working Memory Decrements. JONATHAN BANKS, MATTHEW WELHAF and ALEXANDRA SROUR, *Nova Southeastern University*. — Previous research has suggested that mindfulness mediation training protects against stress-related working memory (WM) decreases (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010).The current study examined the impact of a one-week mindfulness meditation intervention on stress-related WM decrements. Participants completed baseline measures of WM and mind wandering. Participants were assigned to either a mindfulness meditation training or an active control condition, relaxation training. Following one week of at home practice, participants completed a measure of WM and mind wandering. Participants then completed a psychological stress manipulation followed by a measure of WM and mind wandering. Contrary to prior work, mindfulness meditation participants did not show greater changes in WM or mind wandering than control condition participants (Mrazek, Franklin, Phillips, Bairs, & Schooler, 2013). However, protective effects of mindfulness meditation were found, such that decreases in WM following the stress manipulation were only observed in the relaxation training condition.
Email: Jonathan Banks, jonathan.banks@nova.edu

(2085)

The Efficiency of Working Memory Training: An fMRI Study. TIINA SALMINEN, *Humboldt-Universität zu Berlin*, SIMONE KÜHN, *Max Planck Institute for Human Development*, TORSTEN SCHUBERT, *Humboldt-Universität zu Berlin* (Sponsored by Tilo Strobach). — We investigated whether working memory (WM) training trains WM in general or whether training-related changes are task-specific. After dual modality n-back training, a significant improvement in the dual n-back and in an untrained dual-modality WM updating task was observed. The dual n-back-related neuronal activity in the fronto-parietal WM network decreased, while the transfer task-related neuronal activity increased in the striatum, a region that is associated with WM updating processes required by both tasks. These behavioral and neuronal effects were task-specific: there were no improvements in the single versions of the tasks. Also the changes in the neuronal activation patterns during the single tasks were different from the changes observed in the dual tasks. Dual n-back training thus improved the participants' ability to process two WM tasks from two different modalities, concluding that the dual n-back improves a specific function of WM updating rather than a general WM ability.
Email: Tiina Salminen, tiina.salminen@hu-berlin.de

(2086)

Dynamic Reallocation of Resources in Visual Short-Term Memory. SUMMER SHEREMATA and SARAH SHOMSTEIN, *George Washington University*. — Visual short-term memory (VSTM) is a capacity-limited system for maintaining visual information across brief durations. Hemispheric asymmetries occur in parietal cortex, resulting in the representation of remembered items in the right hemifield by both the left and the right hemisphere as memory load increases. Because parietal activity reflects feature-load dependence during VSTM, we predicted that memory demands modulate performance across the visual field in a feature-load dependent manner. In a series of experiments, subjects performed a change detection task in which they remembered a single feature (color or shape) or both features. Our results demonstrate feature-load dependent changes in hemifield bias consistent with dynamic reallocation of VSTM resources, evidenced by left hemifield advantage for one-feature and right hemifield advantage for two-feature memory. Importantly, hemifield asymmetries were then induced by manipulating task-mode, providing direct evidence for dynamic reallocation of resources in VSTM. These experiments, in conjunction with the neuroimaging findings, demonstrate feature-load dependent dynamic reallocation of resources across the visual field in VSTM.
Email: Summer Sheremata, ssheremata@gwu.edu

• RECOGNITION MEMORY II •

(2087)

Learning of Meaningless Images: The Effects of Visual Features and Study Procedure in the Formation of Long-Term Visual Memories. ANNABELLE GOUJON, *CerCo-CNRS & Université Paul Sabatier*, SIMON THORPE, *CerCo* (Sponsored by Arnaud Rey). — Earlier models assumed that visual long-term memory (VLTM) representations are semantic in nature. By contrast, we propose that the visual distinctiveness may be a critical factor for facilitating storage and retrieval of specific images in LTM. In this view, we explored the human capacity to store and explicitly recognize visually complex but meaningless images. During a learning phase, participants were exposed to 300 meaningless images that were presented once or twice for duration ranging from 30ms to 3s. VLTM were then tested in an old/new recognition task. The results show that memory increased linearly with the exposure duration (reaching A'= 0.84 for 3s of exposure) and that one repetition had a strong impact on memory performance. Surprisingly, 30ms of exposure was sufficient to trigger performance above chance level and memory was intact the day after. Those results show that even for brief exposure durations, more than the gist of an image is retained in LTM.
Email: Annabelle Goujon, annabelle.goujon@cerco.ups-tlse.fr

(2088)

Age Progression/Regression in Face Recognition. WENYAN BI and ZEHRA PEYNIRCIOGLU, *American University*. — The query "have you seen me?" accompanies age-progressed pictures of children in the media. We explored whether individuals could recognize the faces of unfamiliar people after studying their childhood pictures or even be able to match pictures of the same people taken at different ages while viewing them. Participants performed above chance, though surprisingly poorly, in a matching-task with several possible targets in view, as well as in a simple yes/no task comparing pairs of child/adult pictures. Whether the comparison picture was the child or the adult version did not make a difference. Memory performance was also quite poor, although in long-term memory, participants did significantly better after studying children's pictures and picking out their adult- version pictures than after studying adults' pictures and picking out their child- version pictures. A similar asymmetry was not observed in short-term memory. The results are discussed within the framework of own-age bias in face recognition.
Email: Zehra Peynircioglu, peynir@american.edu

(2089)

Selective Effects of Selective Attention on Recognition Memory. KATHERINE MOEN and MARIANNE LLOYD, *Seton Hall University*. — Three experiments were conducted to investigate the role of selective attention at retrieval on initial and subsequent tests. When participants took a selective attention test after a full attention test, recognition memory performance suffered. Further, on subsequent tests at full attention, the type of selective attention trial had an impact. Specifically, targets paired with targets were more likely to

be recognized than those paired with lures. In addition, false alarms were reduced when lures were paired with lures as opposed to a target at initial testing. Collectively, the results of the study demonstrate that selective attention is more likely to have an impact at encoding than retrieval and that the context of the pairing of items during selective attention has an effect on later memory. The results are discussed in comparison to effects of divided attention on memory.

Email: Marianne Lloyd, lloydmar@shu.edu

(2090)

The Influence of Source-Constrained Retrieval on Encoding of Foils for Recognition: Examination of Levels of Processing and Enactment During Encoding and/or Retrieval. TETSUYA FUJITA and DAISUKE CHO, *Hosei University*. — Jacoby, Shimizu, Daniels, and Rhodes (2005) showed that new words presented as foils among a list of old words that had been deeply encoded were themselves subsequently better recognized than new words presented as foils among a list of old words that had been shallowly encoded. This result was accounted for by a process that Jacoby et al. named source-constrained retrieval. We had used action sentences to investigate the generality of source-constrained retrieval. A series of experiments suggested that source-constrained retrieval does not always promote the retrieval of foils that were processed semantically. In the present study, we investigated the effect of enactment during encoding and / or retrieval with previous experiments date. On the basis of the result, we discuss requirements about whether the effect of enactment spills over to foils presented during the recognition test.

Email: Tetsuya Fujita, fujita009@nifty.ne.jp

(2091)

The Effect of Acute Naproxen Administration on Memory. SEAN SPANGLER, AMY CRISS and SANDRA HEWETT, *Syracuse University*, JEREMY SHEFNER and DONGILANG WANG, *State University of New York Upstate Medical University*. — Studies showing that non-steroidal anti-inflammatory drugs (NSAIDs) may have adverse effects on memory are correlational, based on self-report, or experimental with Alzheimer's patients. The primary objective of the current randomized placebo controlled, two-period crossover study was to determine whether acute naproxen treatment impairs memory. Healthy young adults received a single dose of placebo or naproxen (750 mg) and two hours later they completed a battery of four tasks including associative recognition, single item recognition, operation span, multiple update working memory task, and lexical decision. They returned 7-10 days later and repeated the study with the other medication (double-blind). There were no significant differences between naproxen and placebo on any measures of memory. These results have important clinical implications and suggest that the observed detrimental effects of NSAIDs may be restricted to chronic usage or to an impaired cognitive system.

Email: Sean Spangler, saspangl@syr.edu

(2092)

Manipulating the Contribution of Familiarity in Relational Memory: A Comparison of Four Imagery Strategies. ALISON ROBEY and TRACY RIGGINS, *University of Maryland-College Park* (Sponsored by Michael Dougherty). — Previous research suggests that the contribution of familiarity to performance on relational memory tasks can be manipulated via task instructions. In the present study familiarity contributions were compared between four conditions manipulating participant's encoding of associations between background colors and common words. Participants either visualized the word as the color of the background (unitized condition), how the item would interact with another item the color of the background (interactive imagery condition), how the word as the color of the background would interact with another item the color of the background (unitization + interactive imagery condition), or the word and background separately (separate condition). Contributions of familiarity were compared with estimates derived from ROCs fit with dual-process models (Yonelinas, 1994, 1997). Preliminary data suggests that compared to the separate condition all other conditions show increased familiarity contributions. Implications of these findings for memory theory and applications to enhance memory will be discussed.

Email: Alison Robey, alisonrobey@gmail.com

(2093)

Predicting and Improving Recognition Memory Using Single-Trial Electrophysiology. KEISUKE FUKUDA and GEOFF WOODMAN, *Vanderbilt University*. — Although we are capable of storing a virtually infinite amount of information in memory, our ability to encode new information is far from perfect. The quality of encoding varies from moment to moment and renders some memories more usable than others. Here we show that we can forecast the likelihood that a given item will be later recognized, on a single-trial basis, by monitoring the fluctuations of the electroencephalogram (EEG) during encoding. Next we show that we can identify items that are poorly encoded using our electrophysiological measures, and successfully improve recognition memory by having subjects restudy the poorly encoded items. At a theoretical level, our findings indicate that the separate electrophysiological measures index independent encoding subprocesses carried out by the brain. At a practical level, our memory forecasts using single-trial electrophysiological signals demonstrate the feasibility and the effectiveness of using real-time monitoring of the moment-to-moment fluctuations of the quality of memory encoding to improve learning and memory.

Email: Geoff Woodman, geoff.woodman@vanderbilt.edu

(2094)

The Potential of Narrative Passwords for Cognitive Authentication Systems. STEFFEN WERNER and CONNOR CLYDE HOOVER, *University of Idaho*. — The need for secure and usable cognitive password systems has long been recognized. Inspired by our studies on recognition-based graphical passwords, this study focuses on "narrative passwords". Users are presented with a short story (< 1,000

words) that contains interchangeable story elements (e.g., protagonist's name, story location, objects) randomly selected from separate pools of possible items. These elements form the narrative password, while the story serves as a context to enhance memory for the items. The results of an initial pilot study using narrative passwords show that (a) performance in an adaptive recognition procedure is significantly better than free recall even at large recognition sets, (b) elements highlighted in the text are remembered better, (c) the amount of information retained is sufficient for use in secure passwords, and (d) story elements have to be selected carefully to ensure high performance. In light of the results we discuss different usage scenarios for narrative passwords.
Email: Steffen Werner, swerner@uidaho.edu

(2095)
Temporal Dissociation of the Reactivation of Episodic Content During Judgments of Memory Confidence. MASON PRICE, EMILY LEIKER and JEFFREY JOHNSON, *University of Missouri*. — Several fMRI studies have shown that episodic memory retrieval involves reactivating the brain regions engaged during encoding. With the limited temporal resolution of fMRI, however, the precise timing of such reactivation is unclear. Reactivation contributing to retrieval should emerge with neural correlates of retrieval success (about 500 ms post-stimulus onset), but reactivation signifying post-retrieval monitoring would follow retrieval success. We addressed this issue by capitalizing on the high temporal resolution of EEG. Subjects studied words with different encoding tasks and later made confidence judgments on a recognition test. Pattern-classification analysis identified neural patterns distinguishing the encoding tasks, and the reactivation of these patterns was then tracked during recognition. More reactivations were associated with high- versus low-confidence judgments during a period of 500-800 ms and again later during the trial. These findings are consistent with reactivation playing two functional roles – contributing to retrieval success and maintaining information for post-retrieval processing.
Email: Jeffrey Johnson, johnsonjeffre@missouri.edu

(2096)
Test Homogeneity Effects in Multi-Item Arrays. COLTON PERRY and SCOTT GRONLUND, *University of Oklahoma*. — Researchers have recently examined the effects of study list homogeneity on single-item memory test criterion placement, finding that higher list homogeneity results in a more conservative criterion due to trial-by-trial comparisons between study items (Viswanathan, Perl, Visscher, Kahana, & Sekuler, 2010). Similarly, Windschitl and Chambers (2004) found that including a poor option (dud) in multiple-item arrays alters the evaluation of the remaining options. The present study combined these approaches to evaluate the effects of varying levels of test item homogeneity as well as the presence of a dud option in multiple-choice tests. Participants were presented with 36 8-item study lists, which were each followed by 4-item tests. These tests were grouped into three categories: high homogeneity, low homogeneity, and low homogeneity with a dud option. They also varied between

target present and target absent tests. Analyses revealed that high homogeneity tests resulted in the poorest performance, but dud options did not affect low homogeneity tests. Despite this, dud options did affect participants' beliefs as to the likelihood that an object was present in the study list. Decision criterion did not differ across tests.
Email: Colton Perry, cjp872@gmail.com

(2097)
Testing Slows Item Recognition: Evidence From Time Course of Output Interference. ASLI KILIC and ILKE OZTEKIN, *Koç University*. — Output interference (OI) is one form of forgetting due to a decline in accuracy as the number of items tested increases. In order to provide an in depth investigation of how OI impacts memory retrieval, the response signal deadline speed-accuracy trade-off (SAT) variant of a 2AFC recognition task was employed. This procedure allowed independent estimates of OI's effects on retrieval success and dynamics by controlling the speed-accuracy tradeoff over the course of testing. Consistent with previous research, results indicated a decline in retrieval success observed by a reduced asymptotic accuracy over the course of test. Additionally, testing also slowed retrieval speed: the time point when information first becomes available was delayed towards the end of the test list. Overall, these data are consistent with previous investigations (e.g., Öztekin & McElree, 2007) of the retrieval dynamics of proactive interference (PI), and indicate that OI and PI have comparable impact on memory performance.
Email: Asli Kilic, kilicasli@gmail.com

(2098)
Encoding Method and Pseudohomophone Effects in Episodic Recognition. SONNY LI and MARCUS TAFT, *University of New South Wales*. — The present research examines how pre-existing knowledge influences the memory of novel stimuli, and whether this is modulated by the encoding method. Specifically, the present research examined the episodic recognition of visually presented nonwords. The research question was whether visually presented pseudohomophones (nonwords that share a pronunciation with an existing word e.g., GRANE) would be better remembered than controls matched on visual similarity to an existing word (e.g., HOUNT). The comparison was examined in both incidental and intentional encoding contexts. There was a higher hit rate for pseudohomophones relative to controls. In addition, pseudohomophone base word foils (e.g., GRAIN) had higher false alarms than foil words visually similar to control nonword targets (e.g., HOUND). This supports the idea that the episodic memory of the pseudohomophone utilises the representation of the base word. Further more, these effects were only present in the explicit encoding condition, suggesting that encoding method is a critical modulating factor.
Email: Sonny Li, sonny.li@unsw.edu.au

(2099)

The Unintentional Influence of External Cues During Recognition. DIANA SELMECZY and IAN DOBBINS, *Washington University in St. Louis*. — Everyday recognition memory judgments are often made in the context of reliable external cues. Prior research demonstrates observers can capitalize on external cues by adaptively biasing their responding; however, situations arise where observers should ignore external information and rely purely on their own memory evidence (e.g., eyewitness testimony). The current Experiments investigated whether participants can separate external cues from internal memory evidence using an explicit recognition cueing paradigm. Critically, participants were instructed to ignore external cues ("Likely Old" and "Likely New") that preceded individual recognition probes (Experiment 1). Results revealed that participants were not able to completely eliminate the influence of cues. Furthermore, even when the cues were presented after individual recognition probes (Experiment 2) participants were still not able to completely eliminate their influence. Overall, these results suggest that external cues may automatically influence recognition judgments regardless of when this information is provided during the decision process.
Email: Diana Selmeczy, dselmecz@wustl.edu

• ATTENTION II •

(2100)

Are We Good at Averaging Sets of Gaze Directions? Comparison of Human and Alien Faces. MIDORI TOKITA and AKIRA ISHIGUCHI, *Ochanomizu University*. — Many studies have shown that observers are able to quickly and accurately extract average values over a range of visual properties, including not only low-level features such as orientation and size, but also high-level features such as emotional expression (Haberman & Whitney, 2009; Sweeny et al., 2009). In this study, we tested whether the summary representation would also occur for gaze directions using two types of faces (i.e., human and alien). Observers viewed sets of faces with different gaze directions and assessed the mean gaze direction of each set. Psychometric functions were obtained using the method of constant stimuli. The slopes of the functions demonstrated that the observers precisely represented mean gaze direction and that the estimated precision was higher in the human condition than in the alien condition. The Point of subjective equality implied that the estimated mean value tended to have a bias toward direct gaze in the alien condition.
Email: Midori Tokita, tokita.midori@ocha.ac.jp

(2101)

RT Distribution Shifting and Skewing Underlie Priming of Popout Effects. BRYAN BURNHAM, *University of Scranton*. — Intertrial priming effects are ubiquitous in the literature. In particular, priming of popout (PoP) is the finding that visual search is faster when the features of a singleton target and the features of nontargets repeat across trials than when the features of the target and nontargets switch across trials. Some accounts suggest intertrial priming influences attentional selection, whereas others suggest intertrial priming reflects episodic or response retrieval; however, a dual-stage account proposed by Lamy, Yashar, and Ruderman (2010) suggests intertrial priming reflects both selection and retrieval. To shed light on this issue, we ran several experiments using the PoP task that included manipulations of search difficulty (set size), response-stimulus interval, and repeating/changing visual feature sets across trials. The data were subjected to analyses of mean RTs and of the RT distributions by fitting the Exponential-Gaussian function to the data. Results revealed PoP effects were associated with both shifting and skewing of the underlying RT distributions, suggesting intertrial priming influences both attentional selection and episodic retrieval processes, consistent with a dual-stage account.
Email: Bryan Burnham, bryan.burnham@scranton.edu

(2102)

Attention Judges by First Impression: The Mutations Paradigm. RICARDO MAX and YEHOSHUA TSAL, *Tel Aviv University*. — Theories of attention rely on specific assumptions regarding the timecourse of distractors' processing. The mutations paradigm provides behavioral assessments of the time window within which distractors are processed during the course of stimuli presentation. A target is flanked by two identical distractors. Once per trial, at a random time, distractors mutate in one out of three alternative ways: from disruptive to neutral, vice versa, or from neutral to different neutral (control). Results revealed that (a) 8 ms of presentation (immediately following onset) were sufficient for disruptive distractors to significantly delay responses; (b) when disruptive distractors were presented within initial 16 ms, distractors' locations were continually processed. That is, prolonged presentations of disruptive distractors increasingly delayed responses; (c) when neutral distractors were presented within initial 16 ms, distractors locations became fully and irrevocably suppressed ~30 ms after onset, even when disruptive distractors appeared 25 ms after onset and remained onscreen until response. Theoretical implications will be discussed.
Email: Ricardo Max, ricardom@post.tau.ac.il

(2103)

Now You See It, Now You Don't: How Neural Transients and Iconic Memory Influence Masking. JAMES PATTEN, THOMAS SPALEK, HAYLEY LAGROIX, *Simon Fraser University*. — A brief target embedded in–and co-terminating with–a noise mask is identified easily when the duration of the mask is long but not when it is short (Di Lollo, 1980; inverse-duration effect). Identification has been said to be mediated by the visible persistence of the target which outlasted that of the mask. We tested an alternative account based on neural transient responses triggered by the onset and offset of the target, relative to those of the mask, without recourse to visible persistence. In Experiment 1, the target was identified accurately under conditions that ruled out visible persistence. In Experiment 2 identification suffered when the transient responses were attenuated by "ramping" the target's onset

and/or offset. In Experiment 3 the gradual improvement in accuracy as a function of mask duration–previously attributed to visible persistence–was shown to be governed by neural transients. All results were consistent with a modified version of von Holst's (1954) hypothesis that a new stimulus establishes an input filter within the system. Any additional stimuli then lead to the perception of a new object only when they do not match the input filter.
Email: James Patten, jwpatten@gmail.com

(2104)

Interobject Spacing Explains the Attentional Bias Toward Interacting Objects. HAUKE MEYERHOFF and STEPHAN SCHWAN, *Knowledge Media Research Center, Tuebingen, Germany*, MARKUS HUFF, *University of Tuebingen*. — Spatio-temporal interactions between simple geometrical shapes typically elicit strong impressions of intentionality. Recent research has started to explore the link between attentional processes and the detection of interacting objects. Here we asked whether visual attention is biased towards such interactions. We investigated probe discrimination performance in algorithmically generated animations that involved two chasing objects and two randomly moving objects. In Experiment 1, we observed a pronounced attention capture effect for chasing objects. Because reduced inter-object spacing is an inherent feature of interacting objects, we designed randomly moving objects that were matched with respect to inter-object spacing at probe onset in Experiment 2. In this experiment, the capture effect disappeared completely. Therefore, we argue that reduced inter-object spacing reflects an efficient cue to guide visual attention towards objects that interact intentionally.
Email: Hauke Meyerhoff, h.meyerhoff@iwm-kmrc.de

(2105)

The Arrangement and Semantic Properties of Objects Bias Attentional Allocation in Scenes. GEORGE MALCOLM and SARAH SHOMSTEIN, *George Washington University*. — When we look at scenes, objects are attended to more than backgrounds making object properties a critical component in understanding attentional orienting. Previous investigations have utilized simple shape arrays to probe objects' spatial and feature properties effect on attention. However, real-world objects have extra properties such as semantic relationships and structural arrangement. Here we investigate the how these real-world object properties bias attentional allocation. In a series of eye-tracking experiments, participants viewed scenes before a cue appeared on an object. Once the cue was fixated, a target appeared requiring participants to make a saccade. To probe semantic biasing of attention, the target appeared on an object that had either a high- or low-semantic relation to the cued object. To probe arrangement, targets appeared either on the same or different object to the cue. Importantly, neither semantics nor arrangement predicted target location. Participants exhibited shorter saccade latencies to targets appearing on objects semantically related to, or on the same

object as, the cue. These results strongly suggest that real-world object properties form a default setting in biasing attentional allocation.
Email: George Malcolm, glmalcolm@gwu.edu

(2106)

Effects of Working Memory and Perceptual Load on Simon Interference. HIDEYA KOSHINO, GINO A. VELTRI, JASON TSUKAHARA and ERIN ALDERSON, *California State University, San Bernardino*. — Perceptual load (PL) hypothesis claims that PL determines attentional selection. One question is whether the PL effect can be generalized to other interference tasks, such as a Simon task. Research has also shown that working memory (WM) contents capture attention. Therefore, we investigated effects of WM and PL on Simon interference. Participants performed an N/X discrimination task with three levels of PL (No PL, Low PL, and High PL) without WM (Exp. 1) and with location WM (Exp.2). There were Simon effects for the No PL and Low PL, but not for High PL conditions in Exp. 1. In Exp. 2, there was a Simon effect for High PL but not for No PL and Low PL when the memory location matched the target location. However, when the target appeared at a different location, there was a Simon effect for No PL but not for Low PL and High PL.
Email: Hideya Koshino, hkoshino@csusb.edu

(2107)

Susceptible to Distraction: Children Lack Top-Down Control Over Spatial Attention Capture. NICHOLAS GASPELIN, TESSA MARGETT-JORDAN and ERIC RUTHRUFF, *University of New Mexico*. — Adults often can exert top-down control to avoid distraction by salient-but-irrelevant stimuli. However, relatively little research has explored how this ability develops across the lifespan. It is often said that children are easily distracted, but there is surprisingly little empirical support for this claim. The current study therefore assessed whether children have intact or impaired control over spatial attention capture. Children (M = 4.2 years) and adults (M = 21.5 years) searched for target "spaceships" of a specific color while trying to ignore salient precues (color singletons or abrupt onsets) that either matched or mismatched the target spaceship color. The results indicated that children are, in fact, much more vulnerable to distraction by irrelevant stimuli than adults, even after accounting for their overall cognitive slowing.
Email: Eric Ruthruff, ruthruff@unm.edu

(2108)

Sleep Variability Moderates Attentional Capture. WYTHE WHITING and KARLA MURDOCK, *Washington & Lee University*. — The present study examined the role of sleep variability (variation in mean sleep duration across nights) as a potential moderator of the relationship between sleep and susceptibility to attentional capture. Seventy-eight college students' sleep data was recorded from wrist-worn devices over the course of seven nights in which participants continued with their normal sleep routines. After the seventh night, participants performed a standard attentional capture task in which they attempted to ignore onset cues (75% invalid) presented before

a four-item search display. Results from the preceding 3 nights of sleep revealed that the amount of inadvertent attentional capture was negatively correlated with both sleep duration, r = -.25, p <.05 and sleep variability, r = -.33, p <.01. Further, sleep variability across the preceding three nights proved to moderate the relationship between attentional capture and sleep duration, F (3, 74) = 6.05, p = .001. Data from this naturalistic study suggest that consistently little sleep is negatively associated with executive attentional function.

Email: Wythe Whiting, whitingw@wlu.edu

(2109)

Learning to Attend: The Influence of Gain vs. Loss on Attention Capture for Younger and Older Adults. JAMIE NAYLOR and MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*. — The present study examined whether gains and losses cause irrelevant stimuli to capture attention and how this effect varies with age. During the training phase, participants searched for a red or green target circle and reported the orientation of the bar inside. One target color was assigned to gain (high gain when correct, low when incorrect) and one to loss (low loss when correct, high when incorrect); participants were not informed of this schedule but received visual reward feedback. During the test phase, color was irrelevant: participants searched for a shape-singleton and reported bar orientation. On most test trials, one distractor was a color singleton, containing the previously-associated gain color, loss color, or neutral color. Responses were slower with both gain- and loss-associated color singleton compared to neutral-color singletons and the no-distractor condition, suggesting that both gain and loss modulate attentional weightings. Reward effects were similar for young and old.

Email: Mei-Ching Lien, mei.lien@oregonstate.edu

(2110)

Detection of Onsets Versus Offsets: Is Our Attentional System Flexible? MARIA J. DONALDSON, *Cleveland State University*, NAOHIDE YAMAMOTO, *Queensland University of Technology*. — Onset primacy is a robust phenomenon wherein onset of new objects captures observers' attention more effectively than offset of previously viewed objects. The present study tested two competing hypotheses to account for this finding. The attentional rigidity hypothesis posits that observers detect onsets more accurately and quickly than offsets under any circumstances. The attentional priority hypothesis postulates that observers perform better in detecting non-onset events if they are prioritized in a given context. These hypotheses were examined by giving participants explicit instructions and/or greater exposure to offsets than onsets, thereby inducing bias toward offset detection. Results showed that participants who performed a change detection task under the bias detected offsets more accurately than those who performed the same task without any bias. These results support the attentional priority hypothesis, suggesting that visual attention may be sufficiently flexible to give priority to various types of events in an adaptive manner.

Email: Naohide Yamamoto, yamamoto@jhu.edu

• COGNITIVE CONTROL II •

(2111)

Endogenously-Demanding Task Switching Shows No Cognitive Control Benefit in Expert Video Game Players. JULIE CONDER, KARIN HUMPHREYS and SCOTT WATTER, *McMaster University*. — Expert action video game players (VGPs) routinely show superior performance on a range of perceptual and cognitive tasks compared to non-gamers (nVGPs). Several recent studies have shown a VGP advantage with task switching paradigms, and interpreted these findings as indicative of superior cognitive control in VGPs. We compared VGP and nVGP performance on a series of task switching designs, manipulating the demand for differing degrees of endogenous cognitive control via task set overlap, task expectancy, and trial timing. Results suggest that VGPs have reduced switch costs when task set overlap is low, and relatively less endogenous cognitive control is required for good performance. However, under high-interference conditions, VGPs were still faster overall, but showed a minimal switch cost advantage compared to nVGPs. We argue that VGPs do not have any advantage in cognitive control compared with nVGPs - when cognitive control demands are high, they show equivalent cognitive control measures to nVGPs.

Email: Julie Conder, julieconder@gmail.com

(2112)

Pupillometric Indicators of Proactive Control in Task Switching. JASON HUBBARD, ATSUSHI KIKUMOTO and ULRICH MAYR, *University of Oregon*. — Proactive control improves performance in high-conflict situations, however it is difficult to assess directly. We used high resolution pupillometry in a cued task-switching experiment to examine how changes in pupil diameter index proactive processes. On trials with a long preparation interval, the pupil diameter revealed a distinct proactive response, reliably distinguishing between switch and no-switch trials. In a high switch-rate condition, where the system is biased towards an unconditional switch mode, pupil size indicated an increased proactive control response even on no-switch trials. Furthermore linear mixed-effects modeling revealed that trial-by-trial variations in pre-stimulus pupil diameter were predictive of both distractibility (i.e., fixating on task-irrelevant distractors) and reaction time. Broadly, findings are consistent with recent work attributing changes in pupil diameter to dynamic shifts in processing modes, rather than simple arousal or effort (Donner & Nieuwenhuis, 2013).

Email: Jason Hubbard, hubbard3@uoregon.edu

(2113)

Multi-Trial Switch Costs and a Mechanism of Ephemeral Task Control. KOKI IKEDA, *Chukyo University*, TOSHIKAZU HASEGAWA, *The University of Tokyo*. — The present study focused on the cause of the persisting performance impairments observed across multiple trials after task switching. Previous studies using the intermittent-instruction paradigm did not agree on whether or how such long-lasting switch costs perseverate, and different theoretical

accounts have been proposed accordingly. By controlling a possible confounding factor of cue encoding failure, we successfully solved the discrepancy and showed that these costs exist in both response time and error rate, and increase their magnitudes as a linear function of the interval length between trials (i.e. response-stimulus interval or RSI). These results supported the interference-based model of multi-trial cost generation. In addition, our finding that the multi-trial costs were systematically suppressed when RSI was short (zero to 100 ms) suggests that there is an adaptive task control system, which is active only for a short period after the response execution.
Email: Koki Ikeda, kokiikd@gmail.com

(2114)

Doubly Dissociating Proactive and Reactive Control in the Stroop Task. CORENTIN GONTHIER, *University of Grenoble*, TODD BRAVER and JULIE BUGG, *Washington University in St. Louis.* — The Dual Mechanisms of Control framework posits the existence of two distinct control modes, reactive and proactive. It has been proposed that the two mechanisms operate independently, but this independence has been hard to study within most experimental paradigms. However, the Stroop task may provide a useful way of assessing the independence of control mechanisms, as the task elicits two types of proportion congruency effects, list-wide and item-specific, thought to reflect proactive and reactive control respectively. The present research tested whether these two proportion congruency effects can be used to doubly dissociate proactive and reactive control. In two experiments, we demonstrate that Stroop proactive and reactive effects are separable, appear in different conditions, exist in the same participants, and are associated with unique behavioral signatures. These results are consistent with the view of proactive and reactive control as involving two independent mechanisms.
Email: Corentin Gonthier, corentin.gonthier@gmail.com

(2115)

Individual Differences in the Context-Dependent Recruitment of Cognitive Control: Evidence From Action Versus State Orientation. RICO FISCHER, *U-Dresden*, FRANZISKA PLESSOW, *Harvard Medical School*, GESINE DREISBACH, *University of Regensburg*, THOMAS GOSCHKE, *Technische Universität Dresden.* — The ability to flexibly adapt to deviations from optimal performance is an important aspect of self-control. In the present study the authors present first evidence that the personality trait action versus state orientation (Kuhl, 2000) modulates the ability of adaptive control adjustments in response to experienced conflicts. Sixty-two individuals with extreme scores on the action-state dimension performed a response interference task. As predicted by the concept of action versus state orientation, action-oriented individuals displayed a stronger conflict adaptation effect as evidenced by a stronger reduction of interference on trials following conflict. These results were further corroborated by a correlational analysis including a sample of 167 participants: the higher the score on the action-state dimension, the lower the interference effect following conflict (i.e., stronger conflict adaptation). The

present individual differences approach extends the current focus on task characteristics and situational demands of conflict monitoring and highlights the need to emphasize the role of the human agent in understanding conflict-triggered adjustments of control.
Email: Rico Fischer, rico.fischer@tu-dresden.de

(2116)

Properties of Context-Driven Control Revealed Through the Analysis of Conflict Adaptation Effects. THOMAS HUTCHEON and DANIEL SPIELER, *Georgia Institute of Technology.* — The context specific proportion congruency (CSPC) effect refers to the reduction in the size of the congruency effect at locations with a high proportion of incongruent trials compared to locations with a high proportion of congruent trials. The CSPC effect is commonly taken as support for context-driven (location) modulations of control in the Stroop task. However, to date there has been only a single demonstration of context-driven control that generalizes to contingency unbiased stimuli at each location (Crump & Milliken, 2009). Across three experiments we fail to replicate the CSPC effect for contingency unbiased stimuli. In two additional experiments using contingency biased stimuli we observe conflict adaptation within but not across locations in the presence of a CSPC effect. These results collectively suggest that CSPC effects reflect individuals' tracking of stimulus contingencies for each location, and that conflict adaptation reflects the sequential updating of such contingencies.
Email: Thomas Hutcheon, thutcheon@gatech.edu

(2117)

Episodic Learning Effects of Selective Attention Via Stimulus and Response Congruency: Evidence From PRP. SCOTT WATTER, *McMaster University*, SANDRA J. THOMSON, *St. Thomas University.* — Recent studies of cognitive control have shown that differences in selective attention demands driven by stimulus congruency can influence later memory for these stimuli. For example, the greater processing demand of word stimuli with incongruent distractors has been shown to improve subsequent recognition performance, versus congruent items. We studied Task2-to-Task1 priming (including the Backwards Compatibility Effect, BCE) within a Psychological Refractory Period (PRP) paradigm, to 1) independently assess both stimulus category and response congruency on Task1 performance, and 2) test what effect these congruency relationships had on a later surprise memory test for PRP Task1 stimuli. Rather than a task-wide effect promoting generally better memory for Task1 stimuli with incongruent Task2 stimuli, we show a pattern of memory effects for Task1 stimuli relative to the timing of stage-specific attentional demands of incongruency (focus of increased processing demand at stimulus category versus response representation within a task), and relative to the timing of incongruent information availability to Task1 with varying SOA. We consider implications for cognitive control, and for theories of desirable difficulty in learning.
Email: Scott Watter, watter@mcmaster.ca

(2118)

Don't Do It Again! Directed Forgetting of Habits. GESINE DREISBACH and KARL-HEINZ BAEUML, *Universitat Regensburg*. — Most of our daily routines are determined by habits. However, the experienced ease and automaticity of habit formation and execution comes at a cost when no longer appropriate habits have to be overcome. So far, proactive and reactive control strategies have been identified that prevent inappropriate habit execution either by preparation or "on the fly". Here, the authors present evidence for a third, retroactive control strategy: In two experiments, applying the list-method of directed forgetting, the accessibility of newly learned and practiced stimulus-response rules was significantly reduced when participants were cued to forget the rules as compared to a group that was cued to remember. Results thus show that directed forgetting, so far only observed and investigated for episodic memory traces, can also be applied to habits. The findings further emphasize the adaptive value of forgetting and can be taken as a retroactive strategy of habit control.
Email: Gesine Dreisbach, gesine.dreisbach@psychologie.uni-regensburg.de

(2119)

The Gratton Effect Remains After Controlling for Contingencies and Stimulus Repetitions. CHRIS BLAIS, AIKATERINI STEFANIDI and GENE BREWER, *Arizona State University*. — The Gratton effect, the observation that the size of the Stroop effect is smaller following an incongruent trial compared to a congruent trial, is one pivotal observation in support of the conflict monitoring hypothesis. Previous reports have demonstrated that non-conflict components, such as feature binding, also contribute to this effect. Critically, Schmidt and De Houwer (2011)report a flanker task and a button-press Stroop task suggesting that there is no conflict adaptation in the Gratton effect; it is entirely caused by feature binding. The current investigation attempts to replicate and extend this important finding across two experiments using a canonical four-choice Stroop task with vocal responses. In contrast to Schmidt and De Houwer, we observe reliable conflict adaptation after controlling for feature binding. We argue that the overall strength of conflict is critical for determining whether a conflict adaptation component will remain in the Gratton effect after explaining binding components.
Email: Chris Blais, chris.blais@gmail.com

(2120)

The Influence of Bilingualism on Conflict Monitoring: An fMRI Investigation. SUSAN TEUBNER-RHODES, DJ BOLGER and JARED NOVICK, *University of Maryland*. — In many contexts, bilinguals outperform monolinguals on tasks requiring cognitive control—the ability to detect and resolve conflict by adjusting behavior. We tested bilinguals' and monolinguals' trial-to-trial cognitive control engagement (i.e., conflict monitoring) to explore the source and nature of real-time mechanisms underlying the advantage. Both groups completed a color-word Stroop task during fMRI to assess neural activation related to conflict adaptation: the phenomenon where conflict detection recruits cognitive control, yielding faster and more accurate resolution of subsequent conflict. When detecting initial conflicts (on congruent-to-incongruent sequences), bilinguals were more accurate than monolinguals and showed greater activation in left caudate, left anterior ventrolateral prefrontal cortex (vlPFC), and right superior temporal pole (STP). Earlier studies implicate these regions in language-switching (caudate), goal-retrieval (vlPFC), and attention-orientation (STP). Bilinguals' extensive language-switching practice may "fine-tune" conflict monitoring, enabling better conflict detection and proactive control than monolinguals, who recruit control reactively following conflict.
Email: Jared Novick, jnovick1@umd.edu

(2121)

Distraction Induced by Unexpected Events May Be Explained by Global Suppression. JAN WESSEL and ADAM ROBERT ARON, *University of California, San Diego*. — Why do unexpected perceptual events impair cognition? How do sudden noises induce distraction? Here, we present data from two experiments in which participants either responded quickly to a visual stimulus (Exp. 1), or had to maintain information in working memory (WM) and perform a recognition test (Exp. 2). In both experiments, presenting an unexpected tone impaired performance. In Exp. 1, unexpected tones before stimulus-onset led to reaction time slowing. In Exp 2., unexpected tones in the delay period reduced WM accuracy. Subsequent neuroscience investigations (using Electroencephalography and Transcranial Magnetic Stimulation) showed that unexpected tones engage a brain network for global suppression of motor activity during action-cancellation. Thus, unexpected events induce global suppression in the motor domain. The degree of activity within this network predicted the decline in behavioral performance. Hence, it is possible that this global suppression could extend into the non-motor domain, which could explain why unexpected events are distracting.
Email: Jan Wessel, jwessel@ucsd.edu

(2122)

Feeling the Beat: Does Building Auditory Expectancies Improve Complex Visual Attention? ASHLEY BANGERT and JAIME M. HARRIS, *University of Texas at El Paso*. — Regular auditory rhythms create temporal expectancies that influence simple visual attention. When people saccade to the location of a dot or detect a gap in a stimulus, they are faster and more accurate for stimuli appearing at a moment predicted by a given rhythm (Miller et al., 2013). We explored whether such expectancies also improve selective attention in a more complex task. Forty-three college students completed the Stroop Switch task (Hutchison et al., 2010), alternating between word-reading and color-naming when cued. Each trial started with 7 tones spaced 600 ms apart. The stimulus then appeared either at the expected moment of an 8th tone (on-time) or ± 76 ms. In contrast to our predictions, people were slower and less accurate for incongruent color-naming trials presented on-time versus earlier or later. Thus, generating

a temporal expectancy heightens response readiness and the salience of automatic processes making it harder to exercise inhibition in complex scenarios.
Email: Ashley Bangert, asbangert2@utep.edu

(2123)
From Proactive to Retroactive Dual-Task Interference: The Important Role of Task-2 Probability. MARK NIEUWENSTEIN, SABINE SCHOLZ and NICO BROERS, *University of Groningen.* — Studies on dual-task interference commonly show that the processing of a to-be-remembered first target (T1) obstructs the processing of a shortly following target (T2). In contrast, Nieuwenstein and Wyble (2014) recently found an opposite pattern, such that a memory encoding task suffered pronounced retroactive interference (RI) from a trailing 2-AFC task, with little evidence for proactive interference (PI). Here, we report that the occurrence of PI or RI depends on the probability of T2. Specifically, if T2 is always present, as in previous dual-task studies, there is strong PI and little RI. In contrast, if T2 is not always present, as in Nieuwenstein and Wyble, there is strong RI and little PI. The occurrence of PI or RI is proposed to reflect the workings of an attentional control mechanism that serves to protect T1 against interference from T2 and that is applied in accordance with the probability of such interference.
Email: Mark Nieuwenstein, m.r.nieuwenstein@rug.nl

(2124)
A Common Neural Basis for Syntactic and Non-Syntactic Conflict-Control. NINA HSU, *University of Maryland*, SUSANNE JAEGGI, *University of California, Irvine*, JARED NOVICK, *University of Maryland.* — During sentence comprehension, cognitive control helps revise incorrect interpretations. During recognition memory, cognitive control helps resolve conflict from familiar but irrelevant items. Despite ostensible task-differences, neural evidence suggests domain-generality: left inferior frontal gyrus (LIFG) engages commonly across language and memory studies involving conflict-control. But is LIFG triggered within individuals over different tasks sharing conflict-control demands? Do functionally-specialized regions interact with LIFG to form a cognitive architecture including independent and joint language/memory functions? We used fMRI to test common conflict-control mechanisms across four different memory and language tasks. Single-subject analyses (n=20) within LIFG demonstrated reliable conflict effects, suggesting that within subjects, LIFG regions selectively mediate conflict-control across domains. Further, connectivity analyses revealed divergence of brain regions co-activating with LIFG in a task-specific manner. Although LIFG may subserve domain-general procedures, it may also act as a conflict-control "hub" around which distinct networks interact, which vary functionally according to task-specific demands.
Email: Nina Hsu, ninahsu@umd.edu

• LETTER AND WORD PROCESSING II •

(2125)
Impact of Word Presentation Format on Reading Chinese and English Text. LIANG TAO, *Ohio University*, ALICE F. HEALY, *University of Colorado, Boulder.* — This study examined the impact of word presentation format on reading Chinese and English text. English text presents clear inter-word spaces, whereas Chinese text presents inter-character spaces with no indication of word boundaries. Two Chinese passages and their English translations were presented in two forms: with inter-word spaces, which resembled English text format, and without inter-word spaces, which resembled Chinese text format. All passages were followed by comprehension questions. Native English speakers from first year Chinese language classes processed the English passages, and both native Chinese speakers and native English speakers from more advanced Chinese language classes processed the Chinese passages. Reading time was faster for English passages with inter-word spaces but was faster for Chinese passages without inter-word spaces. Even native English speakers from the advanced Chinese language classes were slowed down by the extra inter-word spaces in processing Chinese text. The findings indicate that reading text is not aided by clear word presentations in all languages. Therefore, words might not always constitute the basic processing units in reading.
Email: Liang Tao, tao@ohio.edu

(2126)
Modulation of Preview Benefit by Individual Differences in Reading Skill. WONIL CHOI, FERNANDA FERREIRA and JOHN M. HENDERSON, *University of South Carolina.* — This study examined how the preview benefit during sentence reading is modulated by individual differences in reading skill. Using the gaze-contingent boundary technique, we manipulated previews of target as full preview, transposed-letter (TL) preview, or orthographically dissimilar (OD) preview. We measured participants' reading skill with subsets of the Woodcock Reading Mastery Tests. In a correlation analysis, the reading skill measures were highly correlated with eye movement behaviors such as fixation duration and saccadic amplitude. More importantly, preview benefit in skipping rate (measured by subtracting skipping rates in the OD preview condition from the full preview condition) was modulated by reading skill, such that readers with greater skill obtained greater preview benefit from the parafovea than readers with less skill. These results provide evidence that individual differences in reading skill modulate the characteristics of parafoveal processing during reading.
Email: Wonil Choi, wichoi79@gmail.com

(2127)
Exploring Factors That Affect Compound Word Recognition: A Rating Study of Over 600 English Compound Words. BARBARA JUHASZ, YUN-HSUAN LAI and MICHELLE WOODCOCK, *Wesleyan University.* — Research on compound words (e.g. airport, popcorn) can provide insight into how morphological information is integrated into the mental lexicon. Taft and Forster (1976)

demonstrated that the frequency of the first lexeme in English compound words influences compound processing. Since then, there have been many studies that have assessed morphological decomposition by manipulating lexeme frequencies. We extended past research by conducting a rating study on over 600 English bilexemic compound words. Lexical decision times and word naming times were extracted from the English Lexicon Project (Balota et al., 2007). Each rated variable was added to a regression model containing the length and frequency of the compounds, lexeme frequencies, and other relevant lexeme characteristics. Familiarity, age-of-acquisition, imageability, and sensory experience ratings significantly predicted both lexical decision and word naming performance. Semantic transparency was also a significant predictor of lexical decision performance. Implications for theories of morphological processing will be discussed.

Email: Barbara Juhasz, bjuhasz@wesleyan.edu

(2128)

Inhibition in the Eyes: Using Pupillometry to Examine Inhibition in the Masked-Priming Lexical-Decision Task. JASON GELLER and ALISON MORRIS, *Iowa State University*. — In the masked-priming lexical-decision task, competitive network models make the prediction that orthographically-similar word primes should interfere with target processing (i.e., inhibitory priming). Recently, Morris and Still (2012) demonstrated inhibitory priming for substitution neighbors (e.g., blue-BLUR) and, surprisingly, reversed anagrams (e.g., live-EVIL)—a finding that necessitates a re-evaluation of extant slot-coding and standard bigram models of word recognition. In the present study, we sought to replicate and extend the findings of Morris and Still by examining pupil size, a physiological correlate of cognitive effort, concomitantly with response latencies. In general, both measures elicited convergent evidence (i.e., larger peak pupil diameter and longer response latency for similar prime-target pairs). Results suggest (1) pupillometry is a useful tool to examine inhibition in the masked priming paradigm and (2) the front-end of visual word recognition models need modification to account for reversed anagrams.

Email: Alison Morris, almorris@iastate.edu

(2129)

Case Transition Format and Lexical Decision Performance. ALBERT SMITH, RISA F. ORLOSKY, MICHELLE E. AEBI, STEPHANIE M. REYES TORRES and KATHRYN G. VAN GUNTEN, *Cleveland State University*. — Reading MIXed caSE ITEms is harder than reading UPPERCASE or lowercase items: For example, lexical decisions about mixed-case items are slower than those about uppercase and lowercase items. Some models of word identification imply that, due to perceptual learning during reading, readers should process items with uppercase-to-lowercase transitions (e.g., PLAnt) more effectively than items with lowercase-to-uppercase transitions (e.g., plaNT). In two lexical decision experiments with a single set of participants, we investigated whether the type of case transition in mixed-case items affects performance. In the primary experiment, every stimulus item included a case transition. In a control experiment, stimulus

items included both mixed-case and homogeneous case items. The results of the control experiment showed that participants in the main experiment exhibited the previously observed mixed-case performance decrement. In neither experiment was there a discernible effect, for mixed-case items, of type of case transition.

Email: Albert F. Smith, a.f.smith@csuohio.edu

(2130)

Disentangling the Contribution of a Word's Spatial Extent and Number of Letters in Arabic Word Length Effects: An Eye Movement Investigation. EHAB HERMENA, DENIS DRIEGHE and SIMON LIVERSEDGE, *University of Southampton*. — Word length effects during reading are attributed to the number of a word's letters (NoL), and its spatial extent (SpEx). To asses the contribution of these factors, previous research has matched words of different NoL on SpEx either by artificially stretching or shrinking letters in a monospaced font (McDonald, 2006) or by selecting wide or narrow letters in a proportional font (Hautala et al., 2011). We made use of a common Arabic proportional font allowing the rendering of 5- and 7-letter words, matched on spatial extent that occupied either a wide or narrow physical space. Initial analyses revealed greater skipping of words with narrow, compared to wide, SpEx, but no skipping effect for NoL. Fixation time data suggest interactive effects such that 7-letter words with narrow SpEx attracted longer fixations. The findings further elucidate the interactive contributions of orthographic (NoL) and visual (SpEx) contributions to word identification during reading.

Email: Ehab Hermena, ewh1g09@soton.ac.uk

(2131)

Does That Word Feel Moist to You? Contextual and Lexical Contributions to Word Aversion. KATHERINE F. MACNAMEE, *University of Utah*, JENNIFER COANE, *Colby College*. — Word aversion is commonly defined as the strong, often visceral dislike of a word, independent of that word's meaning. That is, words that do not have inherently negative definitions or meaning (e.g., moist) are perceived to be or feel repulsive, whereas the word's synonyms (e.g., humid) don't elicit such reactions. To our knowledge, there is limited exploration of the causes of word aversion. We normed aversive words for emotional valence relative to positive and negative words. We also recorded movement dynamics in response to aversive words as a function of context. Context was manipulated through the valence of prime-target pairs (e.g., positive: cake-MOIST vs. negative: skin-MOIST). We also examined the phonological/orthographic contributions to aversion by having participants rate nonwords similar to our aversive targets (e.g., CROIPS) as positive or negative. Both context manipulation and manipulation of phonology/orthography appear to contribute to the negative reactions individuals have to aversive words.

Email: Jennifer Coane, jhcoane@colby.edu

(2132)

Predicting Individual Differences in the Perceptual Span and Eye Movement Behavior During Reading. PATRICK PLUMMER, MATTHEW J. ABBOTT and KEITH RAYNER, *University of California, San Diego*. — The gaze-contingent moving window paradigm was used to examine the extent to which average reading rate, general cognitive processing speed, and vocabulary size influence the perceptual span and eye movement behavior during reading. Performance on a vocabulary test, average response time in a Rapid Automatized Naming (RAN) task, and average reading rate in unrestricted viewing conditions were all used as predictors in an analysis of individual differences across a number of global reading measures. The current results replicate the previously demonstrated finding that faster readers have a larger perceptual span. The findings also reveal that average reading rate is the best predictor of eye movement measures and the overall size of the perceptual span. Furthermore, indices of reading speed, cognitive processing speed, and vocabulary size all demonstrated independent influences on eye movement behavior. The results also suggest that readers with larger vocabularies adopt reading strategies that take advantage of more numerous and higher quality lexical representations. The results further verify that a number of distinct factors contribute to the size of the perceptual span and the pattern of eye movements during reading.
Email: Patrick Plummer, pplummer@ucsd.edu

(2133)

Opaque and Pseudo-Compounds: Effects of (Pseudo) Morphemic Structure. CHRISTINA GAGNE, THOMAS SPALDING and KELLY NISBET, *University of Alberta*, CAITRIN ARMSTRONG, *McGill University*. — We investigate whether the language system attempts to construct a meaning whenever potential morphemic representations are available, regardless of whether the word contains a morphemic structure. We present three lexical decision experiments examining whether exposure to a pseudo-compound or fully-opaque compound affects the ease of processing an embedded word. Responses were slower and less accurate when the word (e.g., car) was preceded by a pseudo-compound (e.g., carpet) relative to an unrelated prime. However, responses were faster and more accurate when the word (e.g., hog) was preceded by an opaque compound (e.g., hogwash) relative to an unrelated prime. Our results indicate that the language system parses incoming stimuli and attempts to construct a meaning whenever morphemes become available. For pseudo-compounds, the constructed morphemic structure conflicts with the word's monomorphemic structure and induces processing difficulty.
Email: Christina Gagne, cgagne@ualberta.ca

(2134)

Skipping Syntactically Illegal "The" Previews—The Role of Predictability. MATTHEW J. ABBOTT, *University of California, San Diego*, BERNHARD ANGELE, *Bournemouth University*, Y. DANBI AHN and KEITH RAYNER, *University of California, San Diego*. — Recent research has shown that readers skip parafoveal previews of "the" more often than valid previews

of other 3-character words even when "the" is syntactically anomalous (e.g., a verb is expected in that position; Angele & Rayner, 2013). In the present study we manipulated target word predictability and parafoveal preview using the gaze-contingent boundary paradigm to assess whether contextual constraint modulates "the"-skipping behavior. Readers skipped previews of "the" more often than valid previews, and skipped the target more often in sentences in which the target word was predictable compared to unpredictable, even when the parafoveal preview (the) conflicted with the identity of the predicted word (fix). It appears that readers frequently make the decision to skip a short, predictable word even if parafoveal information conflicts both orthographically and syntactically with expectations. Implications for computational models of eye movement control (e.g., E-Z Reader and SWIFT) will be discussed.
Email: Keith Rayner, krayner@ucsd.edu

(2135)

Moving Beyond the Monosyllable: Model Comparisons and Large-Scale Data From Pseudoword Reading. JASMIN SADAT, BETTY MOUSIKOU, REBECCA LUCAS and KATHLEEN RASTLE, *Royal Holloway, University of London*. — More than 90% of English words are polysyllabic, yet the vast majority of work on reading aloud has focused on monosyllables. We conducted a large-scale study in which 41 participants read aloud 915 disyllabic pseudowords. Participants' reading aloud latencies, pronunciations, and stress placements were recorded, and these measures were compared where possible to the performance of rule-based (DRC, Rastle & Coltheart, 2000) and probabilistic (CDP++, Perry et al., 2010; Seva et al., 2009) models of reading. Analyses sought to establish (a) how various properties of the disyllabic pseudowords influenced human and model reading aloud performance; (b) whether stress placement can be predicted by a combination of phonological, orthographic, and morphological cues; and (c) the extent to which pronunciation uncertainty across participants influences human and model reading aloud performance.
Email: Jasmin Sadat, jasmin.sadat@rhul.ac.uk

(2136)

Do Successor Effects in Reading Reflect Parafoveal Processing? Evidence From Corpus-Based and Experimental Eye Movement Data. BERNHARD ANGELE, *Bournemouth University*, ELIZABETH R. SCHOTTER, *University of California San Diego*, TIMOTHY SLATTERY, *University of South Alabama*, TARA L. CHALOUKIAN, *University of California San Diego*, KLINTON BICKNELL, *Northwestern University*, KEITH RAYNER, *University of California, San Diego*. — In the past, reading experiments usually only involved collecting and analysing eye-movements measures on and around a target word. Recently, larger data sets involving numerous subjects reading large numbers of sentences, known as eye-movement corpora, have become available. Several studies of eye movement corpora during reading have found an effect of successor word (n+1) frequency on current word (n) fixation time, suggesting that readers obtain parafoveal lexical information from the upcoming

word before they have finished identifying the current word. Experimental studies tend not to replicate this effect. In the present study, we combined a corpus analysis approach with an experimental manipulation so that either (a) word n+1 or (b) word n+2, (c) both words, or (d) neither word was masked during every fixation. We found successor effects similar to those reported in the corpus studies. Importantly, these successor effects were found even when the parafoveal word was masked, suggesting that apparent successor frequency effects may be due to causes that are unrelated to lexical parafoveal preprocessing.
Email: Bernhard Angele, bernhard.angele@gmail.com

(2137)

Letter Confusability in Skilled Reading: Influences on Letter Identification and Position Coding. SERJE ROBIDOUX, *Macquarie University*. — Skilled reading requires efficient letter identification and ordering. This study considers the influence of low-level features of letter strings on these processes. In the reported experiments, nonwords are formed by transposing highly confusable letters (that are visually similar to each other) or low confusability letters in words (e.g., PLIGRIM, PIGLRIM), or substituting letters with high and low confusability replacement letters (e.g., PIYCRIM, PIDZRIM). The results are consistent with a similar study of developing readers (Robidoux, Kohnen, Kezilas, 2013 Psychonomics): rejecting transposition nonwords is sensitive to the confusability of the transposed letters, while rejecting substitution nonwords shows no such effect. This leads to the counterintuitive conclusion that this very low-level visual characteristic of letter strings does not influence the earliest process of orthographic processing (letter identification), but does influence position coding.
Email: Serje Robidoux, serje.robidoux@mq.edu.au

(2138)

A New Computational Model of Learning to Read Via Self-Teaching. STEPHEN PRITCHARD, MAX COLTHEART, EVA MARINUS and ANNE CASTLES, *Macquarie University*. — The self-teaching hypothesis (Share, 1995) describes a psychologically plausible process by which people learn to read without constant supervision. Despite being highly regarded and supported by a good deal of empirical investigation, the self-teaching hypothesis has not been widely explored computationally. A computational cognitive model affords greater rigour than is possible when considering a purely verbal cognitive theory. In this research, we simulated the self-teaching hypothesis using an adapted version of the dual-route cascaded (DRC) model of visual word recognition and reading aloud. This model allows a quantitative exploration of the complex interaction between sublexical knowledge, contextual ambiguity and word regularity associated with learning to read English, all while effectively simulating the self-teaching hypothesis in action. We present here a thorough account of this new model and its theoretical commitments, and also present the results from a range of simulations exploring the model's operation and plausibility.
Email: Stephen Pritchard, stephen.pritchard@mq.edu.au

• PSYCHOLINGUISTICS I •

(2139)

The Role of Foreign- and Native-Accented Speech in Monolinguals' Spoken Sentence Comprehension. SARAH GREY, *Pennsylvania State University*, JANET G. VAN HELL, *Pennsylvania State University/Radboud University, Nijmegen*. — Written sentences lack socially relevant cues related to speaker identity (e.g., age, sex) that spoken sentences maintain. Unlike readers, listeners can use these cues during comprehension. Research has shown that speaker identity cues affect spoken sentence processing. For example, Dutch bilingual listeners (living in a bilingual context) did not show a P600 effect when listening to grammatical errors produced by foreign-accented speakers but did show P600s to native-accented speech (Hanulikova et al., 2012). This suggests that accent is a relevant speaker identity cue, and affects neural signatures of language processing. However, bilingual listeners may use the accent cue differently than monolinguals. We tested monolinguals listening to foreign-accented and native-accented speakers who made grammatical errors in sentences or produced correct sentences. The results clarify the role of listeners' experience with foreign-accented and native-accented speakers in using accent as a speaker identity cue in spoken language comprehension.
Email: Sarah Grey, greysae@gmail.com

(2140)

Semantic and Syntactic Interference During Chinese Sentence Comprehension: Evidence From Event-Related Potentials (ERPs). YINGYING TAN and RANDI MARTIN, *Rice University*. — The time-course of semantic and syntactic interference effects was investigated during Chinese sentence comprehension, which is argued to be more semantically- than syntactically-based relative to English. The EEG was recorded as 40 subjects read sentences in which an interfering noun appeared between the head noun and main verb. Semantic plausibility and grammatical role of the interfering noun were varied to manipulate semantic and syntactic interference. Prior English studies showed that syntactic interference effects typically precede or even block semantic interference effects. In Chinese, immediate effects of both semantic and syntactic interference were observed on the verb. Syntactic interference was evident in an LAN followed by a P600 effect. Semantic interference was evident in an LAN followed by a late negativity. The LAN effects may reflect WM operations and the late effects may reflect syntactic/semantic revision. The results suggest that semantic interference may play a role earlier in Chinese than English.
Email: Yingying Tan, tyy3737@gmail.com

(2141)

Eye Movements Reveal Asymmetric Effects of Grammatical Number in the Processing of Subject-Verb Agreement. DARREN TANNER and NYSSA BULKES, *University of Illinois at Urbana-Champaign*. — We investigated effects of morphosyntactic feature markedness on processing subject-verb agreement during language comprehension. Previous language production research has shown that long-distance

subject-verb agreement is subject to interference from intervening nouns, but that this interference is asymmetric with respect to number features: only plural-marked nouns result in processing interference. To investigate this in comprehension, we recorded eye movements while participants read sentences with either singular or plural head and local nouns and grammatical or ungrammatical verbs (e.g., "The boy(s) by the water fountain(s) patiently was/were waiting for the school nurse."). Results showed that ungrammaticality effects occurred for singular-head sentences in both early (gaze duration) and late processing (total reading time) measures, but only in late processing measures for plural-head sentences. No attraction interference was found for any reading time measures. We discuss our results in the context of theories of feature markedness and memory retrieval in morphosyntactic processing.

Email: Darren Tanner, dstanner@gmail.com

(2142)

Number Attraction Occurs Even When There Are no Plurals. LAP-CHING KEUNG and ADRIAN STAUB, *University of Massachusetts Amherst.* — A large literature has demonstrated that local plural nouns induce verb agreement errors (e.g., *The key to the cabinets are...). Several previous experiments have suggested that morphological regularity (i.e., an overt -s morpheme) and notional plurality have little if any influence on the potency of a local noun as an attractor. Rather, grammatical number is what matters. These findings predict that number attraction should arise when the attractor is in fact a conjunction of two singular nouns, on the assumption that a conjunction is grammatically plural. Using a two-choice response time (RT) paradigm, we show similar increases in the error rate and RT in sentences with plural local nouns (e.g., The key to the cabinets...) and in sentences with conjoined singular local nouns (e.g., The key to the cabinet and chest...). These results confirm that the grammatical number of the attractor drives attraction and show that in fact attraction can arise even in the absence of any morphologically plural element.

Email: Lap-Ching Keung, lkeung@psych.umass.edu

(2143)

Investigating Grammar Acquisition: How Beneficial Are the Availability of Semantic Information and the Type of Feedback Given During Language Learning for the Grammar Acquisition Process? BIRGIT OETTL, *Universität Tübingen*, GERHARD JAEGER, *Eberhard Karls University, Tuebingen*, BARBARA KAUP, *Universität Tübingen.* — Grammar acquisition constitutes one major challenge during language learning. Therefore, this study investigated potential factors that might facilitate grammar learning, namely the availability of semantic information and the type of feedback given during the acquisition phase. In a series of Artificial Grammar Learning (AGL) experiments participants were exposed to a grammatical rule in an artificial language. Learning performance was subsequently accessed through a grammaticality judgment task. One group of participants received semantic information on the artificial language prior to the AGL task; another group of participants did not. Results

showed that semantics did not affect learning performance when exposure time and prior language knowledge were controlled for. This finding suggests that semantic information does not facilitate grammar learning. Whether and how aspects of the learning situation support grammar acquisition is currently investigated by studying the effect of different types of feedback on the grammar learning process.

Email: Birgit Oettl, birgit.oettl@uni-tuebingen.de

(2144)

Bilinguals' Auditory Perceptual Simulation (APS) During Silent Reading. KIEL CHRISTIANSON and PEIYUN ZHOU, *University of Illinois.* — Two eye-tracking experiments investigated effects of auditory perceptual simulation (APS) of native and non-native speech on bilinguals' sentence reading and comprehension implicitly via eye movements during silent reading and explicitly via off-line comprehension probes. Social attractiveness surveys were used to evaluate readers' attitudes towards the native and non-native speech in the experiment. Standardized vocabulary and verbal working memory tasks were used to measure language-specific individual differences. The results demonstrated that bilingual speakers displayed reading patterns similar to native English speakers when activating APS: APS of the native speech resulted in faster reading speed than APS of the non-native speech; structure and plausibility significantly affected reading speed (ORC >SRC; implausible > plausible) and accuracy (ORC < SRC; implausible < plausible). Highly proficient bilinguals had faster reading speeds and better comprehension than less proficient bilinguals. Correlations between APS performance and subjects' working memory will be discussed within a larger theory of APS.

Email: Kiel Christianson, kiel@illinois.edu

(2145)

Socio-Contextual Information Influences Codeswitching in Spanish-English Bilinguals. CAITLIN Y. TING, *Pennsylvania State University*, JANET G. VAN HELL, *Pennsylvania State University/Radboud University, Nijmegen* (Sponsored by Natasha Tokowicz). — Bilinguals frequently switch between languages within an utterance. Earlier, we found that bilinguals were faster to read codeswitches preceded by socio-contextual cues congruent with the language of the switch than codeswitches preceded by incongruent cues (e.g., "Women in Valencia (congruent)/Chicago (incongruent) always have their cabello cut fashionably"), indicating that socio-contextual cues modulate switching costs. This effect was more pronounced for bilinguals living in a bilingual environment than bilinguals living in a monolingual environment. In the present study, we investigated whether a monolingual or bilingual context would modulate codeswitching. Participants read codeswitched or single-language (English) passages before reading the above codeswitched sentences, containing congruent or incongruent socio-contextual cues, using a self-paced reading task. Only in the bilingual, but not in the monolingual, context did congruent socio-contextual cues

modulate the reading of codeswitched sentences. These results suggest that linguistic context influences whether or not socio-contextual cues affect the reading of codeswitched sentences.
Email: Caitlin Y. Ting, caitlin.y.ting@gmail.com

(2146)

Syntactic Processing in Late Farsi-English L2 learners. FATEMEH ABDOLLAHI and MAHSA MORID, *Pennsylvania State University*, JANET VAN HELL, *Pennsylvania State University/Radboud University, Nijmegen*. — Much research has focused on whether late second language (L2) learners can learn an L2 to a native-like level. As predicted by the Competition Model (MacWhinney, 2005) structures similar between the first language (L1) and L2 are learned most quickly, while uniquely represented structures are learned with greater difficulty or at a slower rate. The present study examined an understudied L2 learner group, learning a typologically distinct L2. Late Farsi (L1) – English L2 learners, immersed in the L2, were tested on syntactic processing of structures similar between the L1 and L2, and unique to the L2. Participants completed a grammaticality judgment task to obtain measures of on-line processing of the L2. Bilingual participants demonstrated accuracy comparable to native speakers in similar constructions, but significantly lower accuracy to unique constructions; an ERP follow-up study is currently in progress. Theoretical implications for syntactic processing and late L2 learning will be discussed.
Email: Fatemeh Abdollahi, fxa143@psu.edu

(2147)

The Gender Congruency Effect During Bilingual Spoken-Word Recognition. LUIS MORALES and DANIELA PAOLIERI, *University of Granada*, PAOLA DUSSIAS, *Pennsylvania State University*, JORGE VALDES KROFF, *University of Pennsylvania*, CHIP GERFEN, *American University*, M. TERESA BAJO, *Universidad de Granada*. — Using the Visual World paradigm, we investigate the gender-congruency effect during bilingual spoken-word recognition. The eye-movements of Italian-Spanish bilinguals and Spanish monolinguals were monitored while viewing two objects on the screen. Participants listened to instructions in Spanish ("Encuentra la(fem.) bufanda(fem.)" -Find the scarf) and were asked to click on the named object. Grammatical gender of the objects' name was manipulated, so that each pair either did or did not share gender in Italian (Congruent and Incongruent conditions), but always shared gender in Spanish. Results showed that bilinguals, but not monolinguals, looked at the target object fewer when it was incongruent in gender, suggesting a between-language gender effect. In a third condition, bilinguals looked at the target picture more when the definite article in the speech provided a valid cue to anticipate its selection (different-gender condition). We discuss the temporal dynamics of gender processing and cross-language activation in bilinguals.
Email: Luis Morales, luismorales@ugr.es

(2148)

Learning Two Artificial Languages: L1 Knowledge Influencing L2 Learning. JULIA YING and MORTEN CHRISTIANSEN, *Cornell University*. — Second language (L2) learners' first language (L1) often affects how they learn the new language. This has been reported in the domains of phonology, morphology, and syntax. The present study employs artificial language learning to investigate how phonological patterns in L1 may affect L2 learning. Participants were first familiarized with a set of novel words with a systematic sound-meaning mapping that provided cues to category structure (objects vs. actions), and then presented with a second set of novel words that either have the same phonological pattern as L1, or the opposite of L1 (i.e., sounds that are associated with objects in L1 are associated with actions in L2 and vice versa). L2 vocabulary recall and learning rates were assessed. Results show potential influence of L1 on the learning speed of L2 and will be discussed in context of the arbitrariness of sound-meaning mappings in natural languages.
Email: Julia Ying, jry26@cornell.edu

(2149)

The Effect of Immersion Context and Cognitive Control Ability on Semantic Prediction and Constraint in Bilingual Readers. MEGAN ZIRNSTEIN, *Pennsylvania State University*, JANET VAN HELL, *Pennsylvania State University/Radboud University Nijmegen*, JUDITH KROLL, *Pennsylvania State University*. — When reading for comprehension, the ability to flexibly generate expectations about upcoming input can be highly beneficial, especially for bilinguals reading in the second language (L2). However, being able to recover when predictions are disconfirmed is also a necessary part of fluent reading. We investigated this process when bilinguals read in the L2. Chinese-English bilinguals immersed in an L2 context (Experiment 1) and Dutch-English bilinguals immersed in an L1 context (Experiment 2) read high vs. low semantically constraining sentences in L2 English while their EEG was recorded. ERPs were time-locked to expected vs. unexpected target words. Cognitive control was measured using the AX-CPT task (Experiments 1 & 2) and a blocked letter fluency task (Experiment 2). Results indicate that control ability mediates the difficulty that bilingual readers have in negotiating conflict when a prediction is disconfirmed. Implications for how immersion context can influence cognitive control ability will be discussed.
Email: Megan Zirnstein, mkz2@psu.edu

(2150)

Interactions Between Native and Non-Native Vowel Categories: L2 Production Training Study. NATALIA KARTUSHINA, ALEXIS HERVAIS-ADELMAN, U. H. FRAUENFELDER and NARLY GOLESTANI, *University of Geneva*. — While native language effects on the production of foreign sounds are well established, the inverse is not. To explore such effects we trained 20 native French speakers with visual articulatory feedback to produce a foreign (Danish) /o/ vowel that perceptually assimilates to the French /o/. We examined the production of native and trained vowels before training and also training-related changes in both vowels.

After training, participants produced the Danish vowel more accurately and less variably. Speakers whose native productions were less variable and acoustically farther from the foreign target vowel improved more in their L2 production. On average, the production of the French vowel did not change. However, across subjects, training-induced changes in the production of the trained vowel were highly correlated with changes in native vowel production, suggesting that learning to produce foreign sounds displaces the representation of acoustically similar native categories toward the new foreign sound category.

Email: Natalia Kartushina, natalia.kartushina@unige.ch

• BILINGUALISM II •

(2151)

Examining the Effects of Active Versus Passive Bilingualism on Executive Control in a Non-Immigrant Population Sample. ANGELA DE BRUIN, THOMAS BAK and SERGIO DELLA SALA, *University of Edinburgh* (Sponsored by Alan D. Baddeley). — It is often argued that bilinguals have a cognitive advantage over monolinguals (e.g., Bialystok et al., 2004). In many of these studies, however, bilingualism is confounded with immigration status. We examined the effects of bilingualism on executive control in older adults by comparing Gaelic-English bilinguals to an English monolingual group matched on lifestyle, socio-economic status, education, IQ, and age. Importantly, none of the participants were immigrants. To examine the effects of knowing versus using two languages, we also tested a group of 'passive bilinguals': People who have learned Gaelic as a child, but mainly use English. Participants completed various executive control tasks, including the Simon task, Test of Everyday Attention, task switching paradigm, and Tower of London task. We will discuss whether bilingualism affects executive control in a non-immigrant population sample, as well as the effects of active versus passive bilingualism.

Email: Angela de Bruin, angela.debruin@ed.ac.uk

(2152)

The Role of Bilingualism and Aging in Working Memory and Executive Control. MARGOT D. SULLIVAN, YOLANDA PRESCOTT and ELLEN BIALYSTOK, *York University*, FERGUS CRAIK, *Rotman Research Institute*. — Bilingual advantages in executive control have been reported across the lifespan (Bialystok et al., 2009), but studies of working memory, a key aspect of executive control, have produced varied results. In the current study, healthy older adult (M = 71.6 years) and younger adult participants (M = 21.2 years) who were either monolingual or bilingual, performed a battery of working memory tasks that varied in their demands for executive control. Tasks included a star counting task that manipulated forward/backward counting and switching demands, a flanker task that required participants to respond to either the correct or opposite arrow direction adding inhibition demands, and a nonverbal recent

probe memory task. In all three tasks, complex conditions that required more executive control were performed better by younger participants and bilinguals, with no interactions. The interpretation is that bilingual advantages in working memory are linked to the need for executive control. Bialystok, E., Craik, F.I.M., Green, D.W., & Gollan, T.H. (2009). Bilingual minds. Psychological Science in the Public Interest, 10, 89-129. doi:10.1177/1529100610387084

Email: Fergus Craik, fcraik@rotman-baycrest.on.ca

(2153)

Distraction Resistance Within and Across Languages: Implications From Suppressive and Facilitatory Priming. EWALD NEUMANN, PAUL N. RUSSELL and ANURADHA Y. SHRIKHANDE, *University of Canterbury*. — Within- and cross-language priming experiments with English monolinguals (Exp. 1) and English-Māori bilinguals (Exp. 2) were conducted. The task entailed both "attended repetition" (positive priming), and "ignored repetition" (negative priming) manipulations involving words within the same language with monolinguals, and across languages with bilinguals. If more proficient bilinguals possess enhanced inhibitory control abilities, they should show reduced positive priming, coupled with increased negative priming, compared to both less proficient bilinguals and the monolinguals in Exp. 1. By contrasting the magnitude of both positive and negative priming effects in these monolingual and bilingual priming tasks, we isolated two forms of inhibitory control evidenced by the more proficient bilinguals. Because the findings corroborate earlier observations with English-Spanish bilinguals (Neumann, et al. 1999), it appears that universal consistencies in bilingual language juggling can involve two sources of inhibitory control – one operating at a local word level, the other at a global language level.

Email: Ewald Neumann, ewald.neumann@canterbury.ac.nz

(2154)

Cognitive Control During Trilingual Language Switching: Does Relative Proficiency Matter? JARED LINCK, ERICA MICHAEL, EWA GOLONKA and MEG EDEN KUYATT, *University of Maryland*. — Recent studies of bilingual speech production suggest that multiple executive functions (EFs) contribute to the cognitive control of language production. In a previously reported study of unbalanced trilinguals performing a language switching task, Linck et al. (November, 2011) examined individual differences in three EFs (working memory, inhibitory control, and task switching) and found that better inhibitory control was related to smaller switch costs into the L1, whereas better working memory was related to larger switch costs into the L1 as well as the L2, but only when switching from the L1. In the current study, highly proficient trilinguals performed the same EF and language switching tasks. We compare the results from less and more proficient trilinguals to assess whether the contributions of each EF to language switching depends on the trilingual's language dominance profile. We discuss the theoretical implications for cognitive control during multilingual language production.

Email: Erica Michael, emichael@casl.umd.edu

(2155)

Interactions Between Cognitive and Emotional Control in Monolingual and Bilingual Children. MONIKA JANUS and ELLEN BIALYSTOK, *York University*. — Considerable reserach shows the powerful effect of emotional control on children's psychosocial adjustment and executive functioning. In previous research, bilingualism has been associated with enhanced executive functioning throughout development, but its effect on emotional control has yet to be investigated. The current study assessed the performance of 8- to 10-year old monolingual and bilingual school children on an emotional variant of the n-back working memory task (1- and 2-back). Angry, happy, or neutral facial stimuli surrounded the to-be-remembered letters and interfered with ongoing cognitive processing. As predicted, children performed better on trials with a lower memory load (1-back) and more positive emotions. Importantly, bilingual children outperformed their monolingual peers on the emotionally aversive conditions which have been shown to cause the most interference in cognitive processing. The interpretation is that bilingualism is associated with better emotional control and adaptive psychosocial skills in children, in addition to its known cognitive advantages.
Email: Ellen Bialystok, ellenb@yorku.ca

(2156)

Translation Ambiguity and Individual Differences in L2 Vocabulary Learning. NATASHA TOKOWICZ, ALBA TUNINETTI and TESSA WARREN, *University of Pittsburgh*, KARLA RIVERA-TORRES, *University of California at Los Angeles*. — "Translation-ambiguous words" (that have more than one translation across languages) are harder to learn and process than "translation-unambiguous words" (that have only one translation; e.g., Degani & Tokowicz, 2010). We taught monolingual English speakers 48 German words with one, two, or three English translations to explore the source of this ambiguity disadvantage and its relationship to individual differences in cognitive skill. Accuracy and reaction time on correct trials from a German to English translation task served as dependent measures. Translation-unambiguous words were translated more accurately than words with two or three translations, which elicited similar responses. For three-translation words, the first translation taught was translated more accurately than the second and third translations. Individuals with higher English vocabulary knowledge translated one and two translation words more accurately than individuals with lower English vocabulary knowledge. These findings provide insight into the mechanisms that make translation-ambiguous words harder to learn.
Email: Natasha Tokowicz, tokowicz@pitt.edu

(2157)

Learning Japanese Sign Language as a Second Language: Form and Semantic Interference in Translation Recognition. YUKITO ISO and NORIKO HOSHINO, *Kobe City University of Foreign Studies*. — Second language (L2) learners rely more on form than on meaning during the early stages of L2 learning (e.g., Talamas et al., 1999). As their L2 proficiency increases, they focus more on meaning than on form. The present study examined the role of iconicity in learning Japanese Sign Language (JSL) as an L2. Specifically, it was predicted that even more proficient learners would heavily rely on form due to the iconic aspect of JSL. Learners of JSL performed a translation recognition task in which a sign was followed by a Japanese word whose sign was form-related, form-and meaning-related, or unrelated to the target sign. The results showed that learners produced smaller form and form-meaning interference with increasing proficiency. Implications for L2 vocabulary learning will be discussed.
Email: Noriko Hoshino, Noriko.Hoshino@inst.kobe-cufs.ac.jp

(2158)

Investigating Prediction in L2 Morpho-Syntax: An Eye Tracking Study. TELJER LIBURD, TESSA WARREN and NATASHA TOKOWICZ, *University of Pittsburgh*. — When speakers of gendered languages hear determiners, they anticipate nouns that share the determiner's gender. We examined whether beginning L2 learners anticipate upcoming nouns using determiners' number/grammatical gender, as a function of cross-language similarities. Native English speakers were taught Dutch nouns, and determiners that were "Similar" or "Different" in English and Dutch, and "Unique" to Dutch. We tracked eye movements to pairs of pictures while participants listened to partial determiner-final Dutch sentences; they identified by button press which picture best completed the sentence. Numerically more fixations were made on the target picture following Similar than Unique sentences. Fixations on the target increased significantly more quickly for the Similar than the Different or Unique condition. Accuracy was higher for Similar than Unique sentences. Cross-language similarity appears to modulate the learnability of mapping a determiner to its noun, and beginning L2 learners can use morpho-syntax to make predictions during online sentence comprehension.
Email: Teljer Liburd, tll28@pitt.edu

(2159)

Informal Translation Experience Facilitates Translation Verification of Idiomatic Phrases. JYOTSNA VAID and BELEM LOPEZ, *Texas A&M University*. — In previous work we have demonstrated that experience in informal translation ("language brokering") is associated with a more convergent conceptual representation across languages (Lopez & Vaid, 2014). The present study examined whether such experience also facilitates activation of idiomatic meanings across languages. Spanish-English proficient bilingual adults with or without prior brokering experience were tested on a translation verification task consisting of idiomatic phrases in each language paired with phrases that were unrelated in meaning to the idiom, or were literal equivalents (word for word translations), figurative equivalents rendered non-idiomatically, or figurative equivalents rendered idiomatically. Supporting our hypothesis, brokers were faster and more accurate in recognizing figurative translations of the phrases. These findings extend other work showing long-term repercussions of brokering experience to the domain of semantic processing.
Email: Belem Lopez, bglopez09@gmail.com

(2160)

Sentence Context Influences Participants' Perception of a Foreign Accent. SARA INCERA, AMEE SHAH, CONOR MCLENNAN and MATTHEW WETZEL, *Cleveland State University*. — In the present study, we used mouse tracking to examine whether sentence context influences subjective perceptions of a foreign accent. Previous work has demonstrated that accent manipulations affect listeners' processing of spoken language. We examined the converse of this relationship. That is, we investigated whether listeners would be more likely to rate an accent as strong when presented in the context of a nonsense sentence. Results revealed that participants were significantly more likely to rate a spoken word as having a "Strong Accent" in the context of a nonsense sentence (66%) than when the same recording was presented in a meaningful sentence context (50%), t(23) = 3.23, p = .004, d = 0.74. The present study provides new information regarding the relationship between lexical access and the subjective perception of foreign-accented speech. In addition, these results have practical implications regarding how foreign accented speakers are perceived.
Email: Sara Incera, saraincera@gmail.com

(2161)

Speech Segmentation in Liaison Contexts by Native and Non-Native French Listeners. ERIN GUSTAFSON and ANN BRADLOW, *Northwestern University* (Sponsored by Matt Goldrick). — This study investigated native and non-native French listeners' segmentation of speech with misaligned syllable and word boundaries (liaison). In liaison, word-final consonants surface as onsets only before vowel-initial words (e.g., petit abri [#pə. ti. t#a. bʁi#] but *petit chou* [#pə. ti# ʃu#]). Participants identified the second word in two-word French phrases as either vowel-initial (liaison environment) or consonant-initial (non-liaison environment). The consonant duration was manipulated to cue either a liaison or consonant-initial parse (short vs. long duration, respectively), and listeners heard clear and degraded signals. Both natives and non-natives showed a lexical bias (more word-word than word-nonword parses), but it was attenuated for non-natives who over-applied liaison yielding comparatively more word-nonword parses for consonant-initial productions (e.g., petit *ableau). Moreover, both groups relied relatively more on consonantal duration in degraded conditions. Together, these findings indicate a dynamic hierarchy of word boundary cues depending on L1/L2 status, and on listening conditions.
Email: Erin Gustafson, egustafson@u.northwestern.edu

(2162)

Training American English Speakers to Discriminate Hindi Dental and Retroflex Stops in Lexical Contexts. ANNE OLMSTEAD, *SUNY-New Paltz*, NAVIN VISWANATHAN, *SUNY-New Paltz & Haskins Lab, New Haven,* BRITTANY T. WILLIAMS and CATHERINE E. ATTANASIO, *SUNY-New Paltz*. — American English (AE) speakers typically have difficulty discriminating between Hindi dental [t̪] and retroflex [ʈ] consonants (Pruitt et al. 2006). In this study, we investigate whether exposure to these non-native contrasts in accented English word contexts promotes their discriminability. In

order to do so, we utilize two differences between AE and Indian English (IE); the voiceless aveolar stop [t] of AE is realized as the retroflex in IE and the interdental fricative [θ] as the dental stop (Sailaja, 2009). Specifically, we compare lexical decision task performance by AE listeners on word–nonword pairs such as theatre/teatre and tennis/thennis in unaccented and accented speech conditions. Following the predictions of the Perceptual Assimilation Model (Best, 1994), we hypothesize that presenting these non-native consonants in these lexical contexts would promote discriminability by facilitating the assimilation of these non-native consonants into separate native categories.
Email: Anne Olmstead, olmsteaa@newpaltz.edu

• NEURAL MECHANISMS OF COGNITION •

(2163)

Mirror Neuron Activation in Musicians and Non-Musicians. MICHAEL O'BOYLE, WILLIAM WESTNEY and JAMES YANG, *Texas Tech University*, CYNTHIA GRUND, *University of South Denmark*, JIANCHENG HOU and DAN FANG, *Texas Tech University*, RAVI RAJMOHAN, *Texas Tech Unversity Health Sciences Center*. — Mirror neurons activate when observing movements performed by another individual even though one is not actually engaged in the movement themselves. In humans, mirror neurons are primarily localized to the supplementary motor areas, primary somatosensory cortex and inferior parietal cortex, with some also found in frontal regions (Rizzolatti & Craighero, 2004). In the present study, fMRI images were acquired while musicians/non-musicians viewed motion capture videos of actual piano performances. Musicians exhibited more activation than non-musicians in several motor neuron regions suggesting that mirror neuron activation is not only associated with the imagining of the observed movement, but can be modulated (i.e., increased/decreased) depending upon the musical expertise of the observer. While all individuals observing motion capture videos would be expected to activate some mirror neurons, those who actually share the capability to produce the target movements show greater activation, perhaps as a by-product of imagining themselves playing the musical piece.
Email: Michael O'Boyle, michael.oboyle@ttu.edu

(2164)

Right Parietal Cortex Mediates Memory for Melodies: A tDCS Study. NORA K. SCHAAL, *Heinrich-Heine-University, Düsseldorf, Germany*, AMIR HOMAYOUN JAVADI, *University College London*, ANDREA R. HALPERN, *Bucknell University*, BETTINA POLLOK, *Heinrich-Heine-University, Düsseldorf, Germany*, MICHAEL J. BANISSY, *University of London*. — Functional brain imaging studies have highlighted the significance of right-lateralized temporal, frontal and parietal brain areas for memory for melodies. We investigated the involvement of bilateral posterior parietal cortices (PPC) for the recognition memory of previously unfamiliar melodies using transcranial direct current stimulation (tDCS). Encoding

and recognition took place before tDCS as a baseline and again after tDCS. Experiment 1 revealed that anodal tDCS over the right PPC leads to a decrease of overall memory performance compared to sham. Experiment 2 confirmed these results and further showed that anodal tDCS over the left PPC does not show a modulatory effect on memory performance, indicating a right lateralization for musical memory. Furthermore, the decline in memory after anodal stimulation only occurred for Remember, not Know judgments. This study reveals a causal involvement of the right PPC in recollective recognition of melodies.
Email: Andrea R. Halpern, ahalpern@bucknell.edu

(2165)

Neural Basis of Individual Differences in a Relative Heading Task. HEATHER BURTE, BENJAMIN O. TURNER, MICHAEL B. MILLER and MARY HEGARTY, *University of California, Santa Barbara.* — Individuals differ in their ability to learn spatial layouts and navigate effectively through environments, but the neural basis of these differences is unclear. Effective navigation is aided by the use of allocentric headings (facing directions relative to the environment), which are coded by the presubiculum (Vass & Epstein, 2013). However, the ability to identify allocentric headings from photographs has shown large individual and strategy differences (Sholl, Kenny & De la Porta, 2006; Burte & Hegarty, 2014). To determine the neural bases of these differences, participants completed tests of navigational preferences and spatial abilities, completed a Relative Heading task within fMRI, and reported strategy use. Relative Heading task performance was correlated with sense-of-direction, perspective-taking ability, and right-left discrimination abilities. Neural correlates of individual and strategy differences were assessed within the presubiculum, retrosplenial cortex, medial parietal, and medial temporal lobes. Identifying the neural bases of individual differences in directional abilities will provide insights into differences within navigational abilities.
Email: Heather Burte, burte@psych.ucsb.edu

(2166)

Enhancing Navigation Efficiency via Low Current Brain Stimulation: A Role for Individual Differences. TAD BRUNYE, AMANDA HOLMES, JULIE CANTELON, MARIANNA D. EDDY, and AARON L. GARDONY, *Tufts University & US Army*, HOLLY A. TAYLOR, *Tufts University.* — We evaluated the influence of right versus left temporal transcranial direct current stimulation (tDCS) on navigation efficiency and spatial memory in individuals with low versus high spatial skills. A mixed design administered low (0.5mA) versus high (2.0mA) intensity anodal tDCS (within-participants) over the right or left medial temporal lobe (between-participants). During stimulation participants navigated virtual environments in search of specified landmarks, and data were logged regarding current position and heading over time. Following stimulation, participants completed pointing and map drawing spatial memory tests. Individual differences in sense of direction reliably and inversely predicted navigation advantages in the 2.0mA

versus 0.5mA right hemisphere stimulation condition. Spatial memory tests also demonstrated that stimulation modulated spatial memory development. Right temporal anodal tDCS may hold potential for enhancing navigation efficiency in otherwise poor navigators, and suggest that continuing research may find value in optimizing stimulation parameters (intensity, focality) as a function of individual differences.
Email: Tad Brunye, tbruny01@tufts.edu

(2167)

Neural Correlates of Human Discrimination Learning. DANIELLE LOWRY, JESSICA PARKS, RICHARD MICHAEL OWEN, BRANDY TIERNAN and SHARON MUTTER, *Western Kentucky University.* — Event–related potentials (ERPs) were recorded during a discrimination learning task in which participants located a target after the appearance of a cue. The cue, a bi-color arrow, was either a valid predictor (100% correct) or an invalid predictor (50% correct) of target location. Depending on the condition, either the presence (feature positive, FP) or the absence (feature negative, FN) of a specific color in the arrow indicated that the cue was valid. Participants learned the FP rule faster than the FN rule and for those who reported rule awareness, reaction times decreased for valid cues relative to invalid cues. Differences in P3 and CNV event-related potential amplitude for valid and invalid cues may reflect increased attention and a reduction in response preparation to predictive cues (e.g., Rose, Verleger, & Wascher, 2001).
Email: Danielle Lowry, kdlowry.wku@gmail.com

(2168)

Neural Mechanisms Underlying Learning From Repeated Memory Retrieval. XIAONAN LIU and DEBORAH TAN, *Carnegie Mellon University*, YA ZHANG, *University of Pittsburgh*, LYNNE REDER, *Carnegie Mellon University.* — Despite the spate of research concerned with why testing is superior to study, it is still unclear whether the testing effect (superior retention following testing compared with additional study) requires only a single test to show this advantage or whether multiple tests are required. In this experiment, subjects were scanned while trying to learn arbitrary word pairs. After studying all word pairs, learning activities varied for different word-pairs in two subsequent learning phases before the final delayed test the following day. Some word-pairs were re-studied in both phases, some pairs were tested in both subsequent learning phases and some had one additional study and one test the same day before the final delayed test. We found behavorial and neuro-imaging differences as a function of the number of tests and as a function of confidence in study and test performance.
Email: Xiaonan Liu, liuxiaonan87@gmail.com

(2169)

Reversing the Testing Effect by Feedback: Behavioral Results and Neural Correlates. BERNHARD PASTÖTTER and KARL-HEINZ BÄUML, *Universität Regensburg.* — Recent work showed that the testing effect can be reversed when feedback is provided in delayed recall testing (Storm, Friedman, Murayama, & Bjork, 2014). The goal of this study

was to replicate the finding and examine possible neural correlates of the effect. Participants learned weakly related word pairs and underwent a practice phase in which half of the items were tested and half were restudied. Two days later, all items were tested twice and feedback was provided on the first recall test. Behavioral results show the testing effect in Test 1 but a reversed testing effect in Test 2, which replicates the previous work. Electrophysiological results show oscillatory correlates of the differential benefits of feedback for tested and restudied items and the reversed testing effect. Connections of the present results to the bifurcation model (Kornell, Bjork, & Garcia, 2011) are discussed.
Email: Bernhard Pastötter, bernhard.pastoetter@psychologie.uni-r.de

(2170)

An Examination of the Processes Underlying the Recognition Memory Decision: A State-Trace Analysis of Behavioural and ERP Data. EMILY FREEMAN, *The University of Newcastle*, JOHN DUNN, *The University of Adelaide*, SIMON DENNIS, *The University of Newcastle*, GILLIAN RHODES, *The University of Western Australia*. — Recognition memory is argued by some to rely on a single process, memory strength, while others prefer a dual process, familiarity and recollection, model. The dual process model is supported by research claiming that two separate event-related potentials (ERPs), the FN400 and a late parietal component (LPC), reflect familiarity and recollection, respectively. Two experiments were conducted in which familiarity (study repetition) and recollection (Experiment 1: focused/divided attention; Experiment 2: same/different orientation) were manipulated. Participants studied items presented 1, 2, or 4 times under either the attention or orientation conditions and were tested using a 6-point confidence rating scale. Behavioural and ERP data were collected and analysed using state-trace analysis. When familiarity (low confidence hit rate/FN400) was plotted against recollection (high confidence hit rate/LPC) for the behavioural and ERP data, evidence of a single process was found. This study supports the notion of a single process underlying the recognition memory decision.
Email: Emily Freeman, emily.e.freeman@gmail.com

(2171)

Are Items in Working Memory, but Outside Focal Attention, Stored With Long-Term Memory Mechanisms? EMMA E. MEYERING and NATHAN ROSE, *University of Wisconsin-Madison*, R. SHAYNA ROSENBAUM, *York University,* BRADLEY R. POSTLE, *University of Wisconsin-Madison.* — Neuroimaging fails to find evidence for an active neural trace for items held in working memory (WM) but outside of focal attention (FA). Are these "unattended memory items" (UMIs) retained in WM via long-term memory (LTM) mechanisms? To address this question, subjects first performed a WM task with retrocues that varied how long items were held in FA, and were later administered surprise LTM tests of declarative and nondeclarative memory for items from the WM test. Subsequent word-stem completion priming was insensitive to the amount of time an item was held in FA. Subsequent

cued recall and delayed recognition, however, was superior for items held longer in FA. These results are inconsistent with the idea that UMIs receive privileged encoding into LTM.
Email: Emma Meyering, meyering@wisc.edu

(2172)

Give Me Just a Little More Time: Effects of Alcohol on the Failure and Recovery of Cognitive Control. KIRA BAILEY, BRUCE D. BARTHOLOW and J. SCOTT SAULTS, *University of Missouri-Columbia*, SARAH A. LUST, *University of Connecticut.* — Although research generally indicates that alcohol impairs cognitive abilities, a close examination of the literature suggests that alcohol's effects are quite variable and likely depend on a number of contextual factors. The purpose of the current study was to characterize the effects of alcohol on cognitive control in terms of neural and behavioral responses to successful and unsuccessful control attempts. Participants were randomly assigned to consume an alcohol (0.80 g/kg ETOH), placebo, or non-alcoholic control beverage prior to completing a flanker task while event-related brain potentials (ERPs) were recorded. Neural indices of conflict monitoring (N2) and performance adjustment (frontal slow wave) were attenuated by alcohol, but only on trials following errors. These functions had recovered, however, by two trials after an error. These findings suggest that alcohol's effects on cognitive control are best characterized as impaired (or delayed) recovery following control failures.
Email: Kira Bailey, baileyki@missouri.edu

(2173)

Pushing the Limits of Visual Word Recognition Skill: Lexical and Nonlexical Processing in Competitive Scrabble Experts. SOPHIA VAN HEES, PENNY PEXMAN, IAN S. HARGREAVES and LENKA ZDRAZILOVA, *University of Calgary*, KAIA MYERS-STEWART, *University of Ottawa*, ANDREA B. PROTZNER, *University of Calgary*. — In a recent study, Hargreaves et al. (2012) showed that competitive Scrabble expertise was associated with exceptional performance in the lexical decision task. We extended this investigation using fMRI to examine the consequences of competitive Scrabble expertise for processing in a lexical decision task and also a separate "twin task" that involves horizontal and vertical processing of non-lexical stimuli. Participants were a group of competitive Scrabble players and a group of non-expert controls. Behavioural results showed little evidence of transfer: group differences were observed in lexical decision but not in the twin task. Imaging results, however, showed that the regions associated with Scrabble (anagramming) skill were similar across both the lexical decision task and the twin task but were different across groups. Thus, the brain changes associated with Scrabble practice were observed regardless of whether the task involved lexical stimuli or other symbols.
Email: Penny Pexman, pexman@ucalgary.ca

(2174)

Vertex- and Paracellation-Level Analyses of IQ and Cortical Folding. DAVID VAZQUEZ, ADAM DAILY, ADAM FELTON and CHRISTINE CHIARELLO, *University of California, Riverside*. — Neuroscience aims to objectively predict individual differences in cognition and behavior based

on brain morphometry. The extent of cortical folding may differ based on genetic and experiential influences. Luders et al. (2008) found that IQ scores correlated positively with amount of folding in the medial occipital-temporal region (N = 65). We examined the association of IQ and folding in a larger sample (N = 200) using vertex analyses of whole-brain gyrification, as well within specific parcellations. We found, both at the vertex and parcellation level, strong positive correlations of folding and full scale IQ in the lingual and fusiform gyri, near the location Luders et al. (2008) reported, as well as extensive perisylvian regions. The current study extends the findings of Luders et al. (2008) and supports the Parietal-Frontal integration theory (Haier, 2003) that intelligence may involve regions in the frontal and parietal cortex, mediated by occipital-temporal regions.
Email: Christine Chiarello, christine.chiarello@ucr.edu

(2175)

Localization of Function With fMRI Data, but Without Subtraction: Using Network Science Analyses to Discern Task-Related Brain Networks. DALE DAGENBACH and JUSTYNA K. RZUCIDLO, *Wake Forest University*, PAUL J. LAURIENTI and ROBERT G. LYDAY, *Wake Forest University School of Medicine*. — Many studies in the past few decades have shown localization of function in the brain with fMRI data using the subtractive method: The activation during the process of interest is contrasted with the activation during performance of a similar condition containing everything except the particular process of interest. While great strides have been made using this approach, it's also been somewhat unnerving because of what's been called the assumption of pure insertion: The subtractive method assumes that the addition of the process of interest doesn't change or alter the other processes in a meaningful way. Because of this concern, other procedures such as parametric variation have been added to neuroimaging methods. In this study, we use network science metrics examining functional connectivity, rather than activation and subtraction, during rest and working memory to derive resting state and working memory networks, thus providing another potential methodology for localizing function.
Email: Dale Dagenbach, dagenbac@wfu.edu

(2176)

Brain and Behavior in Decision-Making. PETER CASSEY, ANDREW HEATHCOTE and SCOTT BROWN, *University of Newcastle*. — Speed-accuracy tradeoff (SAT) is an adaptive process balancing urgency and caution when making decisions. Computational cognitive theories, know as evidence accumulation models, have explained SATs via a manipulation of the amount of evidence necessary to trigger response selection. New light has been shed on these processes by single-cell recordings from monkeys who were adjusting their SAT settings. Those data have been interpreted as inconsistent with existing evidence accumulation theories, prompting the addition of new mechanisms to the models. We show that this interpretation was wrong, by demonstrating that the neural spiking data, and the behavioral data are consistent with existing evidence accumulation theories,

without positing additional mechanisms. Our approach succeeds by using the neural data to provide constraints on the cognitive model. Open questions remain about the locus of the link between certain elements of the cognitive models and the neurophysiology, and about the relationship between activity in cortical neurons identified with decision-making vs. activity in downstream areas more closely linked with motor effectors.
Email: Peter Cassey, peter.cassey@newcastle.edu.au

(2177)

Risky Business? The Effects of Sensation Seeking Personality Traits on Performance Monitoring and Adjustment. SHELBY ADAMS, BRANDY N. TIERNAN, BERENICE ANAYA, JESSICA PARKS, KATHERINE LOWRY and SARAH HERRICKS, *Western Kentucky University* (Sponsored by Robert West). — Individuals with risk-taking and sensation seeking personalities are more likely to be impulsive and make poor decisions. Such behaviors have been linked to poor error processing and attentional control. The purpose of the current study was to discover conditions under which "risk takers" become more aware of behavioral outcomes and how this awareness influences the error related negativity (ERN), a component of the event-related brain potential (ERPs) that reflects a distress-related response to control failures. We related self-report measures of risk taking and other personality traits to the ERN elicited during a variation of the Stroop task. The punishment condition resulted in the largest improvement in error processing of those measuring high on risk taking. Our results provide support that risk-taking traits affect responsiveness to errors, and the ERN reflects the influence of the extent of individuals' concern with the outcome of events.
Email: Shelby Adams, shelby.adams264@topper.wku.edu

• STATISTICS AND METHODOLOGY •

(2178)

The Challenge of the Psychonomic Society Guidelines on Statistical Issues (2012). PETER MORRIS and CATHERINE FRITZ, *University of Northampton*. — In 2012 the Psychonomic Society adopted new guidelines on statistical issues. We examined all of the empirical papers published in the Society's journals in 2013 to discover how much needs to change to meet the guidelines. The Guidelines call for authors to consider statistical power and sample size, but only a tiny proportion of papers did so. The Guidelines emphasize the importance of reporting appropriate measures of variability "e.g., confidence intervals around means and/or around standardized effect sizes", but the reporting of variability was patchy. Nearly half the papers failed to report effect sizes and almost none discussed them. Effect size estimates were mostly limited to partial eta squared and Cohen's d, rather than population estimates. Confidence intervals were very rarely

reported and almost never used or discussed. Psychonomics authors and editors face a challenge to update the standard of statistical reporting if the 2012 Guidelines are to be met.
Email: Peter Morris, p.morris@lancaster.ac.uk

(2179)

Identification of Publication Bias Through Models of Publication Behavior. MAIME GUAN and JOACHIM VANDEKERCKHOVE, *University of California, Irvine.* — Recently, there has been a rising concern in the field of psychology about the reliability of published research findings. Publication bias, or treating positive findings differently from negative findings, is a contributing factor to this concern that has recently been referred to as the "crisis of confidence". The tendency of authors to report, and of journals to publish, only favorable significant findings is likely inflating the number of reported true effects in the literature. Here, we develop a Bayesian test for the detection of publication bias. We postulate a series of different models for the publication process: 1) a no-bias model, 2) an extreme-bias model, 3) a HARKing bias model, 4) a model with a constant bias parameter, and 5) a model with a bias parameter that depends on observed effect size. We compute Bayesian evidence values for all models, under both assumptions of the existence of a true effect and no effect at all. The models are then compared using Jeffreys weights. We use the obtained weights to mitigate the effects of publication bias and estimate the underlying effect size.
Email: Maime Guan, hongyang@uci.edu

(2180)

Order Constrained Linear Optimization. JOE W. TIDWELL and MICHAEL DOUGHERTY, *University of Maryland*, RICK P. THOMAS, *Georgia Tech University*, JEFFREY S. CHRABASZCZ, *University of Maryland.* — Most theories in the social and behavioral sciences are concerned with ordinal relationships, and are not sufficiently specified to justify a particular functional form for the data, including the assumption of linearity. Nevertheless, linear least squares (LLS) techniques are nearly ubiquitous in the analyses of experimental data, despite the fact that LLS lacks constraints that ensures it will accurately capture the ordinal properties of data. We illustrate the seemingly paradoxical finding that predicting metric properties of the data can come at the expense of accuracy predicting the ordinal properties when analyzed with LLS. We then introduce a new technique, order constrained least-squared optimization (OCLO) that is designed to find the best best-fit linear least squares solution, conditional on maximizing rank-order fit. Using both simulated and real data, we demonstrate that OCLO outperforms a variety of LLS models in terms of modeling and predicting rank-order properties of data, with minimal bias in parameter estimates.
Email: Michael Dougherty, mdougher@umd.edu

(2181)

Assessing the Replication Bayes Factor: The Case of Global Versus Local Priming. SARAHANNE FIELD, *University of Newcastle*, ERIC-JAN WAGENMAKERS, *University of Amsterdam*, BEN NEWELL, *University of*

New South Wales, DON VAN RAVENZWAAIJ, *University of Newcastle* (Sponsored by Diane Pecher). — Behavioral priming is arguably one of the key phenomena being studied in contemporary social psychology. Recent retractions (e.g. Smeesters & Liu, 2011) and failed replication attempts (see Pashler & Wagenmakers, 2012) have led to a division in the field between believers and skeptics, and serve to reinforce the importance of confirming priming effects through replication. In this presentation, we describe the results of a preregistered replication of two experiments by Förster and Denzler (2012) as part of a broader move to validate our knowledge of priming effects. This replication is timely in light of the recent allegations of data manipulation against Jens Förster. Verhagen & Wagenmakers (2014) propose three kinds of quantifying the success of replication attempts by means of Bayes factors. We analyze our results with all three of these Bayes factors, highlight their different conclusions and give some recommendations as to their practical use.
Email: sarahanne field, sarahanne.field@gmail.com

(2182)

Context Memory and Context Binding: A Hierarchical Multinomial Modeling Approach. NINA R. ARNOLD, CHRISTIAN BOYWITT and ARNDT BRÖDER, *University of Mannheim.* — Previous research suggests that recollective memories are distinguished from familiar memories not only by quantitative differences in context memory but also by qualitative differences. Stochastic dependency in retrieval of various context features has been observed for remember (R) responses but not for know (K) responses. The present study investigates the relationship between context memory and stochastic dependency in context retrieval. Participants studied words presented in two orthogonal dimensions (two font types and two colors) and memory was tested for the words and their context features. While standard approaches in multinomial modeling aggregate over participants, recent hierarchical extensions deal with participant heterogeneity allowing investigations of correlations between parameter estimates. Importantly, correlations between individual context memory and dependency in context retrieval may hint at the potentially confounding factor of overall context memory between R and K responses in the interpretation of selective dependency in context memory for R responses.
Email: Nina R. Arnold, niarnold@mail.uni-mannheim.de

(2183)

Bayesian Modelling in Systems Factorial Technology. JONATHAN THIELE, *University of Missouri-Columbia* (Sponsored by Jeffrey Rouder). — Systems Factorial Technology (SFT) is a series of methods used to determine the processing architecture employed in perceiving and, more recently, remembering information from two sources. In this poster, I present a novel combination of experimental methods and Bayes factors that provides a simple test of processing architecture which, with moderate assumptions, can be used to test participants naive to a given task.
Email: Jonathan Thiele, jet686@mail.missouri.edu

(2184)

Identifying and Assessing RT Measurement Bias When Data is Collected With Different Equipment. MEREDITH HUGHES and JARED LINCK, *University of Maryland*. — Specialized hardware and software support high-resolution reaction time (RT) measurement in the lab. But for researchers wanting to measure RTs over the web or on mobile devices, equipment differences (e.g., subjects using their own devices) can differentially bias RT measurement between subjects. Ulrich and Giray (1989) showed that mean differences in RT (e.g., congruency effects) are largely unbiased but that mean RTs (e.g., lexical decisions) are systematically overestimated. The bias can be corrected for, but only when the timing interval is known and consistent across subjects. We propose methods for detecting low-resolution RT measurement issues for individual subjects, and apply these methods to simulated RT data that varied across key factors observed in real web-collected RT data (e.g., measurement resolution, within- and between-subjects RT variability). The results can guide researchers in deciding when to fold these or similar detect-and-correct methods into their RT cleaning and analysis procedures.
Email: Jared Linck, jlinck@umd.edu

(2185)

What Should an Active Causal Learner Value? NEIL BRAMLEY and MAARTEN SPEEKENBRINK, *University College London*, JONATHAN NELSON, *Max Planck Institute for Human Development*, DAVID A. LAGNADO, *University College London*. — Causal structure induction is a highly important but relativelyunderstudied aspect of human learning. A mathematical framework hasbeen developed showing how intervening on a system can provideinformation about its causal structure (Pearl, 2000), but there islittle consensus about what makes a chosen intervention more or lessvaluable to real learners. Common norms for choosing interventions incognitive science include (1) classification error reduction(probability gain), and (2) information gain (reduction in Shannonentropy). We explore how each of these norms performs, whenimplemented in a stepwise (myopic) way, on a sequential causallearning task. In a variety of circumstances, stepwise informationgain's performance is superior to that of stepwise probability gain,at the goal of reducing error. We explored this surprising result bytesting a wider variety of information gain-like functions. A varietyof information gain measures, based on expected reduction in Tsallisand Renyi entropy, performed as well as the standard information gainmeasure.
Email: Neil Bramley, neil.bramley.10@ucl.ac.uk

(2186)

Quick, Quick, Slow: Is Millisecond Timing Accuracy Getting Worse in Computer-Based Studies and Could This be Affecting Your Ability to Replicate? RICHARD PLANT, *The Black Box ToolKit Ltd*. — Many researchers make use of computers to present stimuli, interface with other equipment and record responses. There is a tacit understanding that achieving timing consistency may not be as simple as entering identical parameters into different hardware configurations or software packages.With renewed emphasis on replication

across the field now might be an appropriate juncture to address the issues at the individual researcher, journal editor and funder levels. Our own research suggests accuracy is getting worse as hardware becomes faster and software for experimental control more complex. In most other fields poorly controlled studies that did not outline methodology fully or state confidence limits for equipment accuracy would not be published. In this paper we outline the issues, common pitfalls and offer practical solutions, e.g. to move all presentation, synchronisation and response timing off the experimental platform and onto external chronometry whilst adding little or no overhead for the experimenter. (Richard R. Plant is a director of The Black Box ToolKit Ltd and a research associate at the Department of Psychology, University of York.)
Email: Richard Plant, r.plant@blackboxtoolkit.com

(2187)

Semantic Vector Spaces as a Tool for Psychological Investigation. EYAL SAGI, *Northwestern University*. — The dramatic increase in the availability of language data through the Internet over the past two decades, and the corresponding increase in computational power, provide a rich source of information for psychological research. However, analyzing this information and using it to test psychological theories and models is not always easy or straightforward. In this presentation I describe a method that uses semantic vector spaces (such as those generated by Latent Semantic Analysis and Topic Models) to quantify patterns of word co-occurrence and test hypotheses. Using this method, I explore how differences in the representation of nouns and verbs affect the stability of their meaning, compare the levels and types of moral rhetoric associated with various concepts and debates, and track the convergence of language use as a measure of reaching agreement in a negotiation.
Email: Eyal Sagi, eyal@u.northwestern.edu

• CONCEPTS AND CATEGORIES I •

(2188)

Pseudoconceptual Learning in Humans and Pigeons. THOMAS DANIEL and ADAM M. GOODMAN, *Auburn University*, ANTHONY WRIGHT, *University of Texas Medical School*, JEFFREY KATZ, *Auburn University*. — In traditional same/different procedures, subjects are required respond to the relationship that two or more stimuli share. If the stimuli are identical, they are regarded as "same", and if they are not, they are regarded as "different". The current study arbitrarily assigned configurations of stimuli as "same" and "different" so that the abstract concept of same/different is no longer a reliable way to solve the task. We tested humans and pigeons in comparable tasks using touchscreen monitors and found that the two species use different strategies to learn the task. During the acquisition phase of the experiment, pigeons employed item-specific strategies (i.e., memorization) while humans more consistently applied relational rules. However,

neither species transferred this learning above chance when tested with novel items, suggesting that pseudoconceptual learning operates within a very restricted domain.

Email: Thomas Daniel, alex.daniel@auburn.edu

(2189)

Optimizing Learning Schedules of Rule-Based Categories: When Should We Block or Interleave Category Exemplars? SHARON NOH, *University of Texas*, VERONICA YAN, TYSON KERR and ROBERT BJORK, *University of California, Los Angeles*, W. TODD MADDOX, *University of Texas* (Sponsored by Kou Murayama). — When learning categories, should we study exemplars one category at a time (blocked), or intermix exemplars from different categories (interleaved)? Category structure may determine optimal schedules: while interleaving may help participants discriminate between categories when there are fewer features, blocking might help identify which category features are most informative. Across two experiments, we manipulated the number of stimulus dimensions and presentation schedule (blocked vs. interleaved) of rule-based stimuli. In Experiment 1, participants studied four categories of lines that varied along two relevant dimensions: length and orientation. In Experiment 2, we added two irrelevant dimensions. With fewer dimensions (Exp 1), participants demonstrated an interleaving benefit; however, with increasing stimulus complexity, blocking was superior to interleaving. These results suggest that when rules are simple enough, interleaving—or more likely, spacing—becomes a "desirable difficulty". For categories with more features, blocking may help participants test and discover the rules that best define categories.

Email: Sharon Noh, shaaaronz@gmail.com

(2190)

Effects of Problem Type and Categorization Criteria on Children's Function Table Accuracy. REALITY CANTY, *University of Illinois at Chicago*, JAMES PELLEGRINO, *Learning Sciences Research Institute*, SUSAN GOLDMAN, *University of Illinois*, LOUIS V. DIBELLO and TERRY DEJARESCO, *Learning Sciences Research Institute*. — The relationships among problem type, categorization criteria, and solution accuracy in function table reasoning were examined. We individually interviewed and compared the problem-solving accuracy of 42 children who categorized 16 "What's-My-Rule" function tables by operation (addition, subtraction) in a card-sorting task. Twenty-four children categorized the tables using explicit rule-box cues ("add", "+", "subtract", "-") and arithmetic principles (increase means add, decrease means subtract) when the rule-box cues were missing. These children completed function tables more accurately than the 18 children who categorized tables with only rule-box cues. Solution accuracy was greater when problem type, arithmetic principle, and table operation matched rather than conflicted. Results suggest that representing function table operations depends on knowledge of arithmetic principles; using these principles requires table-specific schema for interpreting arithmetic structure in spatial-

numeric relations; and their effect on accuracy varies by problem type. Models of more and less skillful reasoning with "What's-My-Rule" tables are discussed

Email: Reality Canty, rcanty1@uic.edu

(2191)

Analogical Reinforcement Learning With Two-Stage Memory Retrieval. JAMES FOSTER and MATT JONES, *University of Colorado*. — We have recently proposed a model of analogical reinforcement learning, in which analogical comparison provides the RL algorithm with a measure of relational similarity, and RL provides feedback signals that can drive analogical learning. Especially useful analogies produce new schemas that are added to the memory pool. Model performance is considered with respect to a baseline model in which schema induction is not guided by RL feedback signals. This approach relies on combining structure mapping with exemplar-based learning, which is computationally expensive. The current work addresses this challenge by integrating principles from the two-stage MAC/FAC model of analogical retrieval, in which the first stage uses fast feature-vector similarity to efficiently retrieve a set of candidate exemplars, and the second stage uses structural alignment to determine the best analogical matches. This new implementation enables a more psychologically plausible form of analogical inference from the most useful stored exemplars and schemas to novel situations.

Email: Matt Jones, mcj@colorado.edu

(2192)

Further Exploration of Cortical Activity During Explicit and Implicit Category Rule Learning. AUDREY P. HILL, COREY BOHIL and MATTHEW F. MURRAY, *University of Central Florida*. — We tested the COVIS-based prediction that activation in dorsolateral prefrontal cortex (DLPFC) should remain higher during information-integration category learning than unidimensional rule-based category learning, especially when learners use a unidimensional rule with information-integration categories. We replicated conditions from prior neuroimaging studies (Cincotta & Seger, 2007; Filoteo, et al, 2005) but measured BOLD response in DLPFC using functional near-infrared spectroscopy (fNIRS). Each participant completed information-integration (2D stimuli; both dimensions relevant for accuracy) and rule-based (2D stimuli; only 1 dimension relevant for accuracy) training tasks with immediate feedback following each response. Most participants performed above chance in the learning tasks, and we found that oxy-hemoglobin levels were indeed often higher across blocks in the information-integration condition. Decision-bound modeling analyses indicated that in many cases – during information-integration category learning – participants responded according to a unidimensional rule rather than a more appropriate rule combining information from the two stimulus dimensions, supporting our hypothesis.

Email: Corey Bohil, corey.bohil@ucf.edu

(2193)

Transferring Category Knowledge When Reinforcement Is Deferred. ALEXANDRIA ZAKRZEWSKI and BARBARA ANN CHURCH, *University at Buffalo, SUNY*, F. GREGORY ASHBY, *University of California, Santa Barbara*, J. DAVID SMITH, *University at Buffalo, SUNY*, JESSICA L. ROEDER, *University of California, Santa Barbara*, JOSEPH BOOMER, *University at Buffalo, SUNY*, VIVIAN VALENTIN, *University of California, Santa Barbara*. — Theory distinguishes humans' implicit, associative system of category learning from their explicit, rule-based system. Historically, these systems are dissociated by category learning tasks with either a multidimensional, information-integration (II) solution (implicit) or a unidimensional, rule-based (RB) solution (explicit). Research examining whether category knowledge can transfer to untested regions of stimulus space has found impaired transfer in II but not RB tasks (Casale et al., 2012). Further research has shown that humans can learn RB but not II tasks when feedback is deferred and rearranged (Smith et al., 2014). The present experiments asked: Can participants learn to transfer RB and II knowledge to untested regions if the transfer occurs with deferred-rearranged feedback? In two experiments, participants in RB but not II tasks transferred their category knowledge to a new stimulus space under deferred reinforcement, suggesting that transfer in II learning is dependent on further associative learning but RB knowledge is not.
Email: Alexandria Zakrzewski, azakrzew@buffalo.edu

(2194)

Best-Classifier Feedback Can Improve Classification of Mammography Images. ANDREW WISMER, COREY BOHIL and TROY SCHIEBEL, *University of Central Florida*. — Prior research has shown that classification rule learning (under conditions of unequal category payoffs) can be improved using optimal-classifier based feedback (e.g., Bohil & Maddox, 2003). This type of feedback reflects the responses of an optimal classifier with confusable (i.e., overlapping) categories, rather than standard feedback based on actual category membership. Using simple 1-dimensional stimuli, participants reached asymptote faster and nearer to optimal than with standard feedback. The current study extends this approach into the realm of complex real-world stimuli. We trained participants to classify a set of mammography images as either showing cancer or not. Trial-by-trial feedback was based on the best performer from an earlier pilot study. We found that participants trained with this best-classifier feedback signal were better able to discriminate the categories (i.e., showed higher d' levels), and there was evidence that they showed less variability in criterion placement compared to those receiving objective feedback.
Email: Andrew Wismer, andrew.wismer@knights.ucf.edu

(2195)

Category Learning Performance Is Not Influenced by Depletion of Self-Control Resources. LAUREN SZYMULA, SHANNON MCCOY and SHAWN ELL, *University of Maine, Orono*. — Self-control (i.e. the ability to direct thoughts, feelings, and behaviors) has long been argued to be a limited capacity resource. As such, it has been shown that exertion of self-control can negatively impact a wide range of behavior, including cognitive functioning. Yet researchers have generally treated cognition as a unitary process, leaving it unclear how self-control exertion might affect different cognitive systems. To address this question, we investigated the impact of a classic self-control task on two category learning tasks. These tasks use the same stimulus set, but with different underlying rule structures that have been argued to probe for different learning systems. Specifically, following an emotion regulation task, participants completed either a rule-based task (learning is thought to depend upon a hypothesis-testing system) or an information-integration (learning is thought to depend upon a procedural-based memory system) task. Emotion regulation did not significantly affect categorization accuracy or categorization strategy. The implications for understanding the link between self-control and cognition will be discussed.
Email: Lauren Szymula, lauren.szymula@umit.maine.edu

(2196)

Semantic Processing in the Right Hemisphere: A Function of Coarse Coding or Semantic Distance? CASEY E. TURNER and RONALD T. KELLOGG, *Saint Louis University*. — Prior research suggests that the left hemisphere (LH) uses fine semantic fields to strongly select closely-related features of a concept, whereas the right hemisphere (RH) uses coarse semantic fields to weakly select multiple and distantly-related features. Here, participants viewed category names centrally and determined whether a target word (a close or a distant exemplar) presented to either the left visual field/RH or the right visual field/LH was a member of the category. Atypical, distant exemplars were categorized more slowly in the RH relative to the LH with no difference for those close to the prototype. We then tested two explanations of this effect. The category structure hypothesis contends that atypical exemplars are more distant from the prototype in the RH than in the LH. Requiring categorization of two targets should thus worsen the RH disadvantage for the distant exemplars. By contrast, coarse coding in the RH should allow the summation of two weak fields for distant as well as close items, possibly reducing or eliminating the RH disadvantage. The results supported the coarse coding hypothesis.
Email: Ronald Kellogg, kelloggr@slu.edu

(2197)

Features Do Not Tell the Full Story: Category Intension and Extension in Children and Adults. GERT STORMS, FARAH M. DJALAL and EEF AMEEL, *University of Leuven*. — The present research proposes an alternative method, based on family resemblance scores of the category members, to examine the relationship between category intensions and extensions in children and adults. Feature generation and category judgment tasks were used to investigate the intensions and extensions. Family resemblance measures were then correlated with category judgments. The results showed that the prediction of category judgments can be considerably approved if features generated by all age groups are used. This mean that, in categorizing items, children also used features that they did not generate. Furthermore, the correlation

between family resemblance and category judgment declines from the oldest children to the adults in 5 out of 8 categories. These findings suggest that category learning is not exclusively based on feature-based representations, but also on the language specificities that play a role in the later stages of lexical development.

Email: Gert Storms, gert.storms@ppw.kuleuven.be

(2198)

How Forgetting Affects Rule- and Exemplar-Based Judgments. JANINA HOFFMANN, BETTINA VON HELVERSEN and JORG RIESKAMP, *University of Basel*. — People often forget previously acquired knowledge over time, like the names of former classmates. Likewise, how accurately people make judgments may vary as a function of forgetting over time. To make judgments, people often rely on two kinds of strategies: rule-based and exemplar-based strategies. Exemplar-based strategies rely upon retrieval of past exemplars from long-term memory, whereas rule-based strategies do not require storage of past exemplars. Accordingly, exemplar-based strategies may be more prone to forgetting than rule-based strategies. To investigate this hypothesis, 80 participants learned in a training phase to make rule-based or exemplar-based judgments based upon four binary cues. To induce forgetting, we varied within participants the time interval between the training phase and a later test phase from immediate to one day to one week. As predicted, a longer time interval between training and test did not impair judgments for training items in the rule-based task. In the exemplar-based task, however, a longer time interval between training and test led to less accurate judgments for training items. Apparently, forgetting harms exemplar-based judgments more than rule-based judgments.

Email: Janina Hoffmann, janina.hoffmann@unibas.ch

(2199)

Modification of Rules vs. Decision Bounds in Category Learning. DONALD HOMA, *Arizona State University*. — The present study addressed whether re-learning of concepts is more disruptive when a previous rule or a previous decision bound must be altered by subsequent learning. In both conditions, the subjects initially discriminated between two categories. In the rule-based (RB) condition, a simple rule was sufficient to discriminate between the two categories. However, following learning, a third category was introduced that required that this rule be abandoned and replaced by a more complicated rule. In the information-integration (II) condition, the two categories required that a linear decision bound be used to separate the two categories; subsequently, a third category was introduced that violated this decision bound, thereby requiring the formation of an alternative decision bound to learn the concepts. Results showed that disruption of a decision-bound was substantially more disruptive than violation of a learning rule. Implications of how these different concepts are used and modified by subsequent learning are addressed.

Email: Donald Homa, donhoma@asu.edu

(2200)

Bayesian Reasoning With Verbal Information. BJÖRN MEDER, *Max Planck Institute for Human Development*, RALF MAYRHOFER, *University of Göttingen*. — In sequential diagnostic reasoning, the goal is to infer the probability of a cause event from sequentially observed effects. Typically, studies investigating such tasks provide subjects with precise quantitative information regarding the strength of the relations between causes and effects. By contrast, we examined people's performance when this information is communicated through qualitative, rather vague verbal terms (e.g., "X occasionally causes symptom A"). Using a diagnostic scenario with two cause events and four effect events, we conducted experiments comparing human judgments with a Bayesian model whose predictions were derived using numeric equivalents of various verbal terms from an unrelated study with different subjects. We found a close correspondence between sequential diagnostic judgments based on verbal information and the model's predictions, as well as compared to a matched control condition in which information was presented numerically. This is a promising finding for applying computational models of cognition to verbal reasoning tasks.

Email: Björn Meder, bmeder@gmail.com

POSTER SESSION III
Friday Evening
Grand Ballroom, Long Beach Convention Center
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION II •

(3001)

Reverse-Bias Effect of Bistable Image Perception Modulated by Abrupt Change in Visual Scene. TOMOKAZU URAKAWA and SHUJI MORI, *Kyushu University*. — A bistable image like Necker Cube tends to be initially perceived as a reverse of the preceding 'unambiguous' image presented for a prolonged period. This perceptual phenomenon is called the reverse-bias effect. The present study tested a hypothesis whereby the reverse-bias effect would be reduced by adding an abrupt visual change to the bistable image. Participants were asked to report a facing orientation of the bistable Necker lattice surrounded by bars immediately after the bars changed their orientation. The results confirmed our hypothesis, showing the reduction of reverse-bias effect. This adds to current knowledge of bistable image perception and its susceptibility to an abruptly-occurring visual perturbation.
Email: Tomokazu Urakawa, turakw@yahoo.co.jp

(3002)

Translation and Articulation in Biological Motion Perception. MARKUS LAPPE and JANA MASSELINK, *University of Muenster, Germany*. — When we see people walk we perceive the articulation of their limbs and the translation of their bodies. Research on such biological motion perception has focussed mostly on articulation, and presented point light stimuli of human walking in place. Recent experimental and computational approaches have shown that articulated movement is largely derived from temporal analysis of body configuration rather than direct integration of motion signals of the points. However, body translation adds global motion to all points. We measured discrimination of point-light walking without translation and with translation either consistent or inconsistent with articulation. We found that translation induced a response bias in three different discrimination experiments (articulation, facing, and walking direction), particularly at short (200 ms) presentation durations. We conclude that body translation interacts with the configuration-based analysis of articulation in the perception of biological motion.
Email: Markus Lappe, mlappe@uni-muenster.de

(3003)

Perception of the Hierarchy in the Arm-Like Point Light Display: The Effect of Embedded Noise. REIKO YAKUSHIJIN, *Aoyama Gakuin University*, SACHIYO UEDA, *Ochanomizu University*. — When we see the joint structure (e.g., an arm) moving, it might be natural to assume that the movement of the higher-ranked joint in hierarchy (e.g., shoulder) is smaller than those of lower-ranked joints. This assumption, however, is not necessarily true. In this study, what can be the cues to perceive the motion hierarchy other than the stability of local joints was investigated. Point light display of four-folded arm-like moving shape was used in the experiments. Participants were asked to select the orientation of the arm (or the location of the shoulder) that was changed randomly. Naturally, the participants mostly selected the stable point as the shoulder when the embedded motion noise, which propagated along the hierarchy, was not introduced. When the noise was added, however, the participants increasingly selected the opposite orientation. This type of selection increased also when the movement of the least stable point has some consistent components.
Email: Reiko Yakushijin, yaku@ephs.aoyama.ac.jp

(3004)

Examining a Single-Salience-Map Hypothesis for Feature-Based Attention: Centroid Judgments for Orientation and Contrast. MATTHEW INVERSO, CHARLES WRIGHT, CHARLES CHUBB, PENG SUN and GEORGE SPERLING, *University of California, Irvine*. — Do feature-based attention (FBA) tasks all make use of a single salience map? If so, then different features should control performance analogously in different FBA tasks. Suppose, for example, that each of Task1 and Task2 requires the participant to produce a summary response based on target and ignoring distractor items. Then if targets T1 vs distractors D1 yield equal performance in Task 1 as targets T2 vs distractors D2, we should find that T1 vs D1 and T2 vs D2 also yield equal performance in Task 2. We report a dramatic failure of this prediction for tasks requiring the participant to estimate the centroid of targets amid distractors. As the number of display items is increased, performance degrades much more rapidly if targets and distractors differ in orientation than it does if they differ in contrast polarity.
Email: Charles Wright, cewright@uci.edu

(3005)

Output Interference and the Strength-Based Mirror Effect. GREGORY KOOP and AMY CRISS, *Syracuse University*. — Recent work in the study of recognition memory has focused on competing explanations of the strength-based mirror effect (SBME). The differentiation account claims the SBME is a natural product of mnemonic processes (Criss, 2006, 2009; Criss & Koop, in press), whereas the criterion-shift account assumes that metacognitive decisional processes drive the effect (Stretch & Wixted, 1998; Starns et al., 2010). One implementation of the differentiation account is REM (Shiffrin & Steyvers, 1997)—a model that has provided unified account of many recognition phenomena. Critically, the same mechanisms in REM that produce differentiation (e.g., trace updating) are also involved in producing the empirical pattern of output interference at test (OI; Criss et al., 2011). We utilize two designs with mixed-strength study lists to demonstrate

that even under conditions where differentiation at study is minimized, the same mnemonic mechanisms that underlie differentiation persist as evidenced by robust OI at test.
Email: Gregory Koop, gjkoop@syr.edu

(3006)

The Influence of (Biological) Form on the Perception of Biological Motion. LUKE MILLER, BURCU A. URGEN and MARIA FLORENDO, *University of California, San Diego*, JENNIFER COOK, *City University*, AYSE P. SAYGIN, *University of California, San Diego*. — In natural vision, the brain must dynamically integrate form and motion. Here we explored the influence of object form on the perception of motion. Observers judged whether the motion of an object, whose motion was parametrically varied. was more natural than a reference object (rectangle with neutral motion). In Experiment 1, we found a robot hand needed significantly less biological motion than a human hand for its motion to be judged at the same level of naturalness. In Experiment 2, we added two more objects: car (inanimate, can move) and house (inanimate, stationary). We again found the robot hand need significantly less biological motion, but the car and house conditions did not differ from the human hand. Overall we show that object form influences biological motion perception, but only when the object is sufficiently sufficiently similar to a biological object. These results are best interpreted in the predictive coding framework.
Email: Ayse P. Saygin, apsaygin@gmail.com

(3007)

Behavioral and Imaging Evidence on the Eccentricity Effect of Inhibition of Return in the Visual Field. YAN BAO, *Peking University*, ERNST POEPPEL, *Ludwig-Maximilians-Universität München*. — Inhibition of return usually refers to a delayed responding to a target appearing at the same peripheral location as a previous cue if the cue-target onset asynchrony exceeds approximately 300ms. This phenomenon is termed inhibition of return (IOR) and has been suggested to reflect an attentional bias in favor of novel visual space. In recent years we have observed a new phenomenon called "Eccentricity Effect of IOR", suggesting that the inhibitory processing of attentional control in the visual field is not homogeneous but underlies a functional subdivision. Specifically, the IOR effect in the periphery is significantly stronger than that in the perifoveal visual field. Here we present an overview of our recent behavioral and imaging (ERP, fMRI, MEG) studies measuring IOR effects at both perifoveal and peripheral locations, showing strong evidence of this eccentricity effect. Different saccadic programing modes and visual pathways involving both subcortical and cortical structures are discussed.
Email: Yan Bao, baoyan@pku.edu.cn

(3008)

Inhomogeneity of the Visual Field: Perceptual Completion of Moving Stimuli in the Perifoveal Region. ERNST POEPPEL, *Ludwig-Maximilians-Universität München*, YAN BAO, *Peking University*, BIN ZHOU, *Chinese Academy of Sciences*. — The perifoveal region of the visual field is processed differently compared to peripheral regions. This difference is reflected in the programming of saccadic eye movements, the distribution of increment threshold, or spatial attention. Here we report a unique phenomenon of visual completion which is limited to the perifoveal region up to approximately 10 degrees eccentricity. Patients with lesions in the visual cortex are blind in corresponding regions of the visual field, but they still show blindsight. The intensely studied blindsight patient FS surprisingly reports conscious vision across an extended area blindness, but only for horizontally moving vertical and not for stationary stimuli. This effect is made possible by spared representations in the visual cortex as documented with fMRI. We observed an activation only for moving stimuli, but on the "wrong", i.e., ipsilateral side of the brain. This case provides unique insights into the functional architecture of the human visual system.
Email: Ernst Poeppel, ernst.poeppel@med.uni-muenchen.de

(3009)

Differentiating Processes in Object Completion Using a Dot Localization Method. SUSAN CARRIGAN, *University of California, Los Angeles*, EVAN PALMER, *Wichita State University*, PHILIP J. KELLMAN, *University of California, Los Angeles*. — Competing theories of perception of partly occluded objects have emphasized local contour interactions or influences of symmetry or familiarity. These theories may reflect two different processes: a contour completion process and a more global recognition process. The two could be distinguished experimentally if only the former gives rise to precise boundary representations. Using a dot localization paradigm, we assigned participants to either a local or global condition, which determined how the participant was instructed to complete objects with divergent local and global interpretations. On each trial, a small dot was flashed on top of an occluder. Subjects reported whether the dot fell inside or outside the occluded object. Adaptive staircases were used to estimate the point at which the probability was .707 and .293 that the dot would be seen as outside the boundary. The results indicate that local contour interpolation produces precise and accurate boundary representations, whereas symmetry or familiarity cues do not.
Email: Susan Carrigan, suzy.carrigan@gmail.com

(3010)

Does the Perceptual Discriminability of Spatial and Dynamic Patterns Shape our Preferences? FIONA NEWELL, ROBERT MURTAGH and STEFAN HUTZLER, *Trinity College Dublin*. — Previous studies suggest that preferences for certain visual stimuli is associated with the ability to perceive or discriminate these patterns, a theory known as 'perceptual fluency'. However, very little evidence has been provided to support this association in unfamiliar stimuli. We designed a set of continua of novel static and dynamic patterns according to Gestalt principles of organisation. Stimuli were comprised of textures which ranged from ordered or disordered patterns. First, participants provided 'likeability' ratings for stimuli in these continua. Higher preferences were found to patterns which were most ordered and ratings reduced with increasing levels of disorder. We then found that likeability ratings

correlated with familiarity ratings. Finally we tested whether the stimuli on these continua were categorically perceived and found evidence for a boundary between ordered and disordered patterns. Furthermore, this boundary marked the point at which preference ratings declined. Our data suggest that perceivability is strongly related to how much we find a pattern aesthetically pleasing. Moreover these findings suggest an important role for Gestalt principles of organisation in predicting aesthetic preferences.

Email: Fiona Newell, fiona.newell@tcd.ie

(3011)

Explaining Poggendorff Illusion via Emmert's Law. UMUR TALASLI and ASLI BAHAR INAN, *Atilim University*. — Poggendorff illusion, described as perceived non-collinearity of two segments of a physically collinear but interrupted oblique line was approached by numerous theories (e.g., Gillam, 1971; Zanuttini, 1976). The theory we propose is based on the application of Emmert's Law, suggesting that the implied occlusion in Poggendorff stimuli results with equivalence in retinal sizes of occluding and occluded spaces, but with different registered distances due to occlusion. Consequently, Emmert's Law operates resulting in the shrinkage of the occluding entity and tilting of the occluded part of the transversal in the cortical representation. Three experiments testing our theory were (1) empirically confirming the tilting of an occluded continuation of an oblique line, (2) manipulating perceived nearness of the occluding entity via texture density and confirming the predicted misalignment variations, (3) again confirming tilting of the occluded segment of transversals in the predicted amounts as a result of being accompanied by the same texture densities.

Email: Asli Bahar Inan, aslibahar@gmail.com

(3012)

Optimal Integration of Spatiotemporal Cues in Visual Perception of Stiffness. BING WU, SUNG HUN SIM and JONATHAN HIBBARD, *Arizona State University*, ROBERTA L. KLATZKY, *Carnegie Mellon University*. — When a soft object is compressed, the time-varying pattern of visible deformation provides spatial and temporal cues to its stiffness. Here we investigated the role of the two types of cues in stiffness perception and how they were combined. In three experiments, the stimuli were simulated ultrasound videos of linear viscoelastic materials under compression by a constant force. On each experimental trial, the subject saw two videos of virtual materials and judged which material was stiffer. The time-varying deformation in the video was manipulated to present spatial cues, temporal cues, or both types. The JND for stiffness was estimated using an adaptive procedure. The temporal cues proved to be weaker than the spatial cues, producing larger JNDs in the temporal-cues-only conditions, and the perceptual integration of the two types of cues was described well by a maximum likelihood estimation model. (Supported by NIH grant 5R00EB008710)

Email: Bing Wu, bing.wu@asu.edu

(3013)

Dissociating Attention and Saccades: Evidence Against a Strict Premotor Theory of Attention. STEPHEN C. WALENCHOK, *Arizona State University*, ERIK D. REICHLE, *University of Southampton*, STEPHEN GOLDINGER, *Arizona State University*. — Previous research has suggested that the orienting of attention and the motor planning of eye movements are effectively the same neural process (i.e., the premotor theory of attention, Rizzolatti et al., 1987; Beauchamp et al., 2001). According to this theory, eye movement planning and attentional orienting are strictly coupled and cannot be performed independently. In two experiments, we provide evidence against this claim, demonstrating that skilled participants can dissociate attentional orienting from saccade planning. Both experiments required participants to attend to a central location (to identify a target letter) while simultaneously planning and then executing saccades to peripheral locations indicated by endogenous (Experiment 1) or exogenous (Experiment 2) cues. Participants were able to successfully attend to the central location, indicated by high letter identification accuracy, while simultaneously planning accurate saccades to the peripheral target locations. These results have important implications for theories of attention and models of eye movement control.

Email: Stephen Goldinger, goldinger@asu.edu

(3014)

Multidimensional Auditory Affective Ratings Inventory (MAARI) and Computerized Emotion Recognition Toolbox (CERT): A Measurement of Facial Responses to Standardized, Non-Verbal, Human Vocalizations of Emotion. MARY D. MULLANE, SHEAVA OKHOVAT, MEGAN DIFLEY, JOSE MARTIN QUIROGA, SOPHIA ZIOGAS, MARIAN BARTLETT, GWEN LITTLEWORT, JOHN WIXTED and ANDEA A. CHIBA, *University of California, San Diego*. — Emotion in the world guides behavior by influencing perception, memory, decision-making and learning. Voluminous literature details visual emotional information on cognition using facial emotional expression coding (FACS) and emotional pictures (IAPS), yet little is known on the influence of auditory perception of emotion. So an inventory of 650 spontaneous, non-verbal vocalizations of emotion with ratings of valence, arousal and authenticity was developed - the Multidimensional Auditory Affective Ratings Inventory (MAARI). To examine how MAARI influences facial emotional expression, both MAARI and video clips of facial emotion were presented while participants' facial expressions were analyzed with the Computerized Emotion Recognition Toolbox (CERT), which identifies facial action units (FACS). These analyses provide physiological measures, which along with ratings of valence, arousal and authenticity provide a complete, standardized inventory of human emotional vocalizations suitable as an experimental instrument to examine auditory perception of emotive expressions on neural processes underlying aspects of cognition or as a tool in understanding affective insufficiencies in various neurological disorders.

Email: Mary D. Mullane, md.mullane.ucsd@gmail.com

(3015)

The Effect of Symbolic/Conceptual Associations on Single Color Preferences. KAZUHIKO YOKOSAWA, *University of Tokyo*, MICHIKO ASANO, *Rikkyo University*, NANAMI KANAZAWA, *University of Tokyo*, KAREN B. SCHLOSS, *Brown University*, STEPHEN PALMER, *University of California, Berkeley*. — The effects of symbolic/conceptual associations on preference ratings of single colors were explored in the Japanese culture using a procedure analogous to the object-based Weighted Affective Valence Estimates (WAVEs) measured by Palmer and Schloss (2010) in the US. Different groups of participants generated (1) descriptions of symbolic/conceptual associations to 32 chromatic colors, (2) valence (like/dislike) ratings of those symbolic/conceptual associations, and (3) similarity ratings between the colors and associates generated in (1). Symbolic WAVEs were calculated using the same procedure as for object-based WAVEs. The correlation between color preferences and the symbolic WAVEs (r = .67) was comparable to that between color preferences and object-based WAVEs (r = .70). Considering both symbolic and object associations produced a multiple-R of .80, indicating that both object and symbolic/conceptual associations with colors contribute to single color preferences. Symbolic/conceptual associations had a somewhat greater impact on color preferences in females than in males.
Email: Kazuhiko Yokosawa, yokosawa@l.u-tokyo.ac.jp

(3016)

When the Going Gets Tough the Beautiful Get Going. IRENE REPPA, *Swansea University*, SINÉ MCDOUGALL, *Bournemouth University*. — Does aesthetic appeal influence performance and, if yes, how might it do so? Four studies examined the effect of aesthetic appeal on performance. According to one hypothesis, appeal would lead to overall decrements or enhancements in performance (e.g., Sonderegger & Sauer, 2010). Alternatively, appeal might influence performance only in problem situations, such as when the task is difficult (e.g., Norman, 2004). The predictions of these hypotheses were examined in the context of a visual search task, using a well-controlled stimulus set –icons. When search was made difficult using complex stimuli (Experiments 1 and 3), or abstract and unfamiliar stimuli (Experiments 2 and 4), icons that were appealing were found more quickly than their unappealing counterparts. This pattern of results was observed both for younger and older participants. The results show that aesthetic appeal might be more than simply decoration, but could even influence performance. The findings are compatible with accounts positing a facilitatory effect of appeal on performance under duress.
Email: Irene Reppa, i.reppa@swansea.ac.uk

(3017)

Visual Information Processing Efficiency of Fused Multispectral Imagery. JENNIFER BITTNER, M. TRENT SCHILL and LESLIE BLAHA, *Air Force Research Laboratory*, FAIRUL MOHD-ZAID, *Air Force Institute of Technology*. — Visual perception and information processing can be highly influenced by information content and task. Ideal observer analysis allows for consideration of these factors while deriving human processing efficiencies. In this, efficiency is defined as the ratio of human performance to a task specific Bayesian optimal decider capable of utilizing all available information (i.e. the ideal). Our work applied this analysis to test the goals of image fusion, a technique aimed at providing imagery that is more informative and suitable for visual perception. We conducted an identification task with simple Landolt C images fused over seven standard fusion algorithms between six sets of spectral bands. Results indicated comparable efficiencies for fused and unfused imagery with chosen sensor combination playing a larger role in efficiency change. These patterns suggest a potential for multiple factors to influence the success of image fusion with our design providing a framework for such exploration.
Email: Jennifer Bittner, Jennifer.L.Bittner@gmail.com

• ACTION AND PERCEPTION II •

(3018)

Spatial Workspace Symmetry Affects Generalization of Sensorimotor Learning. JENS TIGGELBECK and JOCHEN MUSSELER, *RWTH Aachen University*. — Generalization of sensorimotor learning is often conceptualized by means of updating internal models to counteract distorted visuomotor properties. While these theories acknowledge the influence of context, recent results point to a particular influence of workspace symmetry. Three experiments were conducted to explore the role of the reference frame (egocentric vs. allocentric) of proximal and distal workspace symmetry in generalization. Visual feedback of targeted flicking movements was rotated either 30° clockwise or counterclockwise at a left or right starting position. Generalization of adaptation was assessed by measuring aftereffects at the untrained starting position. The spatial configuration of starting and target positions implied an equilateral triangle constituting the axial workspace symmetry. Rotating distal and proximal or just one of the workspaces by 90° was expected to maintain allocentric but not egocentric symmetry, thus interfering with symmetric transfer. Results generally support the notion that egocentric distal and proximal workspace symmetry is necessary for symmetric generalization to occur. Additionally, congruency in proximal and distal workspace symmetry might further moderate generalization.
Email: Jens Tiggelbeck, jens.tiggelbeck@psych.rwth-aachen.de

(3019)

Influence of Intermixed Auditory/Visual Incompatible Spatial Mapping on the Auditory/Visual Simon Effect. AKIO NISHIMURA, *Yasuda Women's University*, NOBUE SUZUKI and KAZUHIKO YOKOSAWA, *The University of Tokyo*. — Performance is better when a stimulus and a response are on the same side than when they are on the opposite sides, even when the stimulus location is task-irrelevant (Simon effect). The Simon effect is reversed if incompatible location-relevant trials, in which left (right) response is required to right (left) stimulus, are intermixed with the Simon trials. The present study investigates whether

the effect of intermixed incompatible spatial mapping on the Simon effect is modality-specific or not. Simon (i.e., location-irrelevant) and incompatible location-relevant trials were intermixed. We manipulated the stimulus modality (auditory/visual). The reversed visual Simon effect emerged regardless of whether the concurrent incompatible location-relevant task was auditory or visual. The auditory Simon effect was reversed with concurrent incompatible location-relevant auditory task, whereas the positive auditory Simon effect emerged with concurrent incompatible location-relevant visual task. The findings indicate difference in auditory and visual spatial representation properties.
Email: Akio Nishimura, nishimura-ak@yasuda-u.ac.jp

(3020)

Task-Specific Temporal Preparation in Choice Reaction Time Tasks. HANNES SCHROETER, TERESA BIRNGRUBER and DANIEL BRATZKE, *University of Tübingen*, JEFF MILLER, *University of Otago*, ROLF ULRICH, *University of Tübingen*. — Reaction time (RT) usually decreases when an imperative stimulus is preceded by a warning signal. This effect has been attributed to temporal preparation and has mainly been investigated by studies manipulating the foreperiod, that is, the interval between the warning signal and the imperative stimulus. The present study examined to what extent temporal preparation in choice RT tasks involves increased readiness for task-specific processing requirements as opposed to increased task-independent readiness. Participants performed either a pitch, a letter, or a color discrimination task within a variable foreperiod paradigm. Tasks alternated between auditory and visual discriminations and in separate blocks of trials, the upcoming visual discrimination task was either predictable or unpredictable. We observed the standard variable foreperiod effect for both visual discrimination tasks irrespective of task predictability. Importantly, however, the variable foreperiod effect was larger when the visual discrimination task was predictable than when it was unpredictable. These results suggest that temporal preparation in choice RT tasks involves increased readiness for both task-independent and task-specific processing requirements.
Email: Hannes Schroeter, hannes.schroeter@uni-tuebingen.de

(3021)

Stimulus-Response Correspondence in a Visual Go-Nogo Task: Are Reactions Altered by the Presence of Salient Objects? LOGAN H. PEDERSEN and MEI-CHING LIEN, *Oregon State University*, ROBERT W. PROCTOR, *Purdue University*. — Responses are faster when stimulus location, though irrelevant, corresponds to the response location (the Simon Effect). Dolk et al. (2013) found a Simon effect even with a single response location in an auditory go-nogo task when a visually salient but irrelevant object was present. They argued that salient objects trigger spatial coding of action relative to the object. We examined this hypothesis using lateralized readiness potentials (LRPs), an index of response activation. Participants determined the color of a dot within a hand pointing left, right, or straight ahead (pointing direction was irrelevant). They performed a 2-choice task or go-nogo

task in the presence or absence of a Japanese waving cat. We found Simon effects in the 2-choice task but not the go-nogo task, in contrast to Dolk et al.'s findings. LRPs were unaffected by cat presence/absence in both tasks, suggesting that action coding was not modulated by the salient object.
Email: Logan H. Pedersen, pederslo@onid.oregonstate.edu

(3022)

Seeing Not Doing: Perceptual Changes When Others Use Tools. BLAIRE J. WEIDLER and RICHARD A. ABRAMS, *Washington University in St. Louis*. — When an individual observes another person interacting with an object through a reach-extending tool both observer and actor perceive the object to be closer than objects that are out of reach. However, in all prior research, the observer and actor have shared the same frame of reference, leaving open two possibilities: The observer might incorporate the effects of the tool as if in the position of the actor, or they might evaluate the effect of the tool on the actor's capabilities but assess the scene from their own viewpoint. To distinguish between these possibilities, we had an observer and actor view a scene from opposing viewpoints. When the actor used a tool, observers estimated the object to be further from themselves (closer to the actor), indicating that observers evaluate the effects of the tool on the actor's capabilities and then assess the scene from their own point of view.
Email: Richard A. Abrams, rabrams@wustl.edu

(3023)

Knowledge of Uncertainty in Physical Prediction. KEVIN A. SMITH and EDWARD VUL, *University of California, San Diego*. — Recent research suggests that human physical predictions are consistent with inference over a probabilistic distribution of possible world states formed from accurate mechanics under perceptual uncertainty – the noisy Newton theory. However, these accounts have not tried to assess whether people have access to a range of possible future outcomes, or only a sample. Here we tested participants' knowledge of the uncertainty of their own predictions. We asked participants to both predict where a ball bouncing around a computerized table would cross a line, and to place a minimum confidence range around that point. Participants earned "points" if the ball crossed within that range, but earned more points for narrower ranges to incentivize small but credible intervals. Across many conditions, the size of this range was correlated with the distribution of point predictions across participants. This suggests that people have and can use a probabilistic distribution over possible future world states.
Email: Kevin Smith, k2smith@ucsd.edu

(3024)

Effects of Attention and Motor Adjustment on Sensory Information Processing. OLIVER SIMON SACK, MARYVONNE GRANOWSKI, JOCHEN MUSSELER and CHRISTINE SUTTER, *RTWH Aachen University*. — When processing differing sensory information from visual and proprioceptive feedback loops aftereffects emanate in subsequent motor actions. In the present study participants performed linear hand amplitudes with a pen on a covered

tablet, while different gains perturbed the cursor amplitude on the display (phase 1). Then participants replicated either the cursor or the hand amplitude without visual feedback (phase 2). We asked whether intra- and intermodal replications are influenced by alignment of attention: We instructed participants either blockwise (focused attention) or trial-by-trial (divided attention) to replicate the hand or the cursor amplitude. First, we found that the focus of attention modulates replications. Second, gain repetitions – in comparison to gain changes - reduce intra-modal aftereffects. But, we observed a reversed pattern for intermodal replications. The findings support the view that gain repetitions adjusted the forward model so that motor replications became more accurate.
Email: Oliver Simon Sack, Oliver.Sack@psych.rwth-aachen.de

(3025)

Reinforcement Enhances Error-Based Learning of Visual-Proprioceptive Mapping. KRISTA OVERVLIET, *VU University - Research Institute MOVE*, JEROEN SMEETS, *Vrije Universiteit Amsterdam*, KATINKA VAN DER KOOIJ, *VU University - Research Institute MOVE*. — Adaptation to biases between visual and proprioceptive information is generally held to occur by gradually learning from perceived errors. Literature on motor adaptation shows that a second process can contribute: reinforcement of successful movements. Can such reinforcement learning contribute to learning of perceptual mappings when subjects also see their errors? We asked participants to move an unseen hand-held cube towards visual targets and gave them feedback with a ten degrees visual azimuthal rotation that subjects had to adapt to. The feedback was either only performance-error only (by showing the actual position of the hand-held cube) or could be rewarding success simultaneously (by adding a color change and short auditory "yeah" for correct responses). We found that learning of this new visual-proprioceptive mapping improved by giving reinforcement on top of error feedback. Our results suggest that reinforcement learning can enhance adaptation to visual-proprioceptive biases.
Email: Krista Overvliet, krista.overvliet@gmail.com

(3026)

Enhancement and Suppression Biases for Target Selection Transfer Across Saccades and Reaches. JEFF MOHER and JOO-HYUN SONG, *Brown University*. — Human behavior is biased by recent experience. For example, search is faster when a target color is repeated (priming of popout; POP) but slower when the target matches a prior target-absent trial color (distractor previewing effect; DPE). Typically these effects are studied within a single action type; however, real world behavior frequently involves switching among multiple action types (e.g., looking, reaching). In two studies, we examined whether POP and DPE transfer across different effector movements such as saccades and reaches. We cued observers to respond to a popout target with an eye or hand movement. We found that both POP and DPE occurred regardless of whether the response type was repeated or switched from one trial to the next.These data suggest enhancement and suppression biases are represented independently from

their associated actions. Thus, recent experience influences subsequent behavior even in dynamic environments involving frequent switching among action types.
Email: Jeff Moher, jeff_moher@brown.edu

(3027)

The Simon Effect in Participants' Front and Back. JOCHEN MUSSELER, MAGALI KREUTZFELDT and MARCO LEISTEN, *RWTH Aachen University*. — The spatial relations between stimuli and responses affect human performance even in situations in which the stimulus position is irrelevant for the task at hand (Simon effect). The relationship between constrained postures and spatial compatibility were investigated in two experiments applying the auditory Simon task. In Experiment 1 participants operated a rocker switch either in the front or in the back of their body and while either sitting or kneeling. Results indicated that spatial coding in the back compares to either a virtual turn of the observer towards the control device (front-device coding) or along the observer's hand (effector coding). To clarify this issue the rocker switch was operated with one or two hands in Experiment 2, showing a comparable coding only in the one-hand condition and indicating evidence for effector-coding in the back.
Email: Jochen Musseler, muesseler@psych.rwth-aachen.de

(3028)

Perceived Time of Intent Is Determined by the Belief in Free Will. KRYSTAL A. WULF, TIFFANY A. WALL and EVE ISHAM, *University of California, Davis*. — Different perspectives on free will have been shown to elicit different behaviors (Schooler et al., 2008). In the current study, we asked whether the belief in free will would alter the perceived time of intention to be earlier. The participants performed a simple button press and reported the time of intent by reading the time from a computerized clock (e.g. Libet et al., 1983). Additionally, the participants indicated their level of confidence regarding the temporal reports as well as the level of belief toward free will (via a free will questionnaire). Preliminary data (n=16) suggest that those who scored higher on the questionnaire also judged their time of intent to be earlier and felt more confident about their reports. These results suggest that the belief in free will influences the mental representation and memory for the timing of action.
Email: Eve Isham, eaisham@ucdavis.edu

(3029)

Reflexive Orienting to Goal-Directed Actions. ALEXIS BARTON and BENNETT BERTENTHAL, *Indiana University* (Sponsored by Thomas Busey). — When people observe their own goal-directed actions or those of others, they visually anticipate the goal of the action before it is completed (Flanagan & Johansson, 2003). In the current eye-tracking study, we assessed whether the observation of a task irrelevant action interfered with a saccadic response in a two alternative forced choice paradigm. Participants responded with either a right or left gaze shift to a discriminative cue appearing in the center of the screen. In the background, a video showed an actress reaching either right or left to grasp an object. Analysis

of mean RTs revealed that saccades in the opposite direction of the observed reach were slower than saccades in the same direction as the reach or in a no reach condition. This interference suggests that action prediction is an automatic process that must be inhibited when not conducive to task performance.
Email: Alexis Barton, aabarton@indiana.edu

(3030)

The Predictive Coding Account of the Uncanny Valley: Evidence From Event-Related Brain Potentials. BURCU AYSEN URGEN and ALVIN LI, *University of California, San Diego*, CHRIS BERKA, *Advanced Brain Monitoring, Inc.*, MARTA KUTAS and AYSE P. SAYGIN, *University of California, San Diego* (Sponsored by Lawrence Barsalou). — The uncanny valley (UV) hypothesis posits that humans have a negative reaction to almost-but-not-quite-human agents such realistic robots and avatars. Predictive coding (PC) suggests that the brain dynamically integrates information, continually generating and updating its predictions. Here we develop the PC account of UV, and present new empirical data in support of it. Subjects viewed images and movies of 3 agents: human (looks human, moves biologically), robot (looks mechanical, moves mechanically) and android (looks human, moves mechanically) as we recorded EEG. Based on PC, we expected increased prediction error when the brain's expectations were violated, such as mismatch between appearance and motion. The data perfectly supported our hypothesis, revealing a significant increase in the amplitude of the N400 ERP component for the android, but only for the moving condition. PC provides a theoretically-grounded, neurally-plausible framework for the scientific study of the UV, and more broadly, human social perception and cognition.
Email: Burcu Aysen Urgen, burcu.urgen@gmail.com

• SPATIAL COGNITION II •

(3031)

Dimension Weighting in Distance Judgment. KATY VARNER, STEPHEN DOPKINS and DARIN HOYER, *George Washington University*. — We explored dimension weighting in a distance judgment task. To decide whether the focal (horizontal or vertical) distance between two points from a two dimensional array of points is less than a certain critical value, participants assess the overall distance between the points after differentially weighting the horizontal and vertical positions of the points to reduce the contribution of distance on the non-focal dimension. Participants weight positions on the two dimensions so as to make the task capable of accurate performance, but not so as to remove the non-focal dimension from the picture, although this would make the task easier. We offer an account of this somewhat counter-intuitive pattern in terms of attentional receptive fields. We report results suggesting that the pattern occurs not

because dimension weighting consumes attentional resources but rather because of spatial constraints on the layout of attentional receptive fields.
Email: Katy Varner, kvarner18@gmail.com

(3032)

Spatial Ability in Expert Geoscientists. MARGARET TARAMPI, *University of California, Santa Barbara*, KINNARI ATIT, *Johns Hopkins University*, HEATHER PETCOVIC, *Western Michigan University*, THOMAS SHIPLEY, *Temple University*, MARY HEGARTY, *University of California, Santa Barbara*. — Previously Hegarty, et al. (2010) investigated small- and large-scale spatial ability in non-scientific and scientific fields. Geoscientists' self-reported ratings for both small and large scale spatial abilities were the highest compared to all other disciplines. In this study, expert geoscientists were evaluated on Geologic Block Cross-Sectioning Test (GBCT), Spatial Orientation Test (SOT), Santa Barbara Sense of Direction (SBSOD) and Paper Folding Test (PFT). Expert geoscientists scored significantly higher on tests of cross-sectioning (i.e. spatial reasoning about internal structures based on surface information), spatial perspective taking, and environmental spatial ability, but no different to undergraduates on spatial visualization (i.e. small scale spatial ability). Further, when divided by specialization, structural geologists scored significantly higher than other geoscientists on GBCT, SOT and PFT and trending for SBSOD. Taken together, self-report questionnaires alongside psychometric tests can start to elucidate differences in spatial intelligence among scientists and in the spatial thinking required by each field.
Email: Margaret Tarampi, margaret.tarampi@sagecenter.ucsb.edu

(3033)

Internal Consistency of SNARC Effect in Parity, Magnitude, Length, Area, and Brightness Discriminations. OLGA LAZAREVA, BAILEY MACK and JEFFREY KRAFT, *Drake University*. — The spatial-numerical association of response codes (SNARC) effect describes a tendency respond to Arabic numerals representing smaller quantities (e.g., 1 or 2) faster if the response is located on the left than if it is located on the right, and vice versa for larger quantities. The SNARC effect has been interpreted as an evidence of automatic spatial organization of numerical information from left to right, and has recently has been reported for many non-numerical dimensions such as orientation or even emotion. It is not yet clear, however, whether these findings imply that non-numerical information is also organized spatially, just like numbers are. If it is, then we should see an internal consistency across multiple SNARC tasks. We presented five SNARC tasks (parity, magnitude, area, line length, and brightness) sequentially in a within-subject design. We then used linear mixed-effect analysis to derive slopes for each task and each participant, and to compute correlations between different SNARC tasks. We found little consistency in the

magnitude or direction of SNARC effect across multiple tasks suggesting that multiple mechanisms may be involved in the tasks' solution despite their procedural similarity.
Email: Olga Lazareva, olga.lazareva@drake.edu

(3034)
Move to Learn: Perspective Taking and Rotation as Methods of Learning. NORA NEWCOMBE, *Temple University*, STEVEN MARCHETTE, *University of Pennsylvania*, CORINNE HOLMES, *Temple University*. — Compared to mental rotation, perspective taking shows a clear cognitive advantage for spatial updating (Simons & Wang, 1998; Wang & Simons, 1999; Wraga, Creem, & Proffitt, 1999), and appears to become the dominant strategy as task difficulty increases (Kozhevnikov & Hegarty, 2001). Based on these findings, we examined if this cognitive advantage would extend to learning, when perspective taking (PT) and object rotation (OR) are physically enacted. Participants learned an object array in one of three ways: walking around it, rotating it, or passively viewing all sides (static images). Compared to static images, results show that both types of movement significantly improved performance on spatial memory tasks, although PT yielded no advantage over OR. These findings suggest that generated self-movement (PT) or purposeful movement of the landscape (OR) may provide the transitional framework necessary to link all views, thus enabling the construction of more accurate and enduring spatial representations.
Email: Nora Newcombe, newcombe@temple.edu

(3035)
Space in Context: Object-to-Context Associations Affect the Ease of Scene Imagination. STEVEN BEIGHLEY and HELENE INTRAUB, *University of Delaware*. — An object can be associated with a single context (e.g., refrigerator/kitchen) or multiple contexts (e.g., cup/many locations), a distinction which yields differential fMRI activation in parahippocampal cortex (PHC). However, it is it is unclear whether this effect is caused by purely conceptual differences or instead by differences in imagined surrounding space. To explore this, we presented single and multi-context objects in isolation and asked participants to imagine a background of their choosing, after which they rated the ease of imagining on a 5 point scale (easy/fast - difficult/slow). Experiment 1 presented objects from Bar & Aminoff (2003), while Experiment 2 controlled for real-world size and picture-space size using different objects. In both experiments, imagination for single-context objects was rated as easier (M=1.29 vs. 2.71, p<.0001; M=1.69 vs. 2.42, p<.0001). Thus, effects attributed to conceptual differences across single and multi-context objects may be confounded by differences in imagination of surrounding space.
Email: Steven Beighley, smbeighley@gmail.com

(3036)
Impaired Oculomotor Behavior Prevents Reading and Scene Perception in Neglect Patients. LISA S. ARDUINO, *LUMSA University and ISTC-CNR Rome*, SILVIA PRIMATIVO, *Sapienza University of Rome*, ROBERTA DAINI, *University of Milano-Bicocca, Milan,* MARIA DE LUCA, *IRCCS Fondazione Santa Lucia, Rome*, CARLO TONEATTO, *University of Milano-Bicocca, Milan*, MARIALUISA MARTELLI, *Sapienza University of Rome*. — In previous studies we suggested that neglect dyslexia (ND) is the consequence of the concomitant presence of unilateral spatial neglect (USN) and a non-lateralized eye movement deficit. Here we aim at clarifying the features of the altered eye movements. We used the controls eye movements performance in the verbal scene description task as a reference: USN patients were divided on the basis of their fixation location correlations with that of controls (right brain damaged patients without USN). Only those patients identified by an impaired eye movement behaviour produced left lateralized errors in reading single words and words presented within a text passage. We conclude that ND is due to an eye movement deficit associated with USN, which prevents both reading and scene perception. An estimation around 40% of USN patients indicates that the oculomotor behaviour requires particular attention during the diagnostic phase in order to program the best rehabilitation strategy.
Email: Lisa S. Arduino, lisa.arduino@uniurb.it

(3037)
Interpreting Visualizations of Uncertainty on Smartphone Displays. MARY HEGARTY, TREVOR BARRETT, GRANT MCKENZIE and MICHAEL F. GOODCHILD, *University of California, Santa Barbara*. — The blue circle on smartphone displays is an everyday visualization of uncertainty; with the circle size indicating uncertainty of one's location. Like error bars on graphs, it is a discrete visualization of a graded probability function. Two experiments examined the effectiveness of different visualizations of location estimates varying whether and how uncertainty was visualized (uniform blue circle showing confidence interval, faded circle showing graded probability, or both). Given a known location and visualizations of the estimates of two "smartphones" of that location, participants judged which smartphone showed the better location estimation. Participants reported using two primary heuristics (1) choosing the blue circle that was closest to the known location (distance) and (2) chosing the smaller circle (size). Visualizating graded probability with faded circles biased participants towards the distance heuristic. Visualizating confidence intervals with uniform circles biased participants towards the size heuristic (and using uncertainty information) and produced more accurate judgments.
Email: Mary Hegarty, hegarty@psych.ucsb.edu

(3038)
Connecting Scattered Dots in a Cognitive Map: The Roles of Boundaries and a Single Landmark in Integrating Multiple Locations. RUOJING ZHOU and WEIMIN MOU, *University of Alberta*. — It is conjectured that remembering places relative to a boundary is more hippocampal-involved whereas spatial learning relative to a single landmark is primarily striatal-dependent (e.g. Doeller, King & Burgess, 2008). The current study contrasted boundary cues and landmark cues in encoding spatial relations between places. Participants learned four target locations sequentially in an immersive virtual environment with either a single landmark cue or a boundary cue, along with the distal orientation cues. The boundary cue and the landmark cue were removed in the

subsequent test phase. However one of the target locations was displayed instead and participants were thus required to infer the other three targets' locations. The result showed that participants encoded spatial relations between target locations more accurately when they learned in the single-landmark condition than when they learned in the boundary condition. This result indicated that encoding interobject spatial relations might be less hippocampal dependent as expected.
Email: Ruojing Zhou, ruojing@ualberta.ca

(3039)

Direction Giving and Wayfinding in an Indoor Environment. ROBERT J. WOLTER, KASSANDRA HAUPTMANN and ALYCIA HUND, *Illinois State University*. — Finding our way to specified destinations is important. We know that working memory and environmental familiarity affect wayfinding. Moreover, planning and describing routes through a town for oneself and others involves diverse considerations. Our purpose was to examine how working memory and familiarity relate to direction giving and wayfinding in a complex indoor environment. Participants provided directions to fictitious recipients who were familiar or unfamiliar with the indoor environment. They also located a destination and completed a digit span task and a measure of environmental familiarity. As expected, participants provided significantly more information for unfamiliar recipients than for familiar recipients. In addition, when giving directions for fictional recipients, participants more familiar with the environment provided more information. Finally, participants with larger digit spans made fewer errors while wayfinding. These findings provide important details about the role of working memory and familiarity in direction giving and wayfinding indoors.
Email: Alycia Hund, amhund@ilstu.edu

(3040)

Representation of Distance and Direction in Cognitive Maps. DARIN HOYER, STEPHEN DOPKINS and JOHN PHILBECK, *George Washington University*. — The layout of a spatial environment can be coded using direction information or distance information. Current research on cognitive maps focuses on direction information while overlooking distance information. We hypothesize that distance information is at least as influential on cognitive maps as direction information. Participants viewed target objects in a circular room with the aid of landmarks. Participants were removed from the room while the landmarks were relocated. They then returned and indicated the position of the target objects. The landmark relocation was done in such a way as to produce two distinct predictions for object placement; one if the participants solely use the distance between objects, and one if they solely use the relative direction between the objects. Participants placed the objects closer to the distance prediction than the direction prediction. Results suggest that distance is relied on more heavily than the relative direction between objects.
Email: Darin Hoyer, darinhoyer@gwmail.gwu.edu

(3041)

Evidence for Dynamic-Kinematic Routines in the Use of Spatial Terms. DEANNE ADAMS, CHRISTOPHER GALEUCIA, JENNIFER KOLESARI and LAURA CARLSON, *University of Notre Dame*, KENNY COVENTRY, *University of East Anglia*. — For descriptions such as "The penny is in the bowl." the spatial term "in" is traditionally defined by the geometric relations between the objects, such as the penny contained within a bounding box around the bowl. However, Coventry and Garrod (2004) have postulated the use of dynamic-kinematic routines in our understanding of these spatial relations, arguing that how the two objects interact (kinematic) over time (dynamic) is also important. For "in", a location-control routine pertains, with the penny in the bowl if it moves when the bowl moves. Another routine is associated with a transfer of substance from one object held above another, henceforth a "pouring" routine exemplified by "The milk carton is above the glass." We sought independent evidence for the existence of these routines using a speeded prime/probe picture-sentence verification task. Initial support for the location control routine was obtained, but not for the pouring routine.
Email: Deanne Adams, deanne.adams@gmail.com

(3042)

When GPS Goes Wrong: Invalid Guides Distort Spatial Memory. QI WANG, LILY VONG and RUI LIU, *Sun Yat-Sen University*. — Travellers increasingly rely on external devices (e.g., GPS) to guide navigation rather than their memory. What happens when those route guides conflict with travellers' memory? In the current study, participants learned routes presented on computer screen and confirmed that they have remembered each route. Then they went through same routes accompanied with true or false direction cues at intersections. Participants with feedbacks on their decisions showed no differences in performance between the true and false cue condition, indicating that travellers moved based on their memory rather than the unreliable direction cues. However, participants without feedbacks showed interestingly polarization of performance for true and false cue condition. Participants followed the direction cues regardless of the accuracy, although they have been confident about their memory on studied routes. Our findings suggest that false direction guides without any feedbacks might distort stored spatial representations and impair performance of navigation. Additionally, participants relied more on direction cues with complicated routes than simple ones, demonstrating the influence of route complexity on navigation with external guides.
Email: Qi Wang, qwang0921@gmail.com

(3043)

The Categorical Bias in Realistic Virtual Environments. CRISTINA SAMPAIO, MICHAEL WILLIAMS, HAYLEY BARNARD and JOSEPH FLECK, *Western Washington University*. — One criticism of the research on the categorical bias in spatial memory is that it may lack ecological validity, as spaces typically tested do not seem equivalent to the real world. There may be factors associated with a real world

environment that produce spatial codings different from those of simple laboratory-created spaces. Hence, people may not use Cartesian coordinates in representing complex life spaces and may not locate the prototypical location of an area at its geometric mean. Only a few studies to date have taken the category-adjustment approach to investigate bias for locations within real navigable environments (Holden et al., 2013; Sampaio & Cardwell, 2012; Uttal et al., 2010), presumably due to the difficulty in controlling such environments for experimentation. In my own attempt to address the bias in a 3-dimensional everyday space, although the environment was real (a square on a campus), the location memory was still tested on a 2D projected static image of the environment with the observer's viewpoint shifting from environmental to figural at the time of test. This project involves a test of the category bias in a virtual 3D enviroment that contains lifelike visual characteristics yet is controlled.
Email: Cristina Sampaio, cristina.sampaio@wwu.edu

(3044)
Positional Priming of Visual Pop-Out Search Is Supported by Multiple Spatial Reference Frames. AHU GOKCE, *Ludwig-Maximilians-Universität München*, HERMANN MÜLLER, *Ludwig-Maximilians-Universität München and Birkbeck College, University of London*, THOMAS GEYER, *Ludwig-Maximilians-Universität München*. — This study investigates the representation(s) underlying positional priming of visual pop-out search (Maljkovic & Nakayama, 1996). Three search items (1 target and 2 distractors) were presented at different display regions and different locations either in predictable (Experiment 1) or unpredictable (Experiment 2) sequences. This enabled to disentangle retinotopic, spatiotopic, and object-centered priming representations. Two short-term memory effects were tested: Target location priming (facilitation of reaction times (RT) for repeated target locations compared to empty locations) and distractor location priming (slowed RTs for switched target locations compared to empty locations). The target locations were coded in positional short-term memory with reference to both spatiotopic and object-centered representations (Experiment 1vs. 2). In contrast, distractor locations were maintained in object-centered reference frame (Experiments 1, 2). It is concluded that the uncertainty induced by the predictable vs. unpredictable cross-trial item displacements modulates the transition from location- to configuration-based representations in cross-trial memory for target positions.
Email: Ahu Gokce, ahugokce@gmail.com

(3045)
Memory for Landmark Location in Younger and Older Adults. LAUREN RICHMOND, *Washington University in St. Louis*, JESSE SARGENT, *Francis Marion University*, SHANEY FLORES and JEFFREY M. ZACKS, *Washington University in St. Louis*. — Difficulty in navigating through environments is related to reduced mobility and independence in late life. One factor that may influence navigation ability is the segmentation of a route into effective chunks, which can affect memory for landmark location. To assess age-related

differences in landmark memory, young and older adults were exposed to 3 routes during which landmarks were called to their attention. Participants then pointed to unseen landmarks and drew a map of the route and the landmark locations. Afterwards, participants segmented the routes. Participants also completed a cognitive battery assessing working memory, processing speed and chunking of verbal materials. Young adults outperformed older adults on both the pointing and map drawing tasks. We will discuss the role of spatial chunking in explaining these age-related differences, and its relationship to cognitive individual differences. Characterizing the role of segmentation in navigation may offer novel targets for intervention to improve performance.
Email: Lauren Richmond, lauren.richmond@wustl.edu

• RECALL I •

(3046)
Understanding Proactive Facilitation in Cued Recall. WILLIAM AUE and AMY CRISS, *Syracuse University* (Sponsored by Kenneth Malmberg). — In a typical memory interference experiment participants study multiple lists or pairs of items. Items from an initial study list (e.g., A-B) reappear on a second study list paired with new, other items (e.g., A-Br). Performance for A-Br pairs is contrasted with control pairs exclusive to the second study list (e.g., A-B, C-D). When Aue et al. (2012) employed such a design they observed proactive interference evidenced by more incorrect responses for A-Br pairs, as well as proactive facilitation evidenced by more correct responses for A-Br pairs relative to C-D pairs. They proposed multiple explanations for facilitation and a subset are evaluated in the current experiments. In a series of experiments testing the proposed hypotheses, the data appear to be most consistent with the idea that a portion of items, when encountered a second time, are encoded more completely. Implications for models of memory are discussed.
Email: William Aue, william.aue@gmail.com

(3047)
Effect of Foreign Accent on Memory for Words in Auditory and Bimodal Serial Recall Tasks. KIT YING CHAN, KRISTEN T. CAMPBELL and NICHOLAS H. ZURLO, *James Madison University*. — Two experiments examined the recall of lists of words spoken by a native and a Cantonese-accented speaker using serial recall tasks with auditory and bimodal presentation respectively. Identification of the same set of accented stimuli was also examined in a perceptual identification task following the recall task. In the auditory (traditional) serial recall task, participants showed an overall performance decline across all serial positions when the words were foreign-accented. Recall errors at the first and last few serial positions were positively correlated with their identification errors. In the bimodal serial recall task, in which spoken words were presented with synchronized visual words, performance for the accented words declined in the middle serial positions only. Participants' identification performance was almost perfect, suggesting that they were using the visual

cues in the recall task to help process accented words. Results suggest that foreign accent affects phonological encoding in STM and perceptual encoding in precategorical acoustic storage by inducing recognition difficulty. It also impairs memory by imposing a heavier processing load.
Email: Kit Ying Chan, chanky@jmu.edu

(3048)

The Impact of Prediction Errors on Memory Consolidation. ESTHER DE LOOF, LIEN NAERT, TOM VERGUTS and ELGER ABRAHAMSE, *Ghent University*. — Do prediction errors (PEs) enhance item specific memory? To test this frequently suggested hypothesis, we presented participants with a series of faces and induced PEs by violating participants' expectations about faces. First, the salience of the faces was varied based on a prior rating study. Second, the stimuli were paired with a voice of a matching (80%) or mismatching gender (20%; PE). Participants passively viewed the faces while performing a detection task on four target faces (5% of trials). The direct experience of the PEs was verified by measuring pupil size during the detection task; the impact on memory of the PEs was probed in a surprise recall test. While the PE faces elicited no differences in pupil size, their recognition was impaired in the recall test. In contrast, highly salient faces led to a larger pupil size and enhanced recognition. These results indicate that PEs may impair memory consolidation.
Email: Esther De Loof, estherdeloof@gmail.com

(3049)

Neural Correlates of Temporal Context Evolution in Free Recall. NEAL MORTON and SEAN POLYN, *Vanderbilt University*. — Retrieved-context models propose that information related to studied items is integrated into a representation of temporal context, which later serves as a cue to probe memory. Consistent with these models, recent scalp EEG results suggest that category-specific information is integrated over multiple studied items. We hypothesized that the addition of distracting activity between items would disrupt temporal context, causing decreased accumulation of category-specific information over time; as a result, recall would be less influenced by category cues. To test this account, we measured scalp EEG during free recall trials with or without distracting activity during study. We found that inter-item distraction attenuated organization by category during free recall. Consistent with retrieved-context models, in the no-distraction condition, we found evidence of integrative neural oscillatory activity during encoding that reflects the recent history of presented stimuli. In contrast, integrative activity was not observed when there was strong inter-item distraction. These results suggest that distracting activity disrupts the incorporation of semantic information into the contextual cue, leading to decreased organization by category.
Email: Neal Morton, neal.w.morton@vanderbilt.edu

(3050)

Directed Forgetting of Word Pairs: Consequences of Testing With Varied Cue Direction. LEAH KOUCHEL and BRANDEN ABUSHANAB, *UNCG*, LILI SAHAKYAN, *University of North Carolina*. — Research utilizing list-method directed forgetting (DF) suggests that instructing participants to forget a prior study list changes their mental context (Sahakyan & Kelley, 2002), reducing accessibility for that list. Although prior work supports the notion of associative symmetry in word pairs (Kahana, 2002), the role of context in memory for word pairs is still under investigation. The buffer model of memory (Lehman & Malmberg, 2013) assumes that episodic context is more strongly associated with the first item of a pair (WORD A) relative to the second item (WORD B). Based on this assumption, the context-change account of DF predicts that WORD A will be more sensitive to DF than WORD B. Two experiments tested this prediction using cued recall test of unrelated word pairs, with cues provided in backward direction (… – WORD B) or forward direction (WORD A – …). In Experiment 1, cue direction was varied within-subjects, whereas in Experiment 2, it was manipulated between-subjects. Implications for theories of DF, as well as the role of episodic contextual assciations in memory for word pairs are discussed.
Email: Lili Sahakyan, l_sahaky@uncg.edu

(3051)

How Do Religious and Sexual Orientations Affect Memory for Weight-Related Stimuli? CHRISTIE CHUNG, CHELSEA DEES and JULIA PRZEMYSLAW, *Mills College*. — Women are often socialized to adhere to an ideal of thinness, although recent research has shown that sexual orientation and religious beliefs may moderate body dissatisfaction and disordered eating symptoms. The present study examined the effects of religious and sexual orientations on memory for weight-related stimuli. Young college women (aged 18-30), of different sexual and religious orientations, participated in an incidental memory test consisting of weight-related and neutral pictures shown on a computer screen. Our results showed that although memory recall was similar among all groups, LGBTQ women were more likely than heterosexual women to have memory intrusions for both weight-related and neutral stimuli. Religious women showed significantly higher weight consciousness than non-religious women. Further analyses revealed that only non-religious LGBTQ women showed a significant correlation between depression and weight-consciousness. These results clearly demonstrate the roles that religious and sexual orientations play in weight-related cognition.
Email: Christie Chung, cchung@mills.edu

(3052)

The Effect of Survival Processing When Recalling More Complex Information. ALEX VIEANE and BENJAMIN CLEGG, *Colorado State University* (Sponsored by Matthew Rhodes). — Survival processing shows that enhanced retention of information occurs when it is processed within a survival-related context. Although previous work has been conducted with a list learning paradigm, the magnitude of the effects seen and its nature in terms of life-or-death suggests potential utility within real-world situations. The purpose of the current study was to determine whether an advantage from survival processing extends to learning with a close analogue to real-world survival situations. Participants were trained on a set of

procedures to diagnose and intervene with failing automation either in the context of a survival scenario (n = 57), or the same processes but framed with no survival implications (n = 46). No evidence of a difference in information recalled was found with these types of materials. Implications for the survival processing memory effect and its potential real-world applications are discussed.
Email: Alex Vieane, alex.vieane@colostate.edu

(3053)

Handedness Differences Obtained for the Retrieval of Concrete Words Extend to the Retrieval of Abstract Words. STEPHEN D. CHRISTMAN and HIBA HASABELNABY, *University of Toledo*. — Research documents the existence of robust advantages in episodic retrieval among persons with inconsistent hand preference; these results have been interpreted in terms of increased access to right hemisphere processing as mediated by the corpus callosum, which is larger in persons with inconsistent hand preference. However, all prior research used concrete stimuli (e.g., concrete words, real world events). The current study explored handedness differences in the recall of abstract words. There is controversy about hemispheric processing of abstract words, with some studies concluding superior right hemisphere ability (e.g., Kiehl et al., 1999) and others concluding inferior right hemisphere ability (e.g., Eviatar, Menn, & Zaidel, 1990). Participants were presented with either 36 concrete or 36 abstract nouns which they then recaledl after 10 minutes. Concrete words led to better performance than abstract, females did better than males, and, critically, inconsistent-handedness was associated with better recall of both abstract and concrete words.
Email: Stephen Christman, stephen.christman@utoledo.edu

(3054)

Recall of Spoken Material Heard at Different Speech Intelligibility Conditions and the Role Played by Working Memory Capacity. ROBERT LJUNG, KARL ISRAELSSON and STAFFAN HYGGE, *University of Gävle*. — The present study examines speech intelligibility and memory performance for auditory presented material heard under different signal-to-noise ratios. Pre-experimental measures of working memory capacity were taken to explore individual susceptibility to the disruptive effects of noise. Thirty-five participants first completed an operation span task in quiet and later listened to spoken word lists containing 11 one-syllable phonetically balanced words presented at four different S/N ratios (+12, +9, +6, and +3). Participants repeated each word aloud immediately after its presentation, to establish speech intelligibility and later on performed a free recall task for those words. The speech intelligibility function decreased linearly with increasing S/N levels for both the high-WMC and low-WMC groups. However, only the low-WMC group had decreasing memory performance with increasing S/N levels. The memory of the high-WMC individuals was not affected by increased S/N levels
Email: Robert Ljung, robert.ljung@hig.se

(3055)

The Contribution of Encoding and Retrieval Processes to Proactive Interference. OLIVER KLIEGL and KARL-HEINZ BAEUML, *Universität Regensburg*. — Proactive interference (PI) refers to the finding that memory for recently studied (target) material can be impaired by the prior study of (nontarget) material. Previous accounts of PI differed in whether they attributed PI to impaired retrieval or impaired encoding. Employing a typical PI task, here we examined (i) the role of encoding processes in PI by recording EEGs during study of nontarget and target lists, and (ii) the role of retrieval processes in PI by measuring recall totals and response latencies in target list recall. In addition, we measured subjects' working memory capacity (WMC). We observed PI effects at both encoding and retrieval, indicating that impaired retrieval and impaired encoding can contribute to PI. WMC affected PI. At both encoding and retrieval PI was reduced in high-WMC subjects, suggesting that these subjects are able to separate target from nontarget information and create stronger focus on the target material.
Email: Oliver Kliegl, oliver.kliegl@ur.de

(3056)

Lexical Access in Tip-of-the-Tongue States: Movement vs. Phonological Cues. SUSAN RAVIZZA, *Michigan State University*. — Non-iconic movements improve lexical access in a tip-of-the-tongue (TOT) task but not during a word fluency task (Ravizza, 2003). The present experiment seeks to replicate this finding as well as assess the magnitude of improvement in comparison to a phonological cue. Participants were asked to retrieve rare words in response to a definition or question. If the answer was not immediately known, participants rated whether they were in a TOT state or just did not know the answer. They were then given 30 seconds to retrieve the answer while either remaining motionless (with or without a phonological cue) or tapping at their own rate. Consistent with Ravizza (2003), movement resulted in more TOT resolutions than not moving; however, a phonological cue was the most beneficial to retrieval. These results are consistent with the hypothesis that movement facilitates lexical access by providing a non-phonological cue to retrieval.
Email: Susan Ravizza, ravizzas@msu.edu

(3057)

Does Inhibition Drive Kindergarteners' Retrieval-Induced Forgetting? An Absence of Cue Independence. JENNIFER BRIERE and TAMMY MARCHE, *University of Saskatchewan*. — Repeatedly retrieving a subset of information (Rp+) from memory leads to reduced recall of related, un-retrieved information (Rp-) below baseline (NRp) levels, a finding termed retrieval-induced forgetting (RIF). In adults, Rp-forgetting is argued to result from cognitive inhibition whereby competing memories are suppressed to overcome interference arising from repeated retrieval. We investigated the inhibitory account of RIF in kindergartners by evaluating the property of cue independence (i.e., persistent forgetting of Rp- items regardless of the final recall cue, Anderson & Levy, 2007). Thirty-one kindergarteners (M=5.38 yrs, 14 boys) completed 2 counterbalanced RIF tasks using category-exemplar word-

picture pairs. One task used the typical category-cue method of recall and the other used a novel sentence cue at recall. A cue × practice interaction revealed RIF with category-cue recall but not with novel cue recall, a pattern indicative of non-inhibitory mechanisms. Follow-up research aims to further evaluate inhibition in kindergarteners' RIF.
Email: Jennifer Briere, jennifer.briere@usask.ca

(3058)

The Survival Advantage in Memory for Temporal Order. CRYSTAL ROBINSON and JEANETTE ALTARRIBA, *University at Albany, SUNY.* — The current project examines the effects of survival processing relative to item-specific and relational processing on memory for temporal order. Evidence suggests that enhanced item-specific processing plays an important role in the survival advantage (Burns, Hart, Griffith, & Burns, 2012; Nairne & Pandeirada, 2008). In the present experiment, participants were asked to make survival relevance ratings, moving relevance ratings, or pleasantness ratings for a set of 32 words from either common taxonomic or ad hoc categories. Immediately after completing the survival, moving, or pleasantness task, participants were asked to reconstruct the order in which each of the 32 words was originally presented. Findings are discussed with regards to how memory for presentation order may be influenced by both adaptive and mechanistic processes.
Email: Crystal Robinson, cjeanrob@gmail.com

(3059)

Does Impossible Retrieval Practice Support Divergent Thinking? GENNA ANGELLO and STEVEN SMITH, *Texas A&M University*, BENJAMIN STORM, *University of California, Santa Cruz.* — In creative idea generation, creative problem solving, and divergent thinking, access to novel, creative responses is often blocked by common, pre-potent responses that first come to mind. We explored a potential way of increasing the accessibility of novel responses without actually presenting or priming them. Specifically, we used the impossible retrieval-practice paradigm—typically used in the study of retrieval-induced forgetting—to reduce the accessibility of pre-potent category members. Based on the assumption that high-frequency category members would be most likely to be inhibited, we predicted that impossible retrieval practice would lead to the increased accessibility of novel category members on a subsequent category generation task. As predicted, the average novelty of responses was greater for categories that received impossible retrieval practice than for those that did not. These results suggest that failed retrieval attempts can facilitate access to more novel responses in tasks requiring the generation of creative ideas.
Email: Genna Angello, angellogenna@gmail.com

• RECOGNITION MEMORY I •

(3060)

A Neurobehavioral Test of Discrete-State and Continuous Recognition Memory Models. BENJAMIN H. ZOBEL, *University of Massachusetts Amherst*, CHAD DUBE, *University of South Florida*, LISA D. SANDERS and CAREN M. ROTELLO, *University of Massachusetts Amherst.* — Does recognition memory involve a discrete-state decision mechanism, or continuously-valued evidence? We contrasted discrete-state and continuous models' predictions using a simple but novel analysis of the relative rate of change ($\Delta = \delta(T_d)/\delta(L_d)$) in key data (d) comprising response rates or corresponding ERP amplitudes, each on Target (T) vs. Lure (L) trials. Using a modified version of the biased payoff task, response rates showed $\Delta > 1$ as bias was varied from a conservative to a neutral value, and $\Delta < 1$ as bias was varied from a liberal to a neutral value. These results are predicted by continuous models, and contradict existing binary-response discrete-state models implying a constant value of Δ in all comparisons. The FN400 amplitude, a putative familiarity index, exhibited $\Delta > 1$ as predicted by continuous models in the conservative—>neutral comparison. The liberal—>neutral ERP comparison revealed an unexpected pattern inconsistent with both model classes.
Email: Chad Dubé, chaddube@usf.edu

(3061)

Test Feedback Can Lower Discriminability in Recognition Memory. BRYAN FRANKS and JASON HICKS, *Louisiana State University.* — Accuracy feedback in recognition memory testing yielded null results in prior work, but discriminability is consistently lower in feedback conditions. Feedback might actually have a negative, small effect on discriminability. Participants completed two study-test cycles in which we manipulated the presence of feedback at test between-subjects (Experiment 1) and within-subjects (Experiments 2). We manipulated memory strength via study repetitions as well as color cues indicative of expected strength at test. Color cuing at test was manipulated within-subjects in Experiment 1 and between-subjects in Experiment 2. There was a nonsignificant trend for feedback to lower discriminability in Experiment 1 and a significant negative result of feedback in Experiment 2, for strong items. Taken together, these findings suggest that feedback has a consistently negative impact on recognition discriminability but that is of a small effect size and easier to detect in within-subjects manipulations. Criterion noise is considered as a potential explanatory mechanism.
Email: Bryan Franks, bfran19@tigers.lsu.edu

(3062)

Subjective Experiences of Recognizing and of Not Recognizing Paintings and Words. D. STEPHEN LINDSAY, KAITLYN FALLOW and MARCIN KONIECZNY, *University of Victoria.* — Tests of recognition memory for digital scans of paintings consistently elicit a conservative response bias (more misses than false alarms). Conservatism on paintings persists when both paintings and words are used as stimuli and is independent from differences in recognition sensitivity

(d'). ROCs from our previous studies hinted at the possibility that recollection (as opposed to familiarity) may play a greater role in the recognition of paintings than of words. We tested this idea using both the standard remember/know procedure and a modified version in which subjects report the subjective experience associated with NOT recognizing an item, with the "remember" option in this case essentially describing a recollect-to-reject process. Our results suggest that both "old" and "new" decisions are based on recollection more often for paintings than for words, but that this tendency is not related to differences in response bias.
Email: D. Stephen Lindsay, slindsay@uvic.ca

(3063)

Standard Deviation of Lure Evidence Distribution Increases With Mean—Problematic for DPSD Model? STEPHEN DOPKINS, KATY VARNER and DARIN HOYER, *George Washington University*. — In an item recognition task two manipulations increased the false alarm rate without affecting the hit rate. The Unequal Variance Signal Detection (UVSD) model attributed the results to an increase in the standard deviation of the lure evidence distribution. In some fits the Dual Process Signal Detection (DPSD) model attributed the results to an increase in the level of (false) lure recollection. In others the model attributed the results (implausibly) to a decrease in the level of target recollection. These results suggest that the standard deviation of the distribution of mnemonic evidence for lures can vary with the mean of that distribution. This may be problematic for the DPSD model given that the model links the level of recollection to the difference between the standard deviations of the target and lure distributions.
Email: Stephen Dopkins, dopkins@gwu.edu

(3064)

Evidence for Discrete-State Processing in Verbal Cognitive Tasks. APRIL SWAGMAN and JEFFREY ROUDER, *University of Missouri-Columbia* (Sponsored by Jeffrey Johnson). — Cognitive processes in perception and memory have been modeled as continuous processes of varying latent strength or, alternatively, as all-or-none processes mediated by discrete mental states. Continuous models, for example signal detection theory, are well-represented in the literature because of their flexibility in fitting data. Discrete-state models are less popular, perhaps because the models traditionally explored are too constrained and thus unrealistic for behavioral data. In this poster, we present a more reasonable and still testable class of discrete-state models along with a stronger experimental paradigm from Province & Rouder (2012) for model comparison. The critical contrasts involve response patterns across conditions of varying difficulty. We find support for discrete-state mediation for the majority of participants in both recognition memory and the identification of briefly-presented words. We propose the existence of a verbal threshold which leads to all-or-none behavioral reporting.
Email: April Swagman, aprilswagman@mail.missouri.edu

(3065)

Sources of Interference in Item and Associative Recognition Memory: Insights From a Hierarchical Bayesian Analysis of a Global Matching Model. ADAM OSTH, *Ohio State University*, SIMON DENNIS, *University of Newcastle*. — A powerful theoretical framework for exploring recognition memory is global matching, in which memory strength reflects the similarity of the retrieval cues being matched against the contents of memory. We present a model that directly parameterizes the matches and mismatches to the item and context cues, which enables estimation of the magnitude of each interference contribution (item noise, context noise, and background noise). The model was fit using hierarchical Bayesian techniques to ten recognition memory datasets that employ manipulations of list length, list strength, word frequency, study-test delay, and stimulus class in item and associative recognition. The parameter estimates revealed at most a small contribution of item noise that varies by stimulus class, with virtually no item noise for single words and scenes. Background noise estimates dominated at retrieval across nearly all stimulus classes with the exception of high frequency words, which exhibited equivalent levels of context noise and background noise. These parameter estimates suggest that the majority of interference in recognition memory stems from experiences acquired prior to the learning episode.
Email: Adam Osth, adamosth@gmail.com

(3066)

A Test Of Discrete State Models of Recognition Memory: How Do Participants Use a Continuous Response Scale? TINA CHEN, JEFFREY STARNS, CAREN ROTELLO and BENJAMIN H. ZOBEL, *University of Massachusetts Amherst*. — Discrete state models of recognition memory assume that test items elicit internal states of detection or guessing, which probabilistically map onto responses. To fit confidence rating data, these models propose that participants use a wide range of confidence levels when they are in both the detect and guess states. To explore different styles for distributing responses across confidence levels, participants completed a recognition task and a betting task in which they were given probabilities of outcomes and were asked to rate their confidence that the outcome would occur. The betting task was used to define each participant's strategy for using the confidence scale in various states of uncertainty. The results showed substantial variability in how participants used the confidence scale on the memory task. Competitive model fits will be shown for alternative discrete state and continuous detection models.
Email: Tina Chen, tinac@psych.umass.edu

(3067)

Episodic Recollection is a Thresholded Retrieval Process. JAMIE MURRAY and DAVID DONALDSON, *University of Stirling*. — Although much is known about the underlying neural system that supports episodic recollection, exactly how recollection operates remains unclear. One possibility is that recollection reflects a continuous process, whereby test cues always elicit some information from memory. Alternatively, recollection may reflect the operation of a threshold process that allows for retrieval failure, whereby test cues sometimes

elicit no information. Here, we provide evidence that recollection is thresholded by measuring the commonly reported electrophysiological correlate of episodic retrieval - the left parietal old/new effect. We used a novel source task designed to directly measure the accuracy of retrieval success, finding that the left parietal effect was sensitive to the precision of memory responses when recollection succeeded, but was entirely absent when recollection failed. The result of the present experiment clarifies the nature of the neural mechanism underlying episodic memory retrieval, providing novel evidence in support of threshold models of recollection.
Email: Jamie Murray, jm157@stir.ac.uk

(3068)

Physical Retrieval Dynamics Reveal Memorial Retrieval Dynamics. MEGAN PAPESH, *Louisiana State University.* — Sequential sampling models (e.g., Ratcliff & Starns, 2009) suggest that memory decisions are made by continuously sampling memory strength for old and new test items and comparing that strength to a decision criterion; stronger items cross the decision threshold first and are associated with increased accuracy and faster response latencies. Recently, mouse trajectories have been used to reveal the observable time course for this theoretical sampling process, with evidence consistent with unequal variance distributions of item strength for target and foil items (Papesh & Goldinger, 2012). In the present study, these underlying distributions were manipulated by varying the linguistic homogeneity of targets versus foils in a standard memory test. Consistent with the interpretation that mouse trajectories reveal sequentially accumulating evidence, both old and new decision trajectories were sensitive to underlying strength, but only when the class of items was heterogeneous. Results are interpreted within dynamic decision models of recognition memory.
Email: Megan Papesh, mpapesh@lsu.edu

(3069)

The Apple of the Mind's Eye: Reconstructive Memory for the Apple Logo. ADAM BLAKE, MEENELY NAZARIAN and ALAN CASTEL, *University of California, Los Angeles.* — Visual memory is often considered to be very accurate; prior studies show that recognition is near perfect for single presentations of pictures (Shepard, 1967). Despite this phenomenon, recent research shows that memory is relatively poor for some everyday objects, even when these objects are seen often ogr require interaction (e.g. Nickerson & Adams, 1979; Vendetti, Castel, & Holyoak, 2013). Unlike objects in previous studies (pennies, elevator panels), logos are designed to be memorable and distinctive. The present study examined general memory for a very simple yet pervasive logo: the Apple logo. The data show that participants express high levels of confidence in their memory for the logo, however they exhibit surprisingly poor performance on measures of both recall (drawings) and forced-choice recognition. Additionally, the Apple logo was compared to memory and confidence in memory for other popular logos and symbols. These results

suggest that even extremely frequent exposure to simple images—designed for their memorability—does not always lead to accurate recall.
Email: Adam Blake, adamblake@g.ucla.edu

(3070)

Dubious Decision Evidence and Criterion Placement in Recognition Memory. MICHAEL MILLER and JUSTIN KANTNER, *University of California, Santa Barbara.* — Signal Detection Theory models of recognition memory suggest that ideal observers will maximize recognition performance by optimally placing a decision criterion along an axis of memory strength that takes into consideration both the likelihood of a target and the relative value of the response outcomes. However, subjects are normally quite suboptimal in their placement of decision criteria, some much more so than others. Various explanations for the suboptimal placement of decision criterion have been proposed. The most parsimonious explanation, however, is that subjects are simply unwilling to abandon memory evidence, no matter how dubious, in favor of base rates or of the relative values of response outcomes. We tested this explanation by making the memory evidence extremely dubious, and in one study completely non-existent. While some individuals appropriately maximized their response bias, most subjects still clung to decision evidence even when that evidence had no apparent discriminatory value.
Email: Michael Miller, miller@psych.ucsb.edu

(3071)

Individual and Developmental Differences in the Benefits of Interleaved Learning. HALEY VLACH, *University of Wisconsin, Madison.* — A long history of research has demonstrated that distributing learning events in time promotes memory, a phenomenon often termed 'spaced learning' or 'interleaved learning'. A focus of this work has been to document the generality of spaced and interleaving learning across timescales, contexts, and species. The current work takes a different approach by examining how individual and developmental differences are related to the efficacy of interleaved learning. Preschool aged-children (N = 88; 3-5 years-old) were presented with a memory task in which items were presented on a massed or interleaved schedule. Children's ability to retain knowledge across varying timescales was assessed in separate memory tasks. Results revealed that both memory abilities and developmental level (i.e., age) mediated the degree to which children benefitted from interleaved learning. This work has several applied implications and is a powerful example of how a developmental approach can provide new theoretical insights into our understanding of spaced and interleaved learning schedules.
Email: Haley Vlach, hvlach@wisc.edu

(3072)

Age Differences in Item Recognition Memory Discrimination and Criteria: A Meta-Analysis. SCOTT FRAUNDORF, *Carnegie Learning*, KATHLEEN HOURIHAN, *Memorial University of Newfoundland*, AARON BENJAMIN, *University of Illinois.* — Age-related memory deficits appear

ubiquitous, but most research involves tasks requiring self-initiated processing, such as recall. Recognition decreases these demands and may reveal intact memory function. In the first large meta-analysis of age and recognition memory (150 experiments), we used signal-detection theory to separate age-group differences in discrimination (d') versus response bias (c). Older adults (OAs) exhibited poorer discrimination, and this difference increased in easier tasks. OAs were especially disadvantaged in tasks with auditory presentation, with semantically-related or conjunction lures, with orienting tasks (whether "deep" or "shallow"), and with only one study opportunity. Dividing attention, stimulus type (words, pictures, or faces), and affective valence did not differentially affect OAs.These results reveal age-related memory deficits beyond recall, but suggest some aspects of memory function are less impaired. They also reveal differences in how OAs strategically approach memory tasks, clouding interpretation of age-related memory effects.
Email: Scott Fraundorf, scottfraundorf@gmail.com

• FALSE MEMORY I •

(3073)

False Memories and Paranormal Belief. STEPHEN J. GRAY and DAVID A. GALLO, *University of Chicago*. — Research suggests that believers in psychic phenomena may be more susceptible to false memories than skeptics due to differences in retrieval monitoring effectiveness. To test this hypothesis we recruited believers and skeptics (matched on age, sex, and years of education) and administered three different episodic memory tasks: a modified DRM task, a criterial recollection task, and an autobiographical memory task. Replicating our prior work with the DRM task, skeptics were better at identifying the missing associates than believers. However, group differences in susceptibility to the DRM illusion were inconsistent. We also did not find significant group differences on the criterial recollection task or on the autobiographical memory task, even though each of these tasks elicited considerable memory errors (i.e., source memory confusions and imagination inflation errors, respectively). These results provided little evidence that these groups differed on false memory susceptibility, although skeptics generally outperformed believers on measures of critical thinking.
Email: David Gallo, dgallo@uchicago.edu

(3074)

Perceptual and Conceptual Mechanisms of Memory Reconstruction. MANOJ DOSS, MAXIMILIAN BLUESTONE and DAVID GALLO, *University of Chicago*. — How are false memories embellished with recollected details? Prior work suggests two mechanisms, but these are often conflated. According to perceptual recombination, perceptual features are drawn from studied events and imported into a false memory. According to conceptual fluency, activating semantically related concepts causes mental images to be misattributed to recollections. We designed a three-stage task to disentangle these mechanisms. Participants first studied common object labels with or without a corresponding picture. They next saw items that were related to these labels, including perceptually similar scrambled images or conceptually related words. Finally, they attempted to recollect which labels were initially studied with a picture. Consistent with perceptual recombination, presenting similar perceptual features increased picture recollection errors, even when items were matched on familiarity. We also found evidence for conceptual fluency, although the effect was smaller. Finally, we introduced a delay that further dissociated these two mechanisms.
Email: Manoj Doss, mkdoss@uchicago.edu

(3075)

Did You See That Scene? Perceptual Feature Recombination and False Memory Creation. YUNG-TSEN CHEN, MARIKO LYTELL and DAVID A. GALLO, *University of Chicago* (Sponsored by Benton Pierce). — According to the perceptual feature recombination hypothesis, details from studied events can be incorporated into a false memory thereby providing it with illusory detail. We attempted to isolate this mechanism using movie stimuli, while controlling for conceptual familiarity effects. Participants read the entire script of an X-Files movie, and watched half of the scenes from the movie (targets). They next were presented with still images, some from the witnessed scenes (targets) and some from redacted scenes (lures). On a final test, they were presented with pieces of the script and recollected whether they had actually witnessed the action in the movie. We found that participants were more likely to falsely recollect witnessing the action if a still image had been presented, often with high confidence, compared to a control condition that familiarized the actions without a relevant still image. These results provide strong evidence for a perceptual feature recombination mechanism.
Email: Yung-Tsen Chen, bibiclaire@gmail.com

(3076)

Negative Emotion as Gist: Evidence From Picture Recognition. SARAH BOOKBINDER, *Cornell University* (Sponsored by Valerie Reyna). — Although there has been prior work on how true and false memory are influenced by emotional valence and arousal, they have often been confounded. Thus, it is difficult to say whether specific effects are due to valence, arousal, or both. In the present research, we used a picture-memory paradigm that allowed emotional valence to be manipulated with arousal held constant. Negatively-valenced pictures elevated both true and false memory, relative to positive and neutral pictures. Conjoint recognition modeling analyses revealed that negative valence (a) reduced erroneous recollection rejection for true memory and phantom recollection for false memory but (b) increased familiarity for both. Discrete emotion analyses revealed that sadness increased false memory compared to joy, fear, and disgust, and this was due to elevated levels of familiarity. These data are consistent with the view that emotional valence is a conceptual gist that enhances the familiarity of presented and unpresented material.
Email: Sarah Bookbinder, sb978@cornell.edu

(3077)

Mechanisms of Eyewitness Suggestibility: A Test of the Explanatory Role Hypothesis. ERIC J. RINDAL, *Kent State University*, QUIN M. CHROBAK, *University of Wisconsin Oshkosh*, MARIA ZARAGOZA, *Kent State University*, CAITLIN WEIHING, *University of Wisconsin Oshkosh*. — Chrobak and Zaragoza (2013) showed that witnesses were more likely to incorporate forced fabrications into their freely provided testimony when they provided a causal explanation for a witnessed outcome. These findings support the explanatory role hypothesis, which posits that false memory development is a function of the explanatory role the post-event information serves. The present study assessed whether these findings generalize to suggestive interviews involving experimenter provided misinformation and a more stringent test of false memory (a source test). We also assessed the extent to which the explanatory role of the suggested information increases false recollection rather than false belief. In support of the explanatory role hypothesis, the present study showed that participants were less likely to develop false recollections for experimenter provided suggestions when their explanatory strength had been reduced by the presence of an alternative explanation that could explain the same outcome as the suggestion.
Email: Maria Zaragoza, mzaragoz@kent.edu

(3078)

Event Representation in the Misinformation Paradigm. JOHN KIAT and ROBERT BELLI, *University of Nebraska*. — Is event representation in the misinformation paradigm more akin to a verbal narrative or visual representation? In two experiments, participants completed a picture-word source monitoring task in which a list of pictures and words at acquisition were later tested as to their presentation mode, and a postevent misinformation task in which a True/False test (Experiment 1) or a two Alternative Forced Choice test (Experiment 2) was used. In both misinformation tests, participants indicated whether each response was based on something "seen," "read," "seen and read," or a guess. In both experiments, the verbal representation hypothesis received support as the tendency to endorse misinformation as having been seen (including seen and read) was associated only with reporting pictures at acquisition as having been presented as words and not associated with reporting words as having been presented as pictures. This distinction between these error types was supported using item factor analysis.
Email: Robert Belli, bbelli2@unl.edu

(3079)

Effect of Feedback on False Memory. TAMER DESOUKY, *The University of Texas at Arlington*, JOSHUA ARDUENGO, DUSTIN DOUGLAS and JAMES BARTLETT, *University of Texas at Dallas*. — Purpose: The purpose of this study was to determine if immediate feedback of performance has a subsequent affect on overall memory recognition performance. Methods: Four experiments with a pretest-posttest two-group randomized design were conducted (n = 36 per experiment). After a study session, participants in the recognition test had to make old or new judgments on items from the study list (old items), from non-study list (new items), or conjunction items (new items). After each judgment a feedback slide was presented if the answer was correct (experiments 1 & 2), or a percentage of overall correct score (experiments 3 & 4). Results: t-test results revealed that feedback on overall performance has not shown reliable effects in all four experiments. Additionally, utilizing different feedback techniques in experiments 1 and 3 did not improve subsequent performance. Finally, different stimulus study durations also seems to contribute little to feedback performance.
Email: Tamer Desouky, tdesouky@gmail.com

(3080)

Exaggeration Contagion: Do Eyewitnesses Adopt Each Other's Reporting Style? BRITTANY A. HARMAN and NANCY FRANKLIN, *Stony Brook University*. — Exposure to post-event information (e.g., from co-witnesses) can contaminate memory for the original experience. In social contagion, it's the particular details of post-event input that are adopted. The present study examines a potentially more global form of distortion: the impact of co-witness reporting style, particularly the adoption of a co-witness's tendency to exaggerate. We exposed participants to a video of a violent crime, followed by a confederate co-witness's (accurate or exaggerated) answers to a specific question set. Later, they answered these same questions, as well as other questions that were related or unrelated to those they had received post-event input about. The pattern of results for question type and co-witness reporting style suggest that both factors impact eyewitness accuracy. Our results are consistent with similar findings in the psycholinguistics literature involving entrainment and in the social psychology literature on emotional contagion. Potential implications for police best practices will be considered.
Email: Nancy Franklin, nancy.franklin@stonybrook.edu

(3081)

Recollecting Change Prevents False Memories. ADAM L. PUTNAM and HENRY L. ROEDIGER, III, *Washington University in St. Louis*. — What happens when someone notices misleading information in the misinformation paradigm? In our experiment, subjects watched slide shows of various events and then read narratives of each event in which critical details were consistent with, neutral towards, or inconsistent with the original events. At test, subjects completed a recognition test and reported the source for each response (options included: photos, text, both-same, and both-different). Misinformation items usually led to poorer recognition compared to the neutral or repetition items. However, when subjects reported remembering a change for the misinformation items (selecting "both-different") recognition accuracy was identical to the neutral items. Some individual items were even recalled better in the misinformation condition than in the neutral condition. This pattern suggests that remembering change can reduce the misinformation effect. As well, remembering change may lead to better memory for the original event than if no misinformation had occurred.
Email: Adam L. Putnam, adamlputnam@gmail.com

(3082)

What You Think You Saw or Heard Depends on Test Delay: Modality Effects on Short- and Long-Term False Memories. JUSTYNA OLSZEWSKA, *Institute of Applied Psychology*, PATRICIA REUTER-LORENZ, EMILY MUNIER and SARA BENDLER, *University of Michigan*. — How does input modality (visual vs. auditory) influence true and false memory rates? Do such modality effects differ when recognition is tested in short- (STM) versus long-term memory (LTM) tasks? In three experiments manipulating study modality and test modality (Experiments 1, 2) as well as test delay (Experiment 3), we found reliable false recognition for both input modalities and regardless of delay. Furthermore, in STM false recognition rates were nearly twice as great when the memory set was presented visually than auditorily regardless of probe modality. However, in LTM this pattern reversed: semantic errors were greater when study and test were auditory than when they were visual, as reported in prior work. These results demonstrate that false STMs are robust despite the high fidelity of auditory-verbal representations. Dissociable effects of input modality on STM vs. LTM distortions suggest that different memorial cues support recognition as a function of delay.
Email: Patricia Reuter-Lorenz, parl@umich.edu

(3083)

Correcting Misinformation From the 2012 Presidential Campaign. JIMMEKA GUILLORY, *Spelman College*, LISA GERACI, *Texas A&M University*. — In political campaigns, where misinformation abounds, candidates often wish to correct erroneous information about themselves or their records. We examined whether people would accept corrections about erroneous information provided by President Barack Obama and Governor Mitt Romney about the other candidate during the 2012 Presidential debates. Participants read statements made by President Obama and Governor Romney, which included some erroneous statements that were later corrected by factcheck.org. Participants were asked to rate their agreement with the statements. Results showed that the correction was effective for participants—people were less likely to agree with the erroneous statements after reading a correction from factcheck.org. We describe the contribution of political affiliation, knowledge, perceived politician credibility, issue importance, and campaign exposure to people's willingness to accept a correction.
Email: Jimmeka Guillory, jguillo1@spelman.edu

(3084)

Continued Belief in Corrected Misinformation Following an Alternative Explanation. PATRICK RICH, MARIA ZARAGOZA and DAVID RICCIO, *Kent State University*. — Research on the continued influence effect (Johnson & Seifert, 1994) has repeatedly shown that misinformation that is later corrected can continue to subtly influence the types of inferences readers draw about the story. Recent research from our laboratory has expanded on this finding, showing that people also continue to overtly believe that this corrected misinformation is responsible for critical outcomes in the story. The goal of the current study was to investigate whether continued belief, like continued influence, could be reduced by providing an alternative to the misinformation which also explains the events in the story. Overall, providing an alternative explanation greatly reduced overall belief in the misinformation, but did not eliminate continued belief in the misinformation. Consistent with previous findings from our lab, we also found further evidence suggesting that implied misinformation is more difficult to correct than explicit misinformation even when an alternative explanation is provided.
Email: Patrick Rich, prich1@kent.edu

(3085)

Eye-Movements Guided by False Memories: DRM-Saccade Paradigm. LAUREN KNOTT, *City University London*, DAMIEN LITCHFIELD, *Edge Hill University*, TREVOR CRAWFORD, *Lancaster University*, TIM DONOVAN, *University of Cumbria*. — The Deese/Roediger-McDermott (DRM; Roediger & McDermott, 1995) paradigm reliably elicits false memories for critical nonpresented words at test. But do the cognitive processes that produce true and false memories differ when responses are eye movements? We implemented a new technique that examined the dissociation between true and false memories. We recorded eye-movement behaviour on a modified rule-based version of a pro-saccade eye-movement task. Participants' memory of previously studied DRM words was used as the deciding rule as to whether they should look towards or away from a target dot presented to the left or the right of the screen. Saccadic latencies associated with List words and errors on critical lures did not differ, but slower latencies were recorded when participants correctly rejected the critical lure (looked away from the target). This memory-guided eye-movement task could provide new insights into theories of false memory.
Email: Lauren Knott, lauren.knott.1@city.ac.uk

(3086)

Asymmetric Effects of Early Eyewitness Confidence. ROBERT MICHAEL and MARYANNE GARRY, *Victoria University of Wellington* (Sponsored by Daniel Bernstein). — When eyewitnesses answer questions about what they saw, their initial feelings of confidence matter. Eyewitnesses report higher estimates of correct answers when questions are arranged to produce an initial feeling of high confidence than when the same questions are arranged to produce an initial feeling of low confidence. But how does this biased memory appraisal arise? To track how the bias develops, we asked subjects to report estimates of correct answers after every question. We found that patterns of estimates were asymmetric. Eyewitnesses repeatedly made small adjustments to estimates when initially confident, but made large adjustments to early estimates when initially not confident. These results have theoretical implications for the development of false memories, and practical implications in areas such as eyewitness interviewing.
Email: Robert Michael, robert.michael@gmail.com

(3087)

Priming Children's Analogical Reasoning With True and False Memories: A Comparison of Relation and Solution Priming. EMMA THREADGOLD, MARK HOWE and SARAH R. GARNER, *City University London*, LINDEN J. BALL, *University of Central Lancashire*. — Recent research has shown that false memories can prime the solution to compound remote associate tasks (CRATs) and that this extends to complex analogical reasoning problems. The current research furthers this paradigm by providing a comparison of the efficacy of priming either the analogical reasoning problem solution itself or priming the relational link required to solve the problem. It can be argued that priming the relational link of an analogy provides a better demonstration of priming analogical reasoning with memory than priming the solution. We present the findings of an experiment employing a newly developed set of pictorial analogical reasoning problems with 7- and 11-year-old children. The problem solution or relational link was primed with either a true or false memory using a DRM list. These findings provide evidence that there are differences in children's ability to utilize a primed solution or primed relation in solving pictorial analogical reasoning problems.
Email: Emma Threadgold, emma.threadgold.1@city.ac.uk

(3088)

The Effects of Subtle Misinformation in News Headlines. ULLRICH ECKER, *University of Western Australia*, STEPHAN LEWANDOWSKY, *University of Bristol*. — Information presented in news articles can be misleading without being blatantly false. Exp 1 looked at misleading headlines that emphasize secondary content rather than the article's primary gist. We investigated the effects of misleading headlines on readers' processing of factual news articles and opinion pieces, using both direct memory measures and more indirect reasoning measures. Exp 2 looked at an even more subtle type of misdirection. We presented articles featuring a facial image of one of the protagonists, and examined whether the headline and opening paragraph of an article affected the face impressions formed even when the person referred to in the headline was not the person portrayed. We demonstrate that misleading headlines affect memory, inferential reasoning and behavioral intentions, as well as the face impressions that are formed. On a theoretical level, we argue that these effects arise not only because headlines constrain information processing, biasing readers towards a specific interpretation, but also because readers struggle to update their memory in order to correct initial misconceptions. We discuss implications for news consumers, media literacy, and the fact-checking movement.
Email: Ullrich Ecker, ullrich.ecker@uwa.edu.au

(3089)

The Effect of Mindfulness at Encoding and Retrieval on the Production of False Memories. SUSAN SHERMAN and LUCY TUDOR, *Keele University, UK*. — In the Deese-Roediger-McDermott (DRM) paradigm, participants are presented with word lists such as bed, rest, awake, tired, dream etc. which give rise to false memories for the non-

presented but related word sleep. Dividing attention reduces false recognition, as does increasing attention to item-specific details. The current research explored the effect of increasing general attention on true and false memories using a mindfulness manipulation. Participants either received a mindfulness intervention (or not) and manipulation check prior to studying 8 DRM lists. They then either received a mindfulness intervention (or not) and a manipulation check prior to completing an RKG recognition task. Mindfulness at encoding had no impact on the number of list items correctly recognised or filler items incorrectly recognised, but it did reduce the number of lures falsely recognised. Furthermore, it increased R responses for list items and reduced them for lure items. Mindfulness increases attention sufficiently that false memories are reduced either through a reduction in spreading activation at study or increased source monitoring information available at test.
Email: Susan Sherman, s.m.sherman@keele.ac.uk

• **METAMEMORY/METACOGNITION II** •

(3090)

Resolving a Paradox in Strategy Knowledge Updating. JARED M. HOLDER, *Georgia Institute of Technology*, JODI PRICE, *University of Alabama in Huntsville*, CHRISTOPHER HERTZOG, *Georgia Institute of Technology*. — Individuals learn about the relative effectiveness of two memory encoding strategies (interactive imagery and rote repetition) but substantially underestimate cued recall performance when giving an aggregate post-performance estimate (postdiction) for the superior imagery strategy (Dunlosky & Hertzog, 2000). We measured memory for the original encoding strategy, recall confidence, and estimates of strategy effectiveness for each item during recall tests on two lists to evaluate how perceived strategy effectiveness changes over test trials. Multi-level regression models showed that beliefs about strategy effectiveness are shaped across trials by recall confidence, memory errors about original strategies, and confidence judgments about those outcomes. These variables predicted the underestimation of imagery performance that was observed despite questionnaire responses showing that individuals know about imagery's superiority after (but not before) task experience. The shaping of strategy effectiveness ratings occurred mainly early during the first list's test. Feedback at test regarding the accuracy of strategy recall improved overall postdiction accuracy eliminating the underestimation of imagery performance.
Email: Christopher Hertzog,
christopher.hertzog@psych.gatech.edu

(3091)

Metamemory Monitoring and Control following Retrieval-Practice for Text. JERI LITTLE and MARK A. MCDANIEL, *Washington University in St. Louis*. — Test-taking is assumed to help learners monitor what they do and do not know—and consequently improve the effectiveness of their subsequent study. Metamemory monitoring (e.g., accuracy of future

performance predictions) and control (e.g., restudy decisions) have been examined with retrieval-practice following the study of relatively simple materials (e.g., word-pairs), but little is known about such processes with retrieval-practice following the study of text. In the present experiment, participants read texts, then engaged in retrieval-practice or rereading for those texts, made performance predictions, and then restudied half of the texts before taking a recall test 48 hours later. Memory predictions were more accurate in the retrieval-practice condition than in the rereading condition. Although learners in both conditions allocated restudy time on the basis of their predictions, restudy provided a greater benefit following retrieval-practice than following rereading. The present study has implications for how students can use retrieval-practice with text to foster subsequent learning.
Email: Jeri Little, jerilittle@gmail.com

(3092)
The Belief-Based Judgment of Learning for Words in Small and Large Font. ADAM B. BLAKE and ALAN CASTEL, *University of California, Los Angeles*. — Throughout the course of a normal day it is common to make assessments of one's own memory and predictions of future performance. These judgments of learning (JOL) are affected by many factors, but a current debate in metamemory research centers on whether JOLs are driven by fluency or specific beliefs (e.g., Mueller, Dunlosky, Tauber, & Rhodes, 2014). The font-size effect (Rhodes & Castel, 2008) produces differences in JOLs for words in small versus larger font, but no differences in recall, and may be attributed to the effects of subjective or perceptual fluency. In the current study, we attempted to modify participants' beliefs regarding how font size may influence memory, while fluency was help constant. In Experiment 1 participants were given reason to believe large fonts are easier to remember, and the results showed a replication of the font-size effect. Experiment 2 demonstrates that introducing a belief which is counter to the font-size effect (that small-font words may be more memorable) is sufficient to nullify the effect. These results suggest that fluency cannot be the only influence on JOLs and that belief likely plays an important role.
Email: Alan Castel, castel@psych.ucla.edu

(3093)
Self-Regulated Learning in a Dynamic Learning Environment. BARBARA J. WRIGHT, ALAN HARRISON, FATIMA IQBAL, HILLARY SHARPE, AMANDA GRATE, BROOKE KILLION and JODI PRICE, *University of Alabama in Huntsville*. — We investigated how younger adults' (N =124) item selection and study time allocation decisions in a dynamic learning environment were affected by item difficulty (Easy, Medium, Difficult), point value (1, 3, 5), point order (Easy items valued, Difficult items valued) and allotted study time (20 sec. Restricted, 120 sec. Unlimited), with point order and study time manipulated between subjects. Participants studied the same 30 Swahili-English pairs presented in five, six-word grids in each of two trials, in which words changed position within the grid after every

selection. Participants selected easy words earlier in the Easy Valued and the Difficult Valued/Unlimited time conditions. Difficult words were selected earlier in the Difficult Valued/Restricted time condition indicating agenda formation when time was limited. Participants studied difficult words longer, but recalled more easy words. Participants studied all words longer with Unlimited time, which yielded higher recall than Restricted time. Results are interpreted in light of self-regulated learning theories.
Email: Jodi Price, jodi.price@uah.edu

(3094)
Inferential Processes in Metacognitive Monitoring Judgments Following Retrieval Practice. TYLER MILLER, *South Dakota State University*, LISA GERACI, *Texas A&M University*. — Previous research shows that people make more accurate memory predictions after retrieval practice (Miller & Geraci, 2013). Participants may change their predictions following retrieval using analytic processes regarding the factors that they believe influence memory and/or they may do so using non-analytic processes regarding their subjective experiences during retrieval. The current experiments were designed to determine which process participants use to update their predictions. In one condition, learners studied paired-associates, made a memory prediction, completed a short-run of retrieval practice and then made a second memory prediction. We also included a condition in which judges received information about the learners' retrieval practice performance and therefore, would not have access to non-analytic processes when making the second prediction. Results showed that learners consistently decreased their predictions whereas judges did so only in limited cases suggesting that non-analytic processes exert an immediate influence on judgments and analytic processes exert a lagging influence.
Email: Tyler Miller, milltyl@gmail.com

(3095)
Influence of Feedback on Metacognitive Decisions About Spacing Practice Tests: A Framing Effect? KELSEY A. HESLIN, TAYLOR M. CURLEY, MICHAEL K. JACKIEWICZ, COLIN S. FLOWERS, HEATHER ANNE PHELAN and THOMAS TOPPINO, *Villanova University*. — When learners can self-schedule the second presentation of a to-be-learned pair (i.e., choose the spacing), their choices depend on the nature of the expected second presentation. When a restudy opportunity is expected, they choose a long spacing for all items, especially the hardest. When a practice test is expected, they choose a short spacing for the hardest items and do so regardless of whether feedback (another study opportunity) follows the practice test. Ignoring feedback when choosing spacing seems suboptimal but could be explained by demand characteristics (an overt practice test) and/or timing (brief feedback). We eliminated factors that might minimize the effect of feedback but obtained the same results. Subsequent experimentation indicated that learners' choices depend on whether a practice test with feedback is "framed" as a practice

test with feedback or as a restudy opportunity preceded by a practice test. Implications for relevant metacognitive knowledge and strategies are considered.
Email: Thomas Toppino, thomas.toppino@villanova.edu

(3096)

Unskilled but Not Necessarily Unaware. JUNHO LEE and JOO YONG PARK, *Seoul National University*. — It has been widely documented that those who do not have much knowledge about a domain are more overconfident than those who are knowledgeable. Kruger and Dunning (1999) characterized those lacking knowledge as doubly cursed: unskilled and unaware of it. One of the problems with the previous studies is that the self-assessment of performance was made under different conditions: the knowledgeable performers made assessments for higher test scores whereas the other group made those for lower scores. Departing from this tradition, we had participants self-assess their performance under conditions where the mean scores of the high and low performing groups were similar to each other. Most of the test items were the same between the two groups but we added difficult items for the high performers and easy items for the low performers. When the test scores were controlled, there was no difference in the level of overconfidence between the two groups. Implications of the finding were discussed.
Email: Joo Yong Park, jooypark@snu.ac.kr

(3097)

What Important Things Did You Learn Last Week? Selectivity Differences Between High- and Low-Achievers. VERONICA YAN, *University of California, Los Angeles*, VICTOR SUNGKHASETTEE, *Washington University in St. Louis*, KOU MURAYAMA, *University of Reading*, ALAN CASTEL, *University of California, Los Angeles* (Sponsored by Michiko Sakaki). — Research on memory and selectivity has shown that learners can prioritize memory for information that is identified objectively as high-value versus low-value. In the classroom, facts and concepts are not explicitly identified as high- or low-value and students must determine, by themselves, what they need to focus on during later study. Are students able to determine what is important? Students in an undergraduate psychology course were to write down the three most important concepts from the preceding lecture during discussion sections. Current results show that students who later received A's in the course were more homogenous in what they wrote down as being important while students who later received C's were more varied in their responses. These results have implications for improving education; along with investigating effective cognitive strategies (e.g., how best to study), researchers should also focus on improving students' metacognitive abilities (e.g., in choosing what to study).
Email: Victor Sungkhasettee, sungkhav@wustl.edu

(3098)

How Do Text Format and Type of Media Influence Highlighting Behavior and Learning? ALISON TSAI, *University of California, Los Angeles*, CAROLE YUE, *Covenant College*, DANIEL OPPENHEIMER, *Princeton University*, ELIZABETH BJORK and ROBERT BJORK, *University of California, Los Angeles*. — Students commonly highlight a subset of text in a passage to emphasize the information they perceive as important. Active highlighting (i.e., when students select what to mark) tends to be more beneficial than passive highlighting (i.e., when students read previously marked material) because it engages more effortful processing during encoding (Fowler & Barker, 1974). However, current textbooks frequently employ bolded or italicized fonts to guide learners to key material, possibly leading to passive highlighting. Moreover, highlighting behavior may vary between type of media. In the present study, participants highlighted passages in either paper or ebook format and either no formatting, crucial phrases bolded, or non-crucial phrases bolded. Preliminary results indicate that paper participants have a strong tendency to highlight pre-bolded terms, while computer participants highlight without regard to formatting. Interestingly, however, computer participants with non-crucial phrases bolded or no formatting recall more crucial information on a final retention test.
Email: Alison Tsai, alisontsai85@gmail.com

(3099)

Does Interleaving Practice of Mathematics Problems Impact Category Learning Judgments? MICHAEL MUELLER, NATHANIEL FOSTER and JOHN DUNLOSKY, *Kent State University*. — Prior research suggests that interleaving (vs. blocked) practice of mathematics problems improves performance on a later test. In the present study, participants either interleaved or blocked practice on fraction, exponent, and volume problems, and made judgments at the category level of problem type following practice (e.g., "How likely are you to be able to solve for the volume of a wedge?"). Participants returned a week later, made the same judgments as before, and then were given a transfer test. Performance on the test was higher in the interleaving practice group. Most important, category learning judgments were markedly overconfident following practice and before test, and judgments made prior to the test were higher in the interleaved practice group than the blocked practice group. Thus, participants who engaged in interleaved practice were more confident in their ability to correctly solve the problems at test, which reflects the benefits of interleaving at test.
Email: Michael Mueller, mmuelle8@kent.edu

(3100)

Metamemory Predictions for Explicit and Implicit Interference Effects on Memory. DEBORAH EAKIN, *Mississippi State University*. — The theoretical view that people use heuristics based on information available to consciousness when making metamemory predictions is supported by findings of dissociation between memory and metamemory under conditions of explicit retroactive interference (RI; Eakin, 2005). However, this view cannot explain the association between memory and metamemory under conditions of implicit interference from a large versus small number of associates of a cue (Eakin & Hertzog, 2006; 2012). We mixed explicit and implicit interference by using small- and large-set-size cues in both the control and interference conditions of an RI paradigm in order to determine whether

metamemory predictions were more influenced by explicit or implicit interference. In memory, RI effects were obtained overall, but cue-set-size effects were obtained only in the control condition. Metamemory was dissociated under explicit RI and associated with implicit interference effects in the control RI condition.
Email: Deborah K. Eakin, deakin@psychology.msstate.edu

(3101)

Introspection During Visual and Memory Search. JÉRÔME SACKUR, *Ecole Normale Superieure.* — Recent advances in the field of metacognition have shown that participants are introspectively aware of many different cognitive states, such as confidence in a decision. However, whether participants can access the nature of the cognitive processes is highly debated. Here we ask whether participants could monitor multistage cognitive processes. In two series of experiments, based on visual and memory searches, we instructed participants to give, on a trial-by-trial basis, an estimate of the number of items scanned before a decision was reached. In the visual tasks we controlled response times and eye movements; as for the memory tasks, we contrasted metacognitive performance in a simple memory scanning task, and in a judgment of recency task. Results showed that parcipant's metacognition tracked the serial / parallel nature of the processes. Introspection is thus a flexible mechanism. Mental monitoring of cognitive processes is possible in at least some elementary tasks.
Email: Jérôme Sackur, jerome.sackur@gmail.com

• COGNITIVE AGING II •

(3102)

Cognitive Control and Aging: Examining With a New Breakfast Task (Cooking at a Diner). ETSUKO HARADA, TAKANORI OKAWA, SHINNOSUKE TANAKA and TAKAYUKI DAIMON, *University of Tsukuba.* — The breakfast task (Craik & Bialystok, 2006) showed that performance of task management and planning were different between young- and older adults in a complex and ecologically valid task, and were also affected by daily language use, i.e. bilingual vs. monolingual. Although results were fascinating, it was difficult to look into details of process differences, because their main measurements were total time data, which were difficult to interpret the meanings. In order to get more informative data from the experimental task, we made a new version of the breakfast task "as a diner's chef". In serving breakfasts at the same time to plural guests (a cup of coffee, an egg with a different preference, and one or more toasts on demands for each guest), we could observe different kinds errors. Age differences in error patterns will be reported.
Email: Etsuko Harada, etharada@human.tsukuba.ac.jp

(3103)

Retesting, Studying and Incubation: Effects on Tip of the Tongue Experiences. EMMA GARDNER, *Pomona College*, PATRICIA XI, *Claremont Graduate University*, DEBORAH BURKE, *Pomona College.* — New learning benefits more from repeated testing than from repeated studying. Retrieval of known but inaccessible information benefits form the passgae of time, i.e., incubation effects. We compare these three effects on known but inaccessible words, i.e., tip of the tongue experiences (TOTs). Older adults were presented TOT inducing questions requiring production of a famous name or vocabulary word. In the Study condition, the same questions were presented again with answers for study. In the Test condition, the same questions were presented again with no answers and with instructions to try to answer them. In both conditions, the questions were presented again after one week and and three months. In the Incubation condition, no feedback was given after the intial test and participants were tested again after three months. TOTs decreased at both intervals for Study and Test conditions. Thus repeated attempts with no feedback and repeated studying of the word are equally effective in preventing a repeat of a TOT in the future, even after three months, and were more effrective than incubation.
Email: Deborah Burke, DMB04747@pomona.edu

(3104)

Negative Aging Stereotypes Influence Memory Distortion in the Elderly. AMY SMITH, *Tufts University*, JESSICA WONG, *University of Chicago*, SARAH BARBER, *San Francisco State University*, DAVID GALLO, *University of Chicago,* AYANNA THOMAS, *Tufts University.* — Does age-related stereotype threat increase or decrease false memories in older adults? Thomas and Dubois (2011) demonstrated that older adults who experienced high stereotype threat demonstrated more false memories than those under low threat, providing an answer to the aforementioned question. However, in a recent extension, Wong and Gallo (2014) found a reduction in false memories in older adults under threat. Importantly, these two studies differed along one crucial dimension. The latter study paired stereotype type threat with a warning about the nature of false memories. The present study examined the independent and combined contributions of stereotype threat and warning on false memory susceptibility in older adults. Participants engaged in an incidental memory task in which they were presented with standard DRM list items. Following, warning and threat were manipulated. The results suggest that stereotype type threat is disruptive to memory performance in older adults.
Email: Amy Smith, amy.smith@tufts.edu

(3105)

Age-Related Differences in the Contributions of Recall and Familiarity During Category Learning. MARISSA GORLICK, *Yale University*, DAVID M. SCHNYER, NEDA ANN ABDUL-RAZZAK and W. TODD MADDOX, *University of Texas at Austin.* — Memory typically involves two underlying dissociable processes known as recall and familiarity. Declines in memory are seen across the lifespan and appear to be driven primarily by recall while familiarity is left relatively intact. During prototype-distortion tasks, training paradigms determine whether learning is supported by declarative verbal rules (AB task) or perceptual fluency (AN task). We examine whether age-related differences in

recall and familiarity can account for a previously observed older adult deficit in AB learning, and older adult advantage in AN learning. Computational models and ROC curves indicate that younger adult advantages in the AB task are related to greater recall- and familiarity-based processes. However, older adult advantages in the AN task are related to greater familiarity-based processes and demonstrated no relationship with recall. These results suggest that age differences in the contributions of recall and familiarity interact with training paradigms to influence category learning outcomes.
Email: Marissa Gorlick, Marrisa.gorlick@yale.edu

(3106)
It's Important, Pack It: How Goals and Subjective Selectivity Influence Memory. CATHERINE D. MIDDLEBROOKS and TYSON KERR, *University of California, Los Angeles*, KOU MURAYAMA, *University of Reading*, ALAN CASTEL, *University of California, Los Angeles*. — We often must selectively remember important information, but importance is generally subjective, as per one's goals and situation. The current study investigates the roles of subjective judgments of importance and goal manipulation on selectivity in younger and older adults. Under the framing of either a fire evacuation or vacation scenario, participants rated how important it would be to pack a series of items (e.g., lotion, cash) before studying the item-rating pairs. Participants were instructed that they could only pack correctly recalled items, so they should especially try to remember the ones they considered the most important. While younger adults exhibited better memory overall, both age groups displayed selectively better recall for subjectively important items and greater selectivity under the fire evacuation than the vacation context. The results indicate that both younger and older adults can engage in subjectively based value-directed remembering and adjust their selectivity based on particular goals.
Email: Kou Murayama, murakou@orion.ocn.ne.jp

(3107)
Distraction Can Eliminate Forgetting in Young Adults. JOAN K. W. NGO and LYNN HASHER, *University of Toronto*. — We previously reported that older adults can successfully use distraction as a rehearsal device, thereby reducing and even eliminating forgetting that would normally occur over a 15 min interval (Biss, Ngo, Hasher, Campbell & Rowe, 2013). Young adults did not benefit from this manipulation. The present experiment asked under what circumstances would young adults' memory benefit from exposure to items presented as distraction? We considered two such circumstances: learning at a non-optimal time of day (morning) versus at an optimal time of day (afternoon) and explicit warnings versus no warning about an upcoming memory test which might have encouraged young adults to search for rehearsal opportunities. We used a 1-back task on pictures with words as distractors. We present evidence that younger adults' increased susceptibility to distraction at an off-peak time of day enables implicit rehearsal to eliminate

forgetting, whether or not explicit warnings were given. At an off peak time of day, young adults' performance looks much like that of older adults'.
Email: Lynn Hasher, hasher@psych.utoronto.ca

(3108)
Age Invariance in the Mnemonic Effects of Knowledge-Based Schemas. STEPHEN BADHAM and ELIZABETH MAYLOR, *University of Warwick*. — Knowledge-based schemas have long been hypothesized to influence memory processes. Material consistent with an individual's knowledge/experience is generally more memorable than information inconsistent with their knowledge/experience. Sometimes older adults are aided more than young adults by schemas during memory tasks but sometimes there are no age differences in benefits from schemas. Three experiments investigated age differences in effects of schematic support during memory tasks with young and older adults. There was age invariance in benefits from schemas for memory reconstruction during free recall of proverbs, and for recognition of descriptions and pictures of scenes. However, schemas supported older adults' memory more than young adults' memory for person-activity associations, where schemas supported the rejection of schema-inconsistent lures during recognition. Overall the results indicate that older adults can benefit as much as young adults from use of schemas, but in certain circumstances older adults can show greater schema reliance.
Email: Elizabeth Maylor, e.a.maylor@warwick.ac.uk

(3109)
Using Memory Strength to Shift Response Bias in Patients With Amnestic Mild Cognitive Impairment and Alzheimer's Disease. MICHAEL TAT, *Boston University School of Medicine*, REBECCA DEASON, *Texas State University-San Marcos*, SEAN FLANNERY, EMMA GOSSELIN and ANDREW BUDSON, *Boston University School of Medicine*. — In memory tests, patients with Alzheimer's disease (AD) have been shown to adopt a more liberal response bias relative to their healthy peers (Budson et al., 2006). In two experiments, we examined if patients with mild cognitive impairment (MCI) and AD shift their response bias when there are changes to the type of study encoding (deep vs. shallow) and changes to the memory strength of study lists (Weak, Mixed, Strong). Results from Experiment 1 showed that older controls (OC) and MCI patients adopt a conservative response bias when items are encoded deeply, but AD patients do not. Results from Experiment 2 indicated that both OC and MCI patients adopt a conservative response bias for Strong study lists, but not Weak or Mixed study lists. These data suggest healthy and less cognitively impaired individuals can use memory strength to change their response bias, while more impaired individuals are less able to do so.
Email: Michael Tat, mjtat91@gmail.com

(3110)
Reflecting on a Limited Future Leads to Increased Positivity in Younger and Older Adults' Recall. SARAH BARBER, PHILLIP C. OPITZ and BRUNA MARTINS, *University of Southern California*, MICHIKO SAKAKI, *University of*

Reading, MARA MATHER, *University of Southern California*. — Compared with younger adults, older adults have a relative preference to attend to and remember positive over negative information. This is known as the "positivity effect," and researchers have evoked socioemotional selectivity theory to explain it. According to this theory, as people get older they perceive their time horizons as being limited. This prompts people to prioritize achieving emotional gratification, leading to increased positivity in attention and recall. In the current study we directly tested this account. Younger and older adults completed a writing activity in which they reflected on the possibility of either a long future life, or on the possibility of living only six more months. They next viewed positive, negative, and neutral pictures, and then completed a free recall test. Results were consistent with socioemotional selectivity theory. Reflecting on limited time horizons was associated with increased positivity in recall for both younger and older adults.

Email: Sarah Barber, barbersa@usc.edu

• PROSPECTIVE MEMORY •

(3111)

The Dynamic Multiprocess Framework of Prospective Memory: A Matter of Context. MICHAEL SCULLIN, *Baylor University*. — Prospective memory (PM) theories differ on whether intention retrieval relies on spontaneous retrieval or strategic monitoring. The Dynamic Multiprocess Framework contends that spontaneous retrieval and strategic monitoring work together to support PM, particularly when the PM cue is unexpectedly encountered. To test the impact of context expectation, participants (N=53) were introduced to several ongoing task contexts and told that they should remember to press the Q key if they ever saw "table" or "horse" (PM task). Following a retention interval, the PM cues appeared during expected and unexpected contexts (order counterbalanced). Participants relied on strategic monitoring in the expected context. In the unexpected context, there was evidence for a dynamic shift from spontaneous retrieval to strategic monitoring following the first PM cue, particularly when the unexpected context preceded the expected context, F(2,36)=5.42, p<.01. Thus, individuals flexibly rely on spontaneous retrieval and monitoring processes, particularly during unexpected contexts.

Email: Michael Scullin, michael.scullin@emory.edu

(3112)

Intention-Interference in Prospective Memory: Spontaneous Noticing or Spontaneous Retrieval? JAN RUMMEL, *Heidelberg University*, GILLES EINSTEIN, *Furman University*. — Event-based prospective-memory tasks require participants to respond to a target cue with an intended action. It has been argued that the occurrence of the cue can spontaneously trigger the retrieval of the intention. This notion was supported by the intention-interference effect (i.e., slowed responding to cues occurring while the intention is suspended, Scullin, Einstein, & McDaniel, 2009).

It remains unclear, however, whether this effect reflects spontaneous noticing of the cue or retrieval of the intended action. Therefore, we manipulated whether the prospective-memory response was congruent versus incongruent with the appropriate response to the cue while the intention was suspended. We found an overall intention-interference effect which was pronounced under incongruent compared to congruent response conditions but only when the association between the cue and the intended action was additionally strengthened. We conclude that spontaneous cue-noticing and intention-retrieval processes both contribute to prospective-memory but the latter is most likely to occur when the there is a strong associative link between the cue and the intended action.

Email: Jan Rummel, jan.rummel@psychologie.uni-heidelberg.de

(3113)

The Impact of Rumination on Strategic Monitoring in Prospective Memory. ASHLEY SCOLARO, *Central College*. — Some theories of prospective memory hold that strategic monitoring, preparatory processes for encountering a prospective cue, is essential for successful prospective remembering (Smith, 2003). Because attentional capacity is limited, prospective misses may occur when an individual engages in additional capacity demanding tasks. One such capacity consuming task is ruminative thought, and this type of thought may explain deficits in prospective memory among depressed individuals (Ryan et al., 2013; Chen et al., 2013; Altgassen et al., 2011) and neurological controls. In the current study, healthy participants completed an ongoing lexical decision task with an embedded prospective memory component along with the Scott-McIntosh Rumination Inventory (1999). Results revealed that individuals with distraction-based ruminative thought were less effective in recruitment of strategic monitoring resources than individuals with emotion-based or goal achievement-based ruminative thought. These findings suggest that prospective memory can be impacted by some, but not all, types of ruminative thought.

Email: Ashley Scolaro, scolaroa@central.edu

(3114)

Prospective Memory in Educational Settings: Does Load Matter? JILL SHELTON, *Lee University*, EDWARD CHRISTOPHER and IAIN SCOTT, *University of Tennesee at Chattanooga*. — Remembering to perform intended actions at the appropriate time in the future is termed prospective memory. Prospective memory demands occur frequently throughout the day, and are particularly common in a school setting. We explored the relationship between the number of prospective memory demands placed on a student, and their ability to perform in the classroom. Prospective memory load was manipulated (2 versus 8 tasks) while assessing performance on a number of academically relevant tasks. Significant differences between load conditions would suggest that having a higher prospective memory load negatively impacts student's ability to learn and perform in the classroom. Interestingly, no significant group differences were observed, suggesting that prospective memory load does not impact

student's academic performance. The impact of the context in which the prospective memory cue occurred (known versus unknown) was also examined.
Email: Jill Shelton, Jill-Shelton@utc.edu

(3115)
Event-Based Prospective Memory: Salience Trumps Focality. REBEKAH SMITH, *The University of Texas San Antonio*, NADIA KHOJA, *The University of Texas Health Science Center at San Antonio*, R. REED HUNT, *The University of Texas at San Antonio*. — In focal event-based prospective memory (PM) tasks, the characteristics of ongoing stimuli that define the PM target events are processed as part of the ongoing task demands. Typically, focal tasks are associated with better PM performance and are thought to require fewer resources relative to non-focal tasks. The current study used an ongoing size judgment task in which participants evaluated the relative size of objects described by two words. A word served as the focal PM target. The salient non-focal PM target was defined by a color change and although processing of color was not required by the ongoing task demands, color change can capture attention. PM performance was better for the non-focal condition. Ongoing task performance and time to make the PM response were also compared. The results suggest that the focal/non-focal distinction alone cannot fully predict the relative difficulty of PM tasks.
Email: Rebekah Smith, rebekah.smith@utsa.edu

(3116)
Does Visual Attention Have a Different Relationship With Focal and Nonfocal Prospective Memory? CELINDA REESE-MELANCON, *Oklahoma State University*, CHRISTOPHER DAVOLI, *Central Michigan University*, KERI L. KYTOLA, *Oklahoma State University*, KENDRA SMITH and KRISTI MULTHAUP, *Davidson College*. — We (Davoli et al., 2006; Reese-Melancon et al., 2009) reported a positive relationship between measures of visual attention and event-based prospective memory (PM) performance. The present research extended those findings by examining the attention-PM relationship separately for focal (target is central to ongoing task) and nonfocal (target is peripheral to ongoing task) PM tasks. Focal tasks were significantly related to automatic detection speed and marginally related to controlled search speed in Experiment 1 (N = 41). Nonfocal tasks were significantly related to (a) task switching in Experiment 2 (N = 76) and (b) marginally related to controlled search speed in Experiment 1 (N = 43) and Experiment 2. The pattern of relationships generally supports Einstein and McDaniel's (2005) distinction between focal PM tasks where target detection is supported by the ongoing task (automatic detection processes relevant), and nonfocal PM tasks where target detection requires effortful monitoring (controlled search processes relevant).
Email: Celinda Reese-Melancon, celinda.reese@okstate.edu

(3117)
A Comparison of Time-Based and Event-Based Prospective Memory: Effects of Delay. ANGELA CONTE and DAWN MCBRIDE, *Illinois State University*. — Few studies have

compared time-based and event-based prospective memory (PM) tasks in the lab. Thus, the current project investigated differences between these PM tasks in terms of PM accuracy and PM cost. Subjects completed either a time-based or event-based PM task within a lexical decision ongoing task. PM cues appeared in the event-based task at either a 1 or 3 min delay. In the time-based task, subjects were asked to respond after 1 or 3 min. PM performance was significantly higher in the event-based task. Reaction time data showed evidence of a PM cost difference at the 1 min delay with a higher PM cost for the time-based task than the event-based task. These results suggest that time-based tasks may be more difficult and require more resources than event-based tasks.
Email: Angela Conte, amconte@ilstu.edu

(3118)
Retrieval Dynamics in Event-Based Prospective Memory Using Mouse Tracking. JASON HICKS and SAMANTHA SPITLER, *Louisiana State University*. — The software program Mouse Tracker was used to explore retrieval dynamics in prospective memory (PM). Focal and nonfocal PM cues were embedded in an ongoing lexical decision task. Emphasis on the ongoing task versus the prospective memory task was also manipulated. Key outcomes replicated prior work, such as a greater lexical decision cost in nonfocal conditions and better PM accuracy both in focal conditions and when the PM task was emphasized. Mouse trajectories revealed a high percentage of trials in which PM retrieval was associated with an initial drift toward a word/nonword response that reversed in mid-course. Metrics associated with reversals, such as RT and maximum deviation statistics, were greater for nonfocal PM retrieval. Time to initiate mouse movement at trial onset was faster in focal conditions, suggesting that initiation time may be a measure of preparatory attentional processes.
Email: Jason Hicks, jhicks@lsu.edu

(3119)
The Relationship Between Prospective Memory and Cognitive Abilities. TYLER HARRISON, *Georgia Institute of Technology*, ZACH SHIPSTEAD, *Arizona State University*, KENNY L. HICKS, JEFFREY L. FOSTER, ALEXANDRA N. TRANI and PAGE M. SLOAN, *Georgia Institute of Technology*, THOMAS S. REDICK, *Purdue University*, MICHAEL F. BUNTING, *University of Maryland*, RANDALL W. ENGLE, *Georgia Institute of Technology* (Sponsored by M. Jackson Marr). — Although there has been a great deal of interest in prospective memory (PM) over the past two decades, there have been few studies that exmaine PM at the latent level. It is unknown whether PM can be thought of as an individual difference separate from other abilities such as working memory capacity and fluid intelligence. Additionally, it is unclear which cognitive abilities best predict PM performance and whether PM tasks are both reliable and valid. In this study, over 550 subjects completed four 3-hour sessions of cognitive testing. Among the tasks were 4 measures of successful PM retrieval and 2 measures of commission errors. The measures of PM retrieval were highly intercorrelated and formed a latent

PM factor. Prospective memory performance was related to working memory capacity and fluid intelligence but PM was separable from these two constructs.

Email: Tyler Harrison, tharrison9@gatech.edu

• VISUAL SEARCH I •

(3120)

Disentangling Electrophysiological Indices of Selective Cue and Target Processing in a Contingent Capture Paradigm. ASHLEY LIVINGSTONE, JOHN MCDONALD and GREGORY CHRISTIE, *Simon Fraser University*. — An irrelevant cue singleton that possesses a target feature (e.g., color) elicits a contralateral ERP negativity (N2pc) followed by a contralateral positivity (CP). The N2pc and CP have been taken as indices of contingent attention capture by, and subsequent suppression of, the cue singleton. However, the CP occurs after target onset, leaving open the possibility that it reflects processing of the target array, not the cue. We tested these alternatives by varying the cue-target stimulus onset asynchrony (SOA). If the CP reflects cue suppression, it should be maximal shortly after the cue-elicited N2pc regardless of SOA. Conversely, if the CP is related to processing of the target array, its latency would be tied to target onset. Our results show that the CP is time-locked not to the cue, but to the target array. We conclude that the CP reflects attentional enhancement of the cued search array item, not cue suppression.

Email: Ashley Livingstone, alivings@sfu.ca

(3121)

Objects of Interest Can Be Selected Serially and Processed in Parallel During Visual Search. GREGORY CHRISTIE, RICHARD WRIGHT and JOHN MCDONALD, *Simon Fraser University*. — When a search display contains two potential targets that differ subtly, observers deploy attention serially to inspect each item one-by-one. These serial deployments of attention give rise to non-overlapping N2pc waves (an ERP component associated with attentional selection), with ~150 ms separating N2pc onsets. Such results are suggestive of purely serial search, but it remains to be seen whether faster deployments of attention would remain serial. Here, observers indicated whether lines contained within two targets – a color singleton and a shape singleton – were oriented similarly or differently. As expected, the N2pc to the more salient color singleton onset before the N2pc to the form singleton. Critically, however, the latter N2pc emerged well before the first N2pc terminated, with only 40–60 ms separating the N2pc onsets. These findings are consistent with Guided Search, according to which the visual system serially selects items for entry into a parallel object identification mechanism.

Email: Gregory Christie, gchristi@sfu.ca

(3122)

Task Switching and Priming of Pop-Out: Modulating the Demands of Switching. MICHAEL KLEIN and JENNIFER STOLZ, *University of Waterloo*. — Priming of pop-out (PoP)

is the tendency for subjects to identify a target more quickly when they had previously searched for a target defined by the same feature or dimension. Two types of explanations have been proposed: episodic retrieval of previous trials, and weighting of relevant feature or dimension saliency maps. Proponents of each theory have used the behaviour of PoP across task switches to further their arguments, however the influence of task switching on PoP should be clarified before being used to make theoretical claims. The present study examined the interaction between PoP and task switching. Participants located a uniquely coloured square among an array of three squares, and responded via keypress to the position of a notch in its side. The precise task to be performed was varied in an AABB fashion. When the stimulus was ambiguous with respect to which task to perform, and when one keypress mapped to different notch positions between tasks, switches led to larger reductions in PoP than when the stimulus was unambiguous, and when the keypress was mapped to one position. This suggests that more demanding task switches result in a greater reduction of PoP, a result that should be considered in future studies.

Email: Jennifer Stolz, jstolz@uwaterloo.ca

(3123)

When Associations Guide Attention: Features or Objects? REBECCA R. GOLDSTEIN and MELISSA BECK, *Louisiana State University*. — Attentional guidance may be based on incidentally learned associations between the target and features or between the target and bound objects. In the object-association condition, the target was housed in the same color and shape combination on every trial and none of the seven distractors shared the associated color or shape. In the shape-association condition, three distractors shared the target-associated color, but none shared the target-associated shape. In the color-association condition three distractors shared the target-associated shape, but none shared the target-associated color. All three association conditions lead to shorter RTs than the no-association condition, but the shape-association condition was slower than the color- and object-association conditions, which did not differ from each other. Furthermore, the amount of time until the first fixation on the target indicated that the shorter RTs in the association conditions were caused by faster guidance to the target. Critically, a single feature can guide attention to the target just as effectively as a bound object.

Email: Melissa Beck, mbeck@lsu.edu

(3124)

Faces, Faces... Everywhere! Does What We Inhibit Affect Target Selection? ELISABETH BLAGROVE, ZORANA ZUPAN and DERRICK WATSON, *University of Warwick*. — The ability of humans to prioritize stimuli in their visual environment is well established. Paradigms such as the preview search task (Watson & Humphreys, 1997) enable evaluation of such mechanisms; more recently, exploring the impact of behaviourally-relevant stimuli on performance. Previous work using both schematic and photorealistic faces (Blagrove & Watson, 2010, 2014) has shown that faces appear to be relatively resistant to top-down efforts to ignore/inhibit

them. This resistance appears to be present regardless of the affective or perceptual properties of the stimuli. In contrast here, we show that both schematic (Experiment 1) and photorealistic (Experiment 2) faces can be effectively inhibited, provided that participants are not also trying to prioritize the selection of newly-appearing faces. Experiment 3 shows that the difficulty in ignoring faces is likely caused by face-based inhibition of currently visible faces, which may compromise ability to detect facial stimuli presented subsequently.
Email: Elisabeth Blagrove, e.l.blagrove@warwick.ac.uk

(3125)

Effective Conjunction Search for Symbology. ISIS CHONG, *California State University Long Beach*, MARY K. NGO, *Pacific Science & Engineering Group, Inc.*, KIM-PHUONG VU, *California State University Long Beach*. — This study explored the effectiveness of different combinations of symbol features in facilitating participants' ability to extract important global information in visually-cluttered displays. Participants were presented with arrays of visual symbols and had to decide as quickly and accurately as possible whether there were more targets or more distractors present in the array. Combinations of symbol features (color-fill, color-letter, color-shape, and fill-shape) were varied on a block-to-block basis, while set size and ratio of targets to distractors (easy/20:80 or difficult/40:60) were varied on a trial-by-trial basis. The results of this study showed that the combination of color and fill resulted in more efficient search compared to the combinations of color and shape, color and fill, and specific shapes and fill. Implications of these findings for display design to help operators effectively extract important information in symbolic displays will be discussed.
Email: Kim-Phuong Vu, kvu8@csulb.edu

(3126)

The Effects of Previous Video Gaming Experience on Visual Search. PATRICK CONLEY, AMY M. HELLER, DANIELLE P. POCKAT and JACOB D. BRINKMAN, *University of Wisconsin, Stevens Point*. — This study examined the effect of an individual's video gaming history on visual search task performance. The key subject variables recorded were the participants' total amount of video gaming, age of first exposure to video games, and amount of action-based video games played. Other variables regarding the current amount of video gaming, amount of competitive play, and similar characteristics were also measured. The results revealed that, consistent with previous studies, greater amounts of video gaming experience led to superior visual search performance, but also that lower age of first exposure to video games and greater amounts of action-based video gaming improved visual search as well. These findings demonstrate that the background of video game players must be taken into account when determining the effects of video game practice on visual attention, but also support criticism that individuals with greater amounts of video game experience seek out such studies for participation.
Email: Patrick Conley, patrick.conley@uwsp.edu

(3127)

Search Previews Can Affect More Than Efficiency. CARRICK WILLIAMS, *California State University, San Marcos*, MAVERICK E. SMITH, *Mississippi State University*. — Preview searches — where searchers are given a brief preview of a subset of distractors – lead to more efficient search slopes compared to the same search display when all distractors are presented simultaneously (full-element baseline). This preview benefit indicates that searchers are ignoring the previewed distractors during the search. In a series of experiments examining preview searches with multiple real-world targets and distractors, we found a preview benefit, but we also found an unexpected, but consistent, benefit of the preview in the search intercept. Faster preview search intercepts were even found compared to a half-element baseline (set sizes that are half that of the previewed search) or when the preview search efficiency benefit was eliminated by shuffling the previewed object locations. The preview intercept effect indicates that under some conditions, the preview may provide a "running start" to the search in addition to ignoring the previewed objects.
Email: Carrick Williams, carrickwilliams@gmail.com

(3128)

Subset Selective Search on the Basis of Color and Preview Are Similar but Not the Same. MIEKE DONK, *Vrije University*. — The aim of the present study is to investigate how differences in color and temporal onset between irrelevant and relevant sets of elements contribute to subset selective search. Three experiments were performed in which irrelevant and relevant elements were distinct in temporal onset, color, or both. Moreover, the target was defined by a conjunction of features relative to both the irrelevant and relevant elements, relative to the irrelevant elements only, or relative to the relevant elements only. The results showed that the presence of a color difference between irrelevant and relevant elements is sufficient to restrict search to the relevant set of elements. However, to allow subset-selective search to proceed in parallel, an additional difference in temporal onset is required. Together the results are in line with the idea that subset-selective search can be based on different simultaneously operating mechanisms.
Email: Mieke Donk, w.donk@vu.nl

(3129)

Facilitation in Visual Search for Reversed Letters Following r-TMS of the Left Parietal Cortex. GIUSEPPA RENATA MANGANO and MASSIMILIANO OLIVERI, *University of Palermo*, *Fondazione Santa Lucia IRCCS*, *Rome*, LI ZHAOPING, *University College, London*, PATRIZIA TURRIZIANI, DANIELA SMIRNI and LISA CIPOLOTTI, *University of Palermo*. — In a visual search task it is harder to find the letter 'N' among its mirror reversals 'И', than vice versa. Noting that this reversed letter effect involves both a processing of task irrelevant information and a linguistic association, we explored whether the right PPC and/or left posterior regions (left PPC, left vOTC) play a role in the reversed letter effect. We adopted the rTMS methods that we previously used in Oliveri et al. 2010, and conducted

three r-TMS experiments using healthy subjects. The results revealed that rTMS on right PPC had no effect in the task performance. In contrast, rTMS on the left PPC speeded up the performance on finding letter 'N' among its mirror images but not when searching for the mirror image 'И' among 'N's. We suggest that the observed facilitation is related to letter processing subserved by the left PPC.
Email: Giuseppa Renata Mangano, renatamangano@virgilio.it

(3130)

Duration of Search Displays Affects Visual Search Strategy During the Attentional Blink. HAYLEY LAGROIX, THOMAS SPALEK and VINCENT DI LOLLO, *Simon Fraser University*. — Perception of the second of two rapidly-sequential targets (T1, T2) is impaired when presented soon after the first (attentional blink, AB). Using an oddball-search array as T2, Ghorashi et al. (2007) found results suggesting that observers used a strategy of postponing the search for T2 until T1 had been processed. This postponement strategy might have arisen because T2 was displayed until response. We reasoned that such a strategy would not be used if T2 displays were brief. In our experiments we used both brief (50 ms) and long (until response) displays, blocked across trials. We found that RTs were slower to a long-duration T2 inside, but not outside, the AB, consistent with a postponement strategy. To check on this hypothesis, we mixed brief and long T2 durations across trials and found that RTs were faster to a long-duration T2 at all lags, confirming the strategy account.
Email: Hayley Lagroix, hlagroix@sfu.ca

(3131)

Dilution Effects in the Dual-Task Context. SU JIN KIM, RYEONG CHANG and YANG SEOK CHO, *Korea University*. — Tsal and Benoni (2010) suggested that reduced distractor processing in high perceptual load is due to dilution caused by perceptual crosstalk among items in a display. The present study examined whether this dilution occurs before or after the central bottleneck. The low and high load conditions of Tsal and Benoni's Experiment 1b were replicated in Experiment 1 and high load and dilution conditions in Experiment 2 in a dual-task context with a tone discrimination task used as T1. Distractor interference was not modulated by perceptual load in Experiment 1, but significantly modulated by dilution in Experiment 2. Moreover, the magnitudes of the dilution effects and distractor interference were statistically constant across SOAs. These results indicate that the amount of distractor interference was determined by dilution but not by perceptual load. The additive effect of dilution and distractor interference with SOA implies that the dilution effect on congruency was likely to occur not at an early perceptual processing stage but a processing stage after the central bottleneck.
Email: Yang Seok Cho, yscho_psych@korea.ac.kr

• DISCOURSE PROCESSES I •

(3132)

How Does the Story End? Eye and Mouse Movements in Language Anticipation. EDWARD A. CRANFORD, JARROD MOSS and ADRIAN LEWIS, *Mississippi State University*. — Anticipating others' actions is an important process in facilitating language comprehension. There are multiple theories about how anticipation occurs. Serial models assume options are generated one at a time whereas parallel models (i.e., Construction-Integration model) assume simultaneous generation. In this study, participants listened to three-sentence stories and predicted the protagonists' final action by moving a mouse toward one of three options. Each story was presented with either one (1-Plausible) or two plausible options (2-Plausible). Prior results showed that initial mouse trajectories deviated further from the best option in the 2-Plausible condition compared to the 1-Plausible condition. The present mouse-tracking data were consistent with prior results. In addition, eye-tracking data showed that in the 2-Plausible condition compared to the 1-Plausible condition, participants made shorter fixations on the best option but made more fixations and spent more time fixating on other options. The results provide support for a parallel option generation process.
Email: Edward A. Cranford, eac53@msstate.edu

(3133)

Exploring the Importance of Gesture in Reading Comprehension. MATTHEW COLLINS and BRITTNEY GONZALEZ, *Nova Southeastern University*. — Based on theories of embodied cognition (Barsalou, 1999) and the action compatibility effect (Glenberg & Kaschak, 2002), gesturing while reading should facilitate online comprehension processes when reading about actions that match said gestures. However, other research (Pecher, 2013) indicates gesturing provides no facilitation when processing related objects, suggesting motor affordances are not activated during online processing. In the current study, participants read sentences that described an action while performing gestures with their hands. During a matched reading trial, gestures mimicked the action of the target verb-object pair in the sentence. On mismatched trials the target verb-object pair did not match the performed gesture. We examined the impact of gestures on reading time of the target verb-object pairs.
Email: Matthew Collins, wc292@nova.edu

(3134)

Influencing Mind Wandering While Reading by Directing Attention Towards Current Concerns. KRISTOPHER KOPP and CAITLIN MILLS, *University of Notre Dame*, ARTHUR GRAESSER, *University of Memphis*, SIDNEY D'MELLO, *University of Notre Dame*. — Research suggests that mind wandering often consists of prospective thoughts. There have been few attempts, however, to influence mind wandering behaviors by experimentally manipulating the saliency of individuals' current concerns prior to a task. For the current experiment, participants were asked to reflect upon their

immediate future prior to a reading. We compared mind wandering reports from this group to a control condition where no reflection occurred. Directing attention towards current concerns was related to increased self-reports of mind wandering and influenced the types of mind wandering reports that occurred during reading. This data also shows that the indirect effect of mind wandering has a significant influence on the relationship between the manipulation and text comprehension. Lastly, observed patterns of mind wandering while reading suggest that a delay between the manipulation and the task initially inhibited mind wandering reports for the experimental condition, but the effect manifested as participants read.
Email: Kristopher Kopp, kristopherkopp@gmail.com

(3135)

Effect of "Because" on Evaluations of Explanations in Science: Testing the Influence of Individual Differences. LILLIAN ASIALA and KATJA WIEMER, *Northern Illinois University* (Sponsored by Michael Wolfe). — Previous studies have demonstrated that causal connectives influence the perceived quality of explanations (Wiemer & Asiala 2013). Causal connectives like becuase may make an insufficient explanation look more explanatory when the reader is unfamiliar with the topic. This study tested the interaction between individual differences in background knowledge and the presence of connective because on evaluations of explanations varying in quality. Participants were recruited from programs of study in natural sciences, and from psychology. Texts describing scientific phenomena were followed by a causal why question and corresponding explanation to be evaluated by the reader. Explanations were stylistically identical, and overlapped equally with the text, but varied in quality (did or did not contain causally relevant information), and whether they contained connective becuase . As predicted, scientific background knowledge interacted with influence of the connective, in that natural science majors were less influenced by the presence of becuase than psychology majors.
Email: Lillian Asiala, lke.asiala@gmail.com

(3136)

The Influence of Added Explanatory Support on People's Agreement to Social Arguments. YASUHIRO OZURU and MATTHEW MYERS, *University of Alaska, Anchorage*. — A quasi experimental study is conducted to examine how adding an explanatory support (e.g., legalization of marihuana will raise tax revenue) to a claim alone statement on a social issue such as "marihuana should be legalized" will influence people's agreement to and evaluation of argument strength. Participants provided judgments of agreement or argument strength to 16 claim alone statements and claim statements with one or two explanatory supports. The results indicated that adding explanatory support(s) neutralize people's evaluation of the argument relative to their evaluation of a claim alone statement. The finding suggest that the influence of the added support is dependent on people's position or attitude towards the idea expressed in a claim alone statement.
Email: Yasuhiro Ozuru, afyo1@uaa.alaska.edu

(3137)

Aptness and Metaphor Processing: Evidence From Eye Movements. JANE ASHBY and STEPHEN AGAUAS, *Central Michigan University*. — Research suggests that metaphor processing is affected by aptness, defined as the clarity of the relationship between the topic and vehicle of the metaphor. Most previous studies measured metaphor preference ratings and reaction time. This study monitored eye movements during silent reading. Norming materials were created by changing only the metaphor topic, yielding three conditions: low apt (Age is a passport because), high apt (Beauty is a passport because), and literal (A ticket is a passport because). Participants read figurative and literal sentences in a within-subjects design. We examined effects of aptness and metaphoricity on the vehicle (t) and the following word (t+1). Readers spent longer processing t+1 in the metaphorical than the literal condition, indicating that identical lexical items are processed differently in the context of literal and figurative expressions.
Email: Jane Ashby, jane.ashby@cmich.edu

(3138)

Analogy and Text Completion Entail Same Processes as Integrative Priming. LARA JONES, *Wayne State University*. — Integrative word pairs (river - fish) form a distinct entity that is a subclass of the head noun (e.g., a fish that inhabits a river). Taxonomically related pairs (i.e, category coordinates; lobster – fish) have features in common and belong to the same category (seafood). Integrative priming entails an automatic complementary role activation process in which the relational roles of prime (habitat) and target (inhabitant) are activated and then the prime and target are bound or integrated to produce a plausible combination (Mather, Jones, & Estes, 2014). Taxonomic priming may be based on the feature similarity and/or contextual co-occurrence between prime and target (Jones & Golonka, 2012). Based on these different underlying mechanisms, performance across an analogy task (which also entails relational role activation) and a text completion task (which also entails integration) was predicted and found to be related to integrative but not to taxonomic priming. Results then further established integrative priming as a distinct mechanism of lexical priming.
Email: Lara Jones, larajones@wayne.edu

• LANGUAGE PRODUCTION/WRITING •

(3139)

Dynamics of Response Planning in Word Typing: Evidence for Inhibition. SVETLANA PINET, CARLOS M. HAMAMÉ, MARIEKE LONGCAMP, FRANCK VIDAL and F. XAVIER ALARIO, *CNRS & Aix-Marseille Université*. — Typing is a pervasive phenomenon in our modern information societies, yet its cognitive underpinnings remain poorly understood. We sought to characterise the underlying processes leading to typed response production using EEG recordings. EEG data were acquired while expert typists performed a typed version of a picture-naming task. To focus on motor preparation, we

studied activity time-locked to the first keystroke of a word. We observed clear positive and negative waves developing respectively over motor cortices ipsilateral and contralateral prior to the first keystroke. This characteristic pattern is very similar to the one observed in simpler two-alternative choice-reaction time tasks; it can be interpreted in terms of activation of the contralateral primary motor area involved in the movement of the typing hand, accompanied by inhibition of the ipsilateral primary motor area, involved in the movement of the other hand. These data constitute interesting electrophysiological evidence that could constrain behavioural models of typing previously proposed (Rumelhart & Norman, 1982; Logan & Crump, 2011).
Email: Svetlana Pinet, svetlana.pinet@univ-amu.fr

(3140)
Memory and Executive Control Deficits in Fluent and Non-Fluent Aphasia. EKATERINA KUZMINA and BRENDAN STUART WEEKES, *University of Hong Kong*. — The aim of the current study was to investigate memory and executive control deficits in fluent and non-fluent aphasia. A total of 33 Russian-speaking post-stroke aphasic patients from the Moscow Federal Center of Speech Pathology – 17 non-fluent, 16 fluent – and 22 healthy controls were tested with language, memory, executive control tasks and neuropsychological assessment tools (Birmingham Cognitive Screen). Compared with the controls, both clinical groups performed significantly worse on Naming, Story Recall and Recognition, Rule Finding, and Stroop tasks. The non-fluent group had a significantly greater Stroop interference effect and lower scores in the Rule Finding task than the fluent patients. The latter performed significantly worse on the immediate and postponed Story Recognition tasks compared with the non-fluent group. Thus, the executive control, short-term and long-term memory deficits that coexist with language disturbances differ between fluent and non-fluent patients. The implications of these results for understanding cognitive impairment in aphasia will be discussed.
Email: Brendan Stuart Weekes, weekes@hku.hk

(3141)
When Bad Is Good: Taboo Words Improve Homophone Spelling. DANIELLE K. DAVIS, *University of Florida*, JASON B. CRUTCHER, SUNANDA S. MATTANCHERIL and KATHERINE WHITE, *Rhodes College*, LISE ABRAMS, *University of Florida*. — Research on homophone spelling shows that orthographic primes (stair) increase homophone substitution errors (producing hair instead of hare) during sentence production. This experiment investigated whether the presence of taboo words can also influence homophone errors, as taboo words have been shown to interfere with speech production. Participants heard sentences over headphones and attempted to type them verbatim. Half of the sentences contained a contextually-appropriate taboo word or a neutral, non-taboo word, which was followed 1-2 words later by either an orthographic prime containing the inappropriate spelling of the target homophone or an unrelated word. Results showed that sentences containing highly taboo words reduced homophone errors compared to sentences containing neutral

words. However, tabooness did not reduce susceptibility to orthographic priming, as sentences with primes increased errors relative to unrelated sentences. These findings suggest that unlike speech production, taboo words facilitate written sentence production by decreasing homophone errors, which may be a consequence of taboo words increasing attention to the overall task.
Email: Katherine White, whitek@rhodes.edu

(3142)
Stress Effects on Word Retrieval Across the Lifespan. CHRISTOPHER SCHMANK and LORI JAMES, *University of Colorado, Colorado Springs*. — Tip-of-the-tongue (TOT) states can occur when individuals are unable to produce a known word. We predicted that high-stress conditions (standing in front of a mirror and video camera, with supposed evaluation on nonverbal behavior while performing several tasks, including a word retrieval task) would lead to more TOTs and fewer correct responses than low-stress conditions (no mirror or camera, nor evaluative components, but the same retrieval task). Adult participants ages 18-90 were randomly assigned to the high- or low-stress condition, and across all ages, there were more TOTs for participants in the high-stress condition. Among participants in the high-stress condition, people who reported higher state stress scores got fewer correct responses and more TOTs, but the correlation between state stress and TOTs was not found for participants in the low-stress condition. Further, across all participants in the high-stress condition, age was negatively correlated with both state and trait stress, indicating that age decreased the effectiveness of our stress manipulation. Results indicate interesting effects of stress and aging on word retrieval.
Email: Christopher Schmank, cschmank@uccs.edu

(3143)
Let's Take A Walk: An Investigation Into the Role of Flexibility in the Relation Between Cohesion and Essay Quality. LAURA ALLEN, ERICA SNOW and DANIELLE MCNAMARA, *Arizona State University*. — Recent research has reported mixed results regarding the role of cohesion in text quality. These findings suggest that the linguistic properties that affect text coherence and quality may be more complex than previously assumed. Namely, text features may be more or less associated with text coherence and quality given a wide variety of prompts and situations (Hinkel, 2002). We investigated college students' (n = 45) flexibility in their use of cohesion across 16 essays and whether this flexibility related to their writing proficiency. The results suggested that more proficient writers were, indeed, more flexible in their use of cohesion across different writing prompts and that this cohesive flexibility was most strongly related to the unity, or coherence, of students' writing. This is important, as it indicates that cohesive devices may be employed differentially by students across various situations in order to achieve coherence in their ideas.
Email: Danielle McNamara, dsmcnamara1@gmail.com

(3144)

Does Exhausting Executive Control Impair Speech Production? Evidence From Lexical Competition. ANGELA FINK and MATT GOLDRICK, *Northwestern University.* — During speech production, speakers resolve competition between coactive lexical representations (e.g., choosing CAT among lexical candidates CAT, DOG, RAT). We examine the role of specific sub-components of control (Miyake, Friedman, Emerson, Witzki & Howerter, 2000) in managing lexical competition. To heighten competition during production, we use the continuous picture naming paradigm of Howard, Nickels, Coltheart, and Cole-Virtue (2006): naming semantically related pictures (DOG, RAT) yields slower responses on subsequent targets (CAT). We incorporate this into a negative transfer paradigm. Participants perform continuous picture naming before and after intensive practice on behavioral tasks that "exhaust" a specific control process. This is predicted to induce domain-general performance decrements on tasks involving the practiced process (Persson, Welsh, Jonides, & Reuter-Lorenz, 2007)—here, increased semantic interference. In contrast, semantic interference should be unaffected by practice on tasks tapping other control processes not involved in conflict resolution. Implications for theories of production will be discussed.

Email: Matt Goldrick, matt-goldrick@northwestern.edu

(3145)

Structural Variation Does Not Prevent Form Preparation in Word Production: Support for an Attentional Account. ALEXANDRA FRAZER and PADRAIG O'SEAGHDHA, *Lehigh University,* GWENDOLYN REHRIG, *Rutgers University.* — In form preparation, speakers predict how a word will begin before they know what the particular word will be. That is, they prepare a phonological fragment that pertains to several possible words. A standard account views preparation as partial production and therefore stipulates that the possible words must all share the fragment as well as relevant structural properties (Roelofs & Meyer, 1998). Alternatively, preparation occurs through a more flexible sustained attention process that is external to actual production (O'Seaghdha & Frazer, 2014). In Experiment 1, we used an "odd-one-out" design (e.g., one trisyllable among three disyllables) in a word naming format. In Experiment 2, sets of three items all differed in number of syllables (following Roelofs & Meyer, 1998). Both experiments showed clear preparation relative to control conditions with diverse first syllables. Thus, structural variation does not prevent first syllable preparation. These findings are consistent with the sustained attention theory.

Email: Padraig O'Seaghdha, pat.oseaghdha@lehigh.edu

(3146)

Interlopers and the Error Repetition Effect in Tip-of-the-Tongue States. L. KATHLEEN OLIVER and KARIN HUMPHREYS, *McMaster University.* — This study examines the nature of the information recalled during repeated tip-of-the-tongue (TOT) states, in which a speaker's TOT state can be shown to reoccur for individual words, despite being told the correct answer (Warriner & Humphreys, 2008). We have previously argued that this represents an error learning

effect. It is also known that speakers in a TOT state frequently report the presence of "interlopers" – incorrect words that persistently come to mind. This study elicited TOTs from participants, from the same definitions a week apart, while encouraging them to speak aloud their thoughts as they tried to retrieve the words. We measured both the tendency for TOTs to repeat, and the nature of the information recalled at each testing session. Of most interest is the extent to which individual interlopers repeat, as well as other pieces of semantic or phonological information. This helps to clarify what is being learned during the state, and will be discussed in terms of whether a TOT state is better described as specific local minimum, or a more general sub-threshold retrieval state.

Email: Karin Humphreys, krh@mcmaster.ca

(3147)

Effects of Non-Notional-Number Semantic Relations on Subject-Verb Agreement Errors During Sentence Production. DARRELL PENTA and NEAL PEARLMUTTER, *Northeastern University.* — Previous experiments have demonstrated that semantic factors unrelated to notional number can influence head noun-local noun number-mismatch effects in subject-verb agreement production (e.g., Barker, Nicol, & Garrett, 2001; Solomon & Pearlmutter, 2004; Thornton & MacDonald, 2003). In a typical sentence completion paradigm (e.g., Bock & Miller, 1991; Solomon & Pearlmutter), participants in two experiments (N=266, N=121) completed noun phrase-prepositional phrase preambles featuring manipulations of various semantic relationships, including taxonomic category coordinates (e.g., drill-hammer), part-whole relations (e.g., violin-string), and pure association (e.g., jar-cookie). Of these relations, association was the only type to increase mismatch effects reliably. Semantic integration, defined as the degree to which the constituent elements of a specific to-be-uttered phrase are conceptually tightly linked (e.g., The canoe with (vs. near) the weathered flag), was also manipulated and showed a pattern numerically consistent with prior results, though it was not reliable.

Email: Neal Pearlmutter, pearlmutter@neu.edu

(3148)

Relationship Between Executive Function and Written Texts. YAMAKAWA MAYU, *Nagoya University*, DAISUKE FUJIKI, *Aichi University of Education* (Sponsored by Kuninori Nakamura). — In the present study, we investigated the relationship between executive function and written text. Writing involves the following three processes: writing the message, adding information to previously written sentences, and supplementing the message with concrete examples. In our previous experiments, wherein participants were prohibited from revising their written texts, we found that the executive function was unrelated to the number of the messages, but was positively related to the number of sentences containing additional information. In the present study, participants were allowed to revise their written texts. The participants' executive function was measured using the Reading Span Test. The written sentences were classified into the aforementioned three categories according to their underlying processes. The results indicated that executive function inhibited the number

of the messages written. We concluded that executive function played a different role in writing where revision was allowed than in writing where it was not allowed.

Email: Mayu Yamakawa, mayu.y.music@gmail.com

• MEANING/SEMANTICS •

(3149)

Visual Word Recognition in a Semantic Categorization Task: Holistic Processing or Analytical Processing? EMILY SOKOLOFF, ALISON BURROS, JODY KUNIGEL and MEI-CHING LIEN, *Oregon State University*, PHILIP ALLEN, *University of Akron*. — The present study examined whether lexical activation of visual word processing is the result of holistic processing (using whole stimulus shape as the basic encoding unit) or analytical processing (using individual components as the basic encoding unit). Participants determined whether the stimulus related or unrelated to a given category. We measured N170 of event-related potentials, an index of orthographic discrimination (structural encoding), and N400, an index of semantic activation. In Experiments 1 and 2, mixed-case words were intermixed with consistent-uppercase or –lowercase words, respectively. While all word types produced similar N400 effects, mixed-case words elicited a larger N170 effect than consistent-uppercase and -lowercase words at the occipito-parietal sites. We concluded that consistent-case words are processed holistically, but that mixed-case words are processed in an analytical manner and then converted into a pseudo-holistic code (Allen, Wallace & Weber, 1995), thereby resulting in a larger N170 effect due to greater resource demands.

Email: Emily Sokoloff, sokolofe@onid.orst.edu

(3150)

A Reevaluation of Past Metaphor Norms. SPENCER CAMPBELL and GARY RANEY, *University of Illinois at Chicago*. — The use of controlled stimuli is an essential component of the scientific process. Oftentimes researchers will use a shared database of normed stimuli to ensure consistency across projects and laboratories. One such collection is the set of metaphors generated by Katz, Paivio, Marschark, and Clark (1988). Katz et al. collected ratings on ten dimensions that could be used to describe metaphors. Because of the span of dimensions measured, this collection has been used in many studies since its publication 25 years ago. The purpose of the present research was to replicate a portion of Katz el al.'s (1988) metaphor norms to determine if their normative data are still valid. Because of the plasticity of figurative language, a re-norming of selected metaphors from the database was conducted on a new population. Correlations between the data sets show that the pattern of responses has remained consistent across time and populations. These correlations were found when based on all participants, and when the participants were divided into groups based

on vocabulary knowledge and language background. This consistency allows us to be confident in future research that uses the collection.

Email: Spencer Campbell, scampb21@uic.edu

(3151)

How is TURPLE Effect Modulated by Word Frequency of Orthographic Neighbors? MASAHIRO YOSHIHARA, YASUSHI HINO and YUU KUSUNOSE, *Waseda University*. — There is considerable evidence that the processes of reading words and nonwords are affected by the semantic information possessed by their orthographic neighbors. Forster and Hector (2002) reported the so-called TURPLE effect using the semantic categorization task with "animal'" category: negative responses were slower for nonwords derived from animal names (e.g., TURPLE) than for nonwords derived from non-animal names (e.g., CISHOP). Using the same task, Mulatti, Cembrani, Peressotti and Job (2008) also reported that the effect of neighbors was smaller for nonwords with high-frequency neighbors than for nonwords with low-frequency neighbors. Using Japanese katakana nonword targets, we were successful to replicate their findings. When we manipulated word frequency of neighbors for katakana word targets, however, the effect of neighbors was larger for the words with high-frequency neighbors than for the words with low-frequency neighbors. Given these results, the nature of semantic-coding process in visual word recognition is discussed.

Email: Yasushi Hino, hino@waseda.jp

(3152)

Strength and Direction of Lexical Association Indexed by Brain Oscillations: Roles for Theta and Beta in Priming. JOSEPH STAFURA and CHARLES PERFETTI, *University of Pittsburgh*. — In two EEG experiments, participants made word pair meaning judgments: in experiment 1, pairs differed in association strength (Strong vs Weak); in experiment 2, pairs differed in association direction (Forward vs Backward). For a novel neurobiological look at effects of associative strength and direction in word priming, electrical oscillations at the scalp, reflective of mass neuronal activity, were examined in multiple frequency bands. Theta (4-7Hz) power increases were greater for Weak pairs than Strong pairs over right-central scalp, and were greater for Forward pairs than Backward pairs over left-central scalp. Beta2 (19-30Hz) power decreases were greater for Weak pairs than Strong pairs over midline scalp, and were greater for Backward pairs than Forward pairs over right parietal scalp. Thus, Theta may index lexical-semantic memory processing, and beta2 may index fronto-parietal controlled processing during the comparison of Weak associates, and right hemisphere retrospective processing during the comparison of Backward associates.

Email: Joseph Stafura, jzstafura@gmail.com

(3153)

Is NIKE processed like BIRD? Letter-Case and Semantic Priming Effects in Brand-Name Retrieval. STEVE BUENO, *Université Paris*. — Semantic representation of Brand Names (BN) and Common Names (CN) was explored using two

experimental psycholinguistic tasks based on reaction time. In experiment #1 the effect of letter-case presentation for BN was tested. Reaction times showed that BN are recognized faster when presented in lowercase independently of their original case-format. This result challenges the common view that visual features are an intrinsic part of BN's identity (Gontijo & Zhang, 2007). In experiment #2, to the best of our knowledge, BN were used for the first time in a semantic masked-priming paradigm to test the effect of a subliminal BN presentation on the recognition of a subsequent associated CN. A reliable priming effect was observed indicating that direct links have been established in memory between BN and CN. Taken together, these results suggest that BN have acquired the status of CN due to a continuous exposure to BN in everyday life.
Email: Steve Bueno, bueno@univ-paris13.fr

(3154)

Semantic Neighborhoods of Concrete and Abstract Words. ASHLEY N. DANGUECAN and LORI BUCHANAN, *University of Windsor.* — Semantic neighbourhood density (SND; Buchanan, Westbury, & Burgess, 2001) interacts with other word properties (e.g., concreteness) to influence visual word recognition responses in several tasks (Danguecan & Buchanan, 2014). This interaction appears to be impacted by task demands; specifically, the degree of explicit semantic processing required. The goal of the present study was to more precisely chart the flexibility of semantic processing by comparing recognition times for words varying in concreteness and SND across several tasks with different explicit semantic requirements: implicit lexical decision task, progressive demasking task, go/no-go lexical decision task, and semantic categorization task. The results will be discussed in light of a recently developed model of flexible semantic processing that proposes two stages of semantic access: an automatic (task-independent) stage, and a controlled (task-dependent) stage.
Email: Lori Buchanan, buchanan@uwindsor.ca

(3155)

The Nature of Semantic Interference: Evidence from Blocked-Cyclic Comprehension Tasks. TAO WEI and TATIANA SCHNUR, *Rice University.* — Retrieving the meaning of an object can interfere with subsequent processing of meanings from the same category. This semantic interference effect is interpreted as arising from the temporal residual activation of semantic representations (e.g., Campanella & Shallice, 2011). We manipulated semantic relatedness and the number of unrelated intervening trials to test this account in two comprehension experiments which required access to semantic but not lexical representations (i.e., associated word-picture and picture-picture matching). Both experiments showed clear semantic interference effects across trials, confirming a semantic locus of semantic interference in comprehension. Inconsistent with the residual activation account, semantic interference was not reduced but increased by unrelated intervening trials. We propose that this pattern is explained by semantic interference due to a long-

lasting connection weight change mechanism coupled with short-lived semantic facilitation from spreading activation within the semantic system.
Email: Tao Wei, tw8@rice.edu

(3156)

The Relation Between Semantic and Episodic Processes in Self-Generated Thought. FLORENCE RUBY and JONATHAN SMALLWOOD, *University of York* (Sponsored by Jonathan Schooler). — Experiences such as mind-wandering reflect the processing of information that is not derived from the external environment but is instead self-generated by individuals themselves. Although self-generated thought (SGT) is known to be an important part of our mental life, the precise cognitive processes that support it, and in particular the different forms of content it can take (e.g. past or future focused) remain poorly understood. The current experiment tested the relationship between semantic and episodic processes and how these relate to different forms of SGT. Participants performed a semantic judgement task in which they had to select the number of stimuli that were associates of a category (e.g. furniture). This was followed by a surprise recognition task for the semantic items. SGT was measured prior to performing the tasks using experience sampling. Past related SGT was associated with worse performance on the semantic task whereas future thinking was associated with increased performance when making difficult semantic decisions and when retrieving this information. These data suggest that these processes may act in concert during certain periods of SGT.
Email: Florence Ruby, florence.j.m.ruby@gmail.com

(3157)

Mind-Wandering Reduces Semantic Satiation: Mind-Wandering Attenuates Adverse Effects of Repetitive Stimuli. BENJAMIN W. MOONEYHAM and JONATHAN SCHOOLER, *University of California, Santa Barbara.* — We recently sought to demonstrate that mind-wandering may be beneficial under repetitive circumstances. To do so, we embedded thought probes within a test of semantic satiation, an effect where, upon repeated presentations of a verbal/lexical stimulus, the stimulus comes to lose perceived meaning. In our study, participants completed trials in which they were shown a noun repeatedly, either a few times (avg: 3) or many times (avg: 29), and were then presented with another noun and asked to indicate whether the two words were semantically related. After each trial, thought probes asked the participant whether they had mind-wandered in the preceding moments. Our results demonstrated a semantic satiation effect when participants were on-task: for noun-pairs in which the first noun had been presented many times, participants' reaction times were slower for related pairs than for unrelated pairs. However, when participants reported mind-wandering, the effect shifted: reaction times were faster for related pairs than unrelated pairs in the many-repetitions condition. This experiment thus suggests that mind-wandering reduces semantic satiation, likely by providing a break from the tedious task via perceptual decoupling.
Email: Jonathan Schooler, schooler@psych.ucsb.edu

(3158)

Online Processing of Moral Transgressions: ERP Evidence for Spontaneous Evaluation. ANGELIKA KUNKEL and IAN GRANT MACKENZIE, *Universitaet Tübingen*, RUTH FILIK, *University of Nottingham*, HARTMUT LEUTHOLD, *Universitaet Tübingen*. — Experimental studies using fictional moral dilemmas indicate that both automatic emotional processes and controlled cognitive processes contribute to moral judgments. However, not much is known about how people process socio-normative violations that are more common to their everyday life, nor the time-course of these processes. Thus, we recorded participants' electrical brain activity while they were reading vignettes that either contained morally acceptable versus unacceptable information, or text materials that contained information which was either consistent or inconsistent with their general world knowledge. For the latter text materials, knowledge-inconsistent words triggered a larger centroparietal ERP negativity about 300 ms after critical word onset (N400), indicating an influence on meaning construction. By contrast, a larger ERP positivity, starting already at about 250 ms after critical word onset, was elicited by morally unacceptable compared to acceptable words. We take this early ERP positivity to reflect an implicit evaluative (good-bad) categorization process that is engaged during the online processing of moral transgressions.
Email: Angelika Kunkel, angelika.kunkel@uni-tuebingen.de

(3159)

Forgetting the Literal: The Role of Inhibition in Metaphor Comprehension. TIM GEORGE and JENNIFER WILEY, *University of Illinois at Chicago*. — In order to comprehend figurative language does literal information need to be inhibited? Previous research using sentence-verification paradigms has found evidence for the inhibition of literal associates after reading metaphorical sentences; however it is problematic to infer inhibition from this research. Moreover, previous work has not distinguished between familiar and novel metaphor processing. Experiment 1 used a novel metaphor-induced-literal-forgetting paradigm (MILF) to test more directly for evidence of inhibition of literal meanings. Participants initially learned word pairs where the cues were potential metaphoric vehicles and the targets were literal associates. Then, participants read half the vehicles as part of metaphorical sentences. Subsequent forgetting of the targets was greater when vehicles had appeared in metaphorical sentences. In Experiment 2, metaphor novelty was manipulated. A larger MILF effect was observed for novel metaphors than for familiar metaphors, suggesting the processing effort for novel metaphors requires more inhibition.
Email: Tim George, tgeorg7@uic.edu

(3160)

Visual Attention Within the Generation of Emergent Features for Novel Metaphors. ASUKA TERAI and MASANORI NAKAGAWA, *Tokyo Institute of Technology*, TAKASHI KUSUMI, *Kyoto University*, YASUHARU KOIKE, *AN*, KOJI JIMURA, *Tokyo Institute of Technology*. — Typically, a metaphor has the form of "TOPIC is VEHICLE", where the topic and vehicle words often share common characteristics. Novel interpretations of metaphors occasionally involve emergent features that are not based on the typical characteristics of the topic or vehicle words. In the present study, the participants made vocal responses in a task of freely generating metaphor interpretations and participant eye movements were continuously recorded. The results reveal that emergent features were mainly generated from novel metaphors and, more importantly, gazes at presented words were for longer durations prior to the generation of emergent features. Prolonged gazes occurred for several seconds prior to the generation of emergent features, particularly, in the case of the topic word. These results provide empirical data concerning the behaviors that proceed creative cognition.
Email: Asuka Terai, asuka@nm.hum.titech.ac.jp

• **PSYCHOLINGUISTICS II** •

(3161)

Neuroelectric Markers of Hemispheric Differences in Ambiguity Resolution of Words in Context: A Split Visual Field ERP Study. MARK FAUST, ELAINE HILL and JORDAN PIERCE, *University of North Carolina at Charlotte*. — Control of lexical activations that vary in their appropriateness in relation to a preceding sentence context is an important aspect of sentence comprehension. Homographs, words with the same written form but multiple distinct meanings (e.g., bank) provide a challenging control problem requiring lexical disambiguation in light of preceding context. To assess behavioral interference from contextually inappropriate homograph meanings, participants read sentences that ended in a homograph and judged the relationship between probe words and the preceding sentence. We used event-related potential (ERP) methodology to identify neuroelectric markers of the control of contextually inappropriate homograph meanings, e.g., the N400, a negative scalp potential sensitive to the semantic incongruity between a word and prior sentence context. The present study adds to our previous work by using split visual hemifield presentation of the target probe words to better understand hemispheric differences in cognitive control during sentence comprehension.
Email: Mark Faust, mefaust@uncc.edu

(3162)

Executive Function for Agreement Processing. ERIKA HUSSEY, LAUREL BREHM and KIEL CHRISTIANSON, *University of Illinois at Urbana-Champaign*. — Recent research has implicated a role for memory retrieval mechanisms in number agreement processing (Dillon, Mishler, Slogget, & Phillips, 2013; Lewis & Vasishth, 2005), however the workings of other executive functions remain largely underspecified. Taking an individual-differences approach, we examined how three canonical executive function constructs predict self-paced reading times while processing subject-verb agreement in the face of irregular attractors. We assessed the differential contribution of representational and lexical cues by crossing orthographic marking—the presence of a word-final s—with

grammatical plurality (e.g., person/people, duck/ducks, dress/dresses, cactus/cacti). Performance on non-linguistic indices of language experience (Author Recognition), verbal fluency (verb generation), working memory capacity (reading span), and inhibitory control (Stroop) was used to predict variation in agreement attraction. Our findings are discussed within the context of spreading activation and interference resolution accounts for sentence processing.
Email: Erika Hussey, ehussey@illinois.edu

(3163)

Executive Functions Predictors of Learners' Language Processing Abilities: A Training Study. LUCIA POZZAN, *University of New South Wales*, JOHN TRUESWELL, *University of Pennsylvania*. — Real time language comprehension and production require focusing on and rapidly integrating multiple sources of information. Growing evidence shows that this process is supported by domain-general executive function (EF) skills. Here we explore whether the ability to process complex sentences in a second language is supported by EF skills and can benefit from EF training. Over 2 months, 20 Chinese child learners of English played games (www.lumosity.com) aimed at measuring and training EF-skills. Pre and post-training sentence processing tasks were also administered. After correcting for age and English proficiency, EF skills reliably predicted differences in sentence processing (Task1: r=.45, p=.04; Task2: r=.75, p<.01) at pre-test; moreover, training-related EF improvements predicted sentence processing improvements (Task1: r=.60, p<.01; Task2: r=.50, p=.03). These results indicate that domain-general EF skills support language processing and training-related gains can transfer to untrained domains. Such findings represent an important step in identifying the cognitive processes that support language processing and acquisition, as well as the circumstances under which language learners might benefit from cognitive gains.
Email: Lucia Pozzan, lucia.pozzan@gmail.com

(3164)

Local Attraction in Sentence Comprehension Is Influenced by Global Constraints and Executive Abilities. NAZBANOU NOZARI, *Johns Hopkins University*, JOHN C. TRUESWELL and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*. — Sentences are processed incrementally, meaning that the possible space of referents is subject to global constraints imposed by prior context. Recent findings, however, point to possible violations of global constraints through local attractions. In an eye-tracking paradigm, our participants heard simple sentences (e.g.,"She will peel the red apple.") while viewing four line-drawings (apple, banana and two distractors). Global constraint was manipulated by using restrictive vs. non-restrictive verbs (e.g.,"peel" vs. "paint"). Local attraction was manipulated by including a picture that was either compatible with the adjective (heart) or not (bone). Critically, the adjective-compatible distractor was always incompatible with the restrictive verb. A non-verbal flanker task was administered afterwards. We found (1) local attraction at the cost of violating global constraints, (2)

modulation of local attraction by global constraints, and (3) a negative correlation between the magnitude of local attraction and the ability to inhibit flankers in the non-verbal task.
Email: Nazbanou Nozari, nazbanou.nozari@gmail.com

(3165)

Statistical Language Learning: Support From General Attention, or Verbal Capacity? NICOLETTE NOONAN and LISA ARCHIBALD, *University of Western Ontario*. — Preliminary work suggests that statistical language learning (SLL) may rely on explicit processes such as attention (Toro et al., 2005) or working memory (WM) (Evans et al., 2009). One hypothesis is that implicit learning requires (at least) minimal attention such that learning is reduced under any attention-demanding conditions. Another possibility is that implicit learning requires adequate processing capacity such that learning is impaired under conditions placing limits on available capacity. Such capacity constraints might be domain-specific or domain-general. The present study provided the first systematic evaluation of the relationship between SLL and explicit processing by comparing performance under standard conditions to learning while actively engaged in low or high demand working memory tasks involving either verbal (same-domain) or visuospatial (cross-domain) stimuli. Results revealed reduced SLL when engaged in either verbal working memory task. These findings suggest a key role of domain-specific verbal capacity resources supporting implicit SLL.
Email: Lisa Archibald, larchiba@uwo.ca

(3166)

Verbal and Visual-Spatial Working Memory Resources Modulate Multi-Modal Co-Reference. STEPHANI FORAKER, *SUNY Buffalo State*. — Comprehenders heard/viewed video-taped discourses that contained an ambiguous pronoun in speech, accompanied by a hand gesture that could bias interpretation to a distant referent or a recent referent, in comparison to baseline no-gesture and ambiguous gesture conditions. Reaction times at pronoun offset for recognizing a distant referent's name probe were faster than the no-gesture baseline when the gesture indicated the matching, distant referent, and slower when the gesture indexed the mismatching, recent referent. Furthermore, the higher a comprehender's verbal WM score (reading span), the stronger the effect of gestured information. Higher visual-spatial WM scores (symmetry span), on the other hand, facilitated recognizing the distant referent probe only when integrating the ambiguous gesture. In contrast, reaction times for recognizing a recent referent were uniformly faster than for a distant referent, were unaffected by gestured information, and were not modulated by verbal or visual-spatial WM resources – consistent with a recent referent's representation persisting in focal attention (Foraker & McElree, 2007).
Email: Stephani Foraker, forakesm@buffalostate.edu

(3167)

Effects of Reading With Auditory Perceptual Simulation, Reading Aloud, and Reading Silently on Sentence Processing and Comprehension. PEIYUN ZHOU and KIEL CHRISTIANSON, *University of Illinois*. — Two eye-tracking

experiments investigated differential effects of reading aloud, normal silent reading, and reading silently with Auditory Perceptual Simulation (APS) of one's own voice on sentence processing and comprehension. Reading modes (reading with APS of one's own voice vs. reading aloud), syntactic structure (subject-relative clause vs. object-relative clause) and plausibility (plausible vs. implausible) were manipulated in Experiment 1. Experiment 2 examined readers' eye movements and comprehension for the same sentences during normal silent reading. The initial results from Experiment 1 demonstrated that reading modes, structure (ORC > SRC), and plausibility (implausible > plausible) significantly affected the reading speed. Processing (reading) time was reduced when participants read with APS compared to reading aloud. Plausibility (plausible > implausible) and structure (SRC > ORC) affected comprehension. There was no significant difference between reading aloud and reading with APS on response accuracy, but differences between these two modes and normal silent reading were observed.
Email: Peiyun Zhou, youneverleave@gmail.com

(3168)

The Effect of Interaction on the Selection of Reference Objects. CHRISTOPHER GALEUCIA and LAURA CARLSON, *University of Notre Dame*. — Communication between interlocutors involves common ground, which includes assumptions that each party makes about shared information drawn from their past experiences and current shared context. Conversation may be facilitated when speakers use their assumptions about shared information. We test this idea in the domain of spatial descriptions. Spatial descriptions such as "The keys are beside the binder" define the location of a target object by describing it with respect to a reference object that is assumed known or easily found. Environments are populated with multiple objects, and speakers need to select the one that will best serve the listener as a reference object. We test the idea that introducing an object into common ground makes it salient and therefore a good reference object. Participants were asked to describe the location of a set of keys that were on a table surrounded by numerous objects. The critical manipulation was whether the experimenter, the subject, neither or both interacted with a binder before they were asked to describe the location of the keys. Across conditions, participants often explicitly invoked common ground in their descriptions, and differentially referred to the interacted object.
Email: Christopher Galeucia, cgaleuci@nd.edu

(3169)

An Exploration of Individual Differences in Statistical Learning. LUCY C. ERICKSON, *Carnegie Mellon University*, MICHAEL KASCHAK, *Florida State University*, ERIK D. THIESSEN, *Carnegie Mellon University*, CASSIE BERRY, *Florida State University*. — Statistical learning (SL) is proposed to play an important role in many domains. However, it is not clear that the measures used in SL experiments are sufficiently reliable to assess individual differences in SL ability, nor that they tap into the same underlying ability. To address this question, we presented participants with four novel languages in which words could be segmented on the basis of statistical information, at both an initial session and at a subsequent session one week later. Performance across languages was generally uncorrelated. Performance within a language (from time 1 to time 2) showed small but significant correlations. A composite score of the four languages showed the greatest correlation from time 1 to time 2, as well as evidence of learning preserved over the delay interval. These results suggest that the use of composite measures is a promising avenue for the measurement of individual variation in SL.
Email: Michael Kaschak, kaschak@psy.fsu.edu

(3170)

Child-Directed Speech Effects in Artificial Grammar Learning. AGNES LUKACS, *Budapest University of Technology and Economics*, FERENC KEMENY, *BME Department of Cognitive Science*. — Artificial grammar learning is often understood as a model of grammar acquisition in child language development. While we know that first language acquisition is facilitated by several characteristics of child directed-speech such as the use of shorter sentences and exaggerated prosody, we do not know how these factors influence learning in adults, and what their relative contribution is to learning different aspects of language is. We tested the effects of 3 factors in an auditory AGL task in young adults: 1) ordered presentation of strings starting with the shorter ones ('starting small') versus random presentation of strings of different length, 2) exaggerated versus monotonous prosody, 3) presenting the strings as a background to a cartoon. Presenting shorter strings before longer ones lead to significantly higher learning on the task, while the natural prosody and an association with a cartoon did not affect the efficacy of extracting abstract regularities from auditory strings.
Email: Agnes Lukacs, alukacs@cogsci.bme.hu

(3171)

Conceptual and Lexical Repetition During Bilingual Prosody Production. TUAN LAM and VIORICA MARIAN, *Northwestern University*. — In natural conversation, speakers often mention the same referents multiple times over the course of a conversation, and prior research has demonstrated that previously mentioned referents are produced with less acoustic prominence compared to previously unmentioned referents. However, it is unclear whether this effect is due to repetition of word-forms, repetition of concepts, or a combination of both word-form and concept repetition. In this study, we examined the effect of concept repetition in code-switching Korean-English bilinguals to determine whether word-form repetition is required for reduction. Balanced and unbalanced bilinguals performed an event description task involving repetition of referents both within and across languages. In balanced bilinguals, concept repetition led to prominence reduction both within and across languages, whereas in unbalanced bilinguals, only repetition within languages led to prominence reduction. This pattern

suggests that the internal structure of a speaker's language system determines whether or not conceptual repetition can influence reduction.

Email: Tuan Lam, tuan.lam@northwestern.edu

(3172)

Can We Read at 30 Words Per Second? CYRUS SHAOUL, JACOLIEN VAN RIJ, PETAR MILIN and HARALD BAAYEN, *University of Tuebingen*. — How fast can we read sentences while still accurrately understanding the words? To find out we first tested how well people read bare words presented very briefly and masked. Participants made lexicality decisions for words exposed for 8ms to 67ms. We also manipulated the type of mask (noise masks and strings of random consonants). The data showed that random consonant masks interfered more with lexical processing: only when words were presented for longer than 60ms were consonant masks defeated. Our second step was to test how well words would be recognized in picture/sentence-verification task, where each word in a sentence is a mask for the following word. Participants judged whether a target picture matched a word in the sentence presented at 33 ms/word (or 30 wps). The picture either followed or preceded the sentence. Accuracy was above chance when recognizing words with a preceding picture and accuracy was lower, but above chance, for items in which the picture followed the sentence, indicating that the context effect was not merely caused by a picture priming effect. Lexical processing appears to be taking place even at a presentation rate of 30 words per second, but only when facilitated by context.

Email: Cyrus Shaoul, cyrus.shaoul@uni-tuebingen.de

(3173)

Influences of Individual and Text-Level Characteristics on Eye-Movement Patterns During Sentence Reading. KAZUNAGA MATSUKI and VICTOR KUPERMAN, *McMaster University*, JULIE A. VAN DYKE, *Haskins Laboratory*. — Two streams of reading research suggest that eye-movement patterns are influenced on one hand by the word/text complexity (Rayner, 1998) and on the other hand by individual differences in cognitive abilities and reading experience (e.g., Kuperman & Van Dyke, 2011). The present research bring the two streams together by investigating how text-level and individual-level characteristics influence eye-movement patterns over the time-course of reading, as well as comprehension accuracy. Fifty-one proficient readers read passages of varying complexity from the Gray Oral Reading Test, while their eye-movements were recorded. Participants also completed a large battery of tests assessing various components of the reading comprehension ability (vocabulary size, decoding, phonological awareness, and experience with print), as well as general cognitive and executive (tapping) skills. Analyses using random forests indicated that while the individual-level variability influences early eye-movement measures, indices of later integrative processes, including comprehension accuracy, are only affected by text-level factors.

Email: Kazunaga Matsuki, matsukik@gmail.com

(3174)

Parafoveal-on-Foveal Effects of the Grammaticality of Word n+2 in English Reading. KLINTON BICKNELL, *Northwestern University*, ROGER LEVY, *University of California, San Diego*. — In determining the architecture of the reading system, a key question is the extent to which readers process words ahead of the currently fixated word. There is clear evidence that readers fixating a word (n) do some processing of the next word (n+1) and low-level processing of word n+2. It is unknown, however, whether readers engage in deeper, grammatical processing of future words. Additionally, there is mixed evidence regarding whether the processing of future words n+1 and n+2 can affect eye movement behavior on word n. We present experimental results demonstrating longer gaze durations, longer go-past times, and more first-pass regressions out of a word n when word n+2 is ungrammatical. This is to our knowledge the first clear demonstration of grammatical processing of future words. Additionally, these results represent some of the clearest evidence that non-superficial processing of future words can affect eye movements on the currently fixated word.

Email: Klinton Bicknell, kbicknell@northwestern.edu

(3175)

What Can Children Learn From Six Million Words? JON WILLITS and *MICHAEL JONES, *Indiana University*. — What could children learn about words' meanings from their distributional statistics? What do the statistics tell us about the possible organization of semantic memory? We addressed these questions by constructing a semantic model using the distributional statistics for 6,000,000 words of child-directed speech (from the CHILDES corpus), spoken to children under five years of age. First, we assessed the usefulness of the model's representations for inferring nouns' category memberships. The model's average performance was 83.5%% correct (ranging from 70-91%, depending on the category). Second, we investigated the hierarchical nature of the model's representations, by comparing words' between- and within-category similarity to other words at various taxonomic levels. We found that the semantic space that emerges from the distributional statistics is strongly hierarchically organized. These analyses demonstrate that small samples of distributional statistics are useful for inferring semantic relationships such as words' category memberships, and that these statistics suggest that taxonomic and hierarchically structured representations ought to emerge naturally, given the structure of the input.

Email: Jon Willits, jon.willits@gmail.com

(3176)

Children Use Phonetically-Cued Talker Information to Disambiguate Similar Objects. NICHOLAS MOORES, KEVIN MCGOWAN, MEGHAN SUMNER and MICHAEL C. FRANK, *Stanford University*. — Variation in speech conveys linguistic information like sounds and words, and social information like talker age and gender. We investigate whether children use linguistic and talker information in object disambiguation, and whether these effects increase when a voice becomes contrastive. Six children (3-5yrs.) responded to male/female voices in a click-on paradigm with

gendered-images (man's vs. woman's bike). They heard 12 sentences framed Find my X , with a Competitor absent (CA) or present (CP). CA trials had a critical image (man's bike) and 3 distractors. CP trials had a critical image (man's bike), a gendered-competitor image (woman's bike), and 2 distractors. Accuracy was 92% for CA and 64% for CP trials, suggesting children use gender information greater than chance. Accuracy increased on CP trials after second voice introduction (76% vs. 50%). These findings suggest children make speech-social mappings that help disambiguate instances of a single noun that differ only by gender.
Email: Meghan Sumner, sumner@stanford.edu

(3177)
Toddlers' Sensitivity to Subcategorical Phonetic Mispronunciations During Online Word Recognition. MELISSA PAQUETTE-SMITH, *University of Toronto*, ELIZABETH JOHNSON, *University of Toronto Mississauga*. — A classic finding in the field of developmental speech perception is that infants learn to ignore phonetic information that does not signal phonemic contrasts in their native language. However, given that adults show delays in lexical access when words contain subcategorical mispronunciations suggests that sensitivity to non-contrastive phonetic information is not lost entirely, but may be masked by the demands of the task. Here we investigate 22 to 25-month-olds' responses to subcategorical mispronunciations of known words during online word recognition. When target words contained a subcategorical mispronunciation (created by cross-splicing the vowel of the target word with the same vowel produced in a different coarticulatory context) toddlers were slower to fixate the target. Sensitivity to these mispronunciations seems to increase with age, with older children showing impairments earlier on in the trial. This work suggests that children, like adults, encode non-contrastive variation. Moreover, sensitivity to certain types of non-contrastive variation may actually increase with language experience.
Email: Melissa Paquette-Smith, m.paquette.smith@mail.utoronto.ca

• REASONING AND JUDGMENT I •

(3178)
Shifting Across Time: The Effects of Time Pressure on Relational Reasoning. KATHERINE LIVINS, *University of California Merced*, LEONIDAS A.A. DOUMAS, *University of Edinburgh*, MICHAEL SPIVEY, *University of California, Merced*. — Relational cognition (i.e., reasoning based on the roles that objects play instead of the features they possess) can be disrupted by time pressure. For instance, time pressure increases the likelihood that one notices similar object features instead of similar relational roles when both are present (Goldstone & Medin, 1994). That said, the exact time-course of this featural-to-relational shift, and whether it can be affected by priming are unanswered questions. The proposed presentation will address these issues with two experiments. Both experiments used crossmapping analogy problems (i.e.,

problems that could be answered by mapping object features or roles), and manipulated the amount of time the base analog was presented. The first experiment showed that the shift from featural to relational mappings occurs within a small temporal window, while the second experiment showed that this temporal window may be affected by sensory-motor priming.
Email: Katherine Livins, klivins@ucmerced.edu

(3179)
Captivated or Stimulated: How Do Task-Irrelevant Emotions Influence Reasoning? ISABELLE BLANCHETTE and CHARLES VIAU-QUESNEL, *Université du Québec à Trois-Rivières*. — Task irrelevant emotions decrease performance in deductive reasoning tasks. Two hypotheses have been proposed to account for this effect: (1) emotions orient attention away from the reasoning task or (2) emotions lead to heightened arousal, which in turn has been found to reduce reasoning performance. It is difficult to disentangle the putative effects of arousal and attentional demands. To this end, we ran two experiments using a dual-task paradigm combining a syllogistic reasoning task (with emotional and neutral contents) and a concurrent time production task. The two hypotheses concerning the effect of emotion lead to opposite predictions concerning timing responses. If emotions capture attention, time productions should lengthen. If emotions heighten arousal, time productions should shorten. Results suggest that both hypotheses may be true depending on time constraints on the reasoning task: without temporal pressure, time productions shortened in emotional trials; with temporal pressure, time productions lengthened in emotional trials.
Email: Isabelle Blanchette, isabelle.blanchette@uqtr.ca

(3180)
Can Insight Be Detected Using Transfer? VLADIMIR SPIRIDONOV, IVAN VOLKONSKII and ANN MUHUTDINOVA, *Russian State University for the Humanities*. — Beginning with the works of gestalt psychologists the existence and the role of insight—the key moment in the problem solving process, associated with a saltatory reorganization of the representation of the problem, which leads to its solution and is often accompanied by vivid emotional experiences—was questioned. The situation changed drastically after the introduction of the problem space theory by A. Newell and H. Simon (Newell, Simon, 1972) who proposed a step by step approach to the goal state with associated gradual local changes of a problem's representation instead of a single-step solution discovery. In a series of two experiments using the nine dot problem (Maier, 1930) was obtained a direct experimental evidence for the existence of insight – an abrupt and global change of problem representation in course of its solving. In addition, the results revealed a new perceptual factor that plays an important role in the occurrence of insight—the dots located in the middle of the sides of the original square and serving as the key to finding the solution are masked by the perceptually more prominent corners of the square.
Email: Vladimir Spiridonov, vfspiridonov@yandex.ru

(3181)
Knowledge Selection and Response Dynamics in Category-Based Induction. EOIN TRAVERS, AIDAN FEENEY and JONATHAN ROLISON, *Queen's University Belfast*, AIMEE KAY BRIGHT, *Queen Mary University of London*. — To investigate the influence of associative and structured knowledge during inductive reasoning, participants completed a triad task, choosing to generalize a biological property from a base category to a foil category whose association with the base varied, or to a taxonomically-related category. Mouse cursor trajectories were recorded during the task. Participants were less likely to generalize normatively to the taxonomically-related species as the strength of the association between the base and the foil increased. Mouse trajectories revealed an attraction towards strongly associated foils, even when the correct response was chosen. Furthermore, this effect manifested as an increase in initial movements straight towards the foil response followed by a direction change, rather than a graded increase in the mean deviation, as observed in previous mouse-tracking studies. This result suggests that associative and more structured knowledge compete for control of inductive reasoning and that structured knowledge is available to reasoning processes later on.
Email: Aidan Feeney, a.feeney@qub.ac.uk

(3182)
Knowledge Updating and the Visual Impedance Effect. ALEXANDER SWAN and RUSSELL REVLIN, *University of California, Santa Barbara*. — The present study examines the cognitive constraints imposed by reasoners when they are obliged to update their knowledge in the face of new, previously disbelieved propositions. In three experiments, reasoners were faced with rejection of previously endorsed statements in order to retain new, belief-contravening assertions. The updating decisions reflected both the abstract knowledge of categories and, surprisingly, the presence if irrelevant visual features (e.g., Tom lives in a dessert where all snakes slither). The presence of the irrelevant visual features significantly enhances the retention of associated statements. Our findings are consistent with the proposal that a Visual Impedance Effect (Knauff, 2013) participates in knowledge updating.
Email: Alexander Swan, swan@psych.ucsb.edu

(3183)
Perspective Shifting: Alternating Between 'Self' and 'Other' in the Theory of Mind Mechanism. ELISABETH BRADFORD, INES JENTZSCH and JUAN-CARLOS GOMEZ, *University of St. Andrews*. — This research explored differentiation between 'Self' and 'Other' in belief-attribution abilities (part of the Theory of Mind (ToM) mechanism). Adult participants completed a computerized false-belief task in which they attributed beliefs to themselves and other people, in a matched design, assessing behavioural and neural correlates of belief-attribution to the 'self' and 'other'. Participants responded faster to self-oriented than other-oriented questions, and this distinction was supported by electroencephalography (EEG) measures, largest across

central parietal lobes from 550ms after stimulus onset. Importantly, when a 'perspective-shift' was required within a trial, shifting from Self-to-Other was significantly slower than shifting from Other-to-Self. In contrast, in 'no perspective-shift' trials, no difference was observed between Self-to-Self and Other-to-Other trials. The results indicate that the 'Self' is consistently processed, whilst the 'Other' is only processed when explicitly necessary. Results support the notion of a Self/Other differentiation within the ToM mechanism, at both a behavioural and neural level.
Email: Elisabeth E.F. Bradford, eefb@st-andrews.ac.uk

(3184)
The Influence of an Inherence Heuristic on Scientific Explanation. ZACHARY HORNE, ANDREI CIMPIAN and JOHN HUMMEL, *University of Illinois at Urbana-Champaign*. — What mental processes underlie scientific explanation? Although scientific reasoning is typically careful and methodical, we hypothesize that it is also influenced by a more intuitive explanatory process: namely, an inherence heuristic (Cimpian & Salomon, in press). The central claim of the inherence heuristic proposal is that, when people construct everyday explanations, they unwittingly oversample inherent (as opposed to extrinsic) facts about the entities whose behavior is being explained. Here, we investigated the influence of this heuristic process on explanations for novel scientific phenomena in the domain of chemistry. Participants (N = 99) were provided with short vignettes describing unexpected outcomes of chemistry experiments and were asked to explain these outcomes. As predicted, explanations were couched primarily in terms of inherent features of the substances involved. Importantly, this was so even though (1) such features were not mentioned in the vignettes but (2) extrinsic factors were (e.g., the reaction occurred at a high altitude). These findings shed light on the psychological processes that underlie scientific explanations and have implications for our understanding of the history of science.
Email: Zachary Horne, horne2@illinois.edu

(3185)
Judgment in the Presence of Multiple Anchors. MICHAEL T. BIXTER and CHRISTIAN C. LUHMANN, *Stony Brook University*. — In uncertain environments, individuals often use external cues to guide their judgments and decisions. Anchoring refers to the finding that numerical judgments often gravitate toward previously considered standards. Although an extremely robust effect, prior research has largely focused on demonstrating anchoring in a variety of domains. The present study instead investigated the nature of the cognitive mechanisms underlying anchoring by studying how multiple anchors affect numerical judgments. In Experiment 1, participants exposed to both a low and high anchor provided judgments that were lower than those exposed only to the high anchor, but higher than those exposed to only the low anchor. Furthermore, when exposed to multiple anchors, the anchor encountered first exerted a disproportionate influence. Experiment 2 replicated this primacy effect with both plausible and implausible standards. Finally, Experiment

3 demonstrated that the primacy effect could be eliminated by inserting a distracter task between presentation of the two anchors.
Email: Michael Bixter, mbixter@gmail.com

(3186)
Conditional Reasoning: The Complexity of Development. CAROLINE GAUFFROY and PIERRE BARROUILLET, *University de Geneve*. — The adaptive role of conditional reasoning for our species naturally raises the question of its development. Currently, there is a controversy between two theoretical accounts. Whereas some theories assume that young children perfectly understand If p then q statements (Harris and Nunez, 1996), others theories defend the opposite view by assuming that conditional reasoning is a late developmental achievement (Gauffroy and Barrouillet, 2009). We suggest that this theoretical debate results primarily from the use of different types of conditionals. The defenders of the early-capacity view mainly investigate the understanding of deontic reasoning (i.e., "If you go out then you have to put your coat"), whereas the theories assuming a late developmental achievement focus on descriptive conditionals ("If the piece is a square then it is red"). By studying the understanding of both kinds of conditional from 6- to 20- years old, we propose a first answer to this debate.
Email: Caroline Gauffroy, caroline.gauffroy@unige.ch

(3187)
Tracking Memory Processes During Sequential Diagnostic Reasoning of Ambiguous Symptom Information. AGNES SCHOLZ, *Chemnitz University of Technology*, GEORG JAHN, *University of Greifswald*, JOSEF KREMS, *Chemnitz University of Technology*. — Studying memory processes during thinking and reasoning proves difficult because they are thought to proceed without accompanying actions towards the environment. Memory indexing is a method that allows tracking memory processes by recording eye movements. It is based on the finding that people look at emptied spatial locations when processing information associated with this location. We applied memory indexing to study ambiguous sequential diagnostic reasoning during which multiple pieces of information have to be combined to find a probable explanation for observed symptoms. Participants learned information about symptoms and causes presented in spatial frames on a screen. Gaze allocation on emptied spatial frames during symptom processing and during the diagnostic response reflected the subjective status of hypotheses held in memory and the preferred interpretation of ambiguous symptoms. Memory indexing affords rich information about the set of contending hypotheses, biased symptom processing, and hypothesis change during sequential diagnostic reasoning.
Email: Agnes Scholz,
agnes.scholz@psychologie.tu-chemnitz.de

(3188)
Does Wrong Prediction by Experts Provide More Support Than That by Novices? KUNINORI NAKAMURA, *Seijo University*. — The current research explored whether lay people have a tendency to provide higher support for "wrong"

predictions made by experts than those made by novices. Three empirical studies consistently revealed that there indeed exists a preference for wrong predictions even when predictions are made by experts. In addition, the current research also formulates preferences for wrong predictions made by experts in terms of a Bayesian inference and expresses the processes by which one may believe the wrong prediction in the form of two factors—prior odds and likelihood ratio. Finally, I argue that this preference is logical when treated as a result of the comparison between the two competing hypotheses.
Email: Kuninori Nakamura, knaka@seijo.ac.jp

• DECISION MAKING II •

(3189)
Influence of Information Source on Judgment of Escape Information With Intuition and Delayed Deliberation. HONG LI, *Tsinghua University*. — We explored influence of information source on escape judgment with intuition and delayed deliberation, which addressed an important gap in crisis decision literature. The explorations were conducted at unconscious and conscious priming levels. Mode of thinking was manipulated and examined within-subjects in order to observe the effects of duration of thinking on judgment. Results at both unconscious and conscious priming levels revealed a very significant main effect of information source, as well as a significant interaction of information source and mode of thinking. We found that information source was more important than information content in making judgment. Effects of information source were significantly different with intuition and deliberation. In conclusion, who provides information is more important than the information content and the effect of information source is different with intuition and deliberation. Our findings contribute to the crisis literature by demonstrating the effect of information source.
Email: Hong Li, lhong@mail.tsinghua.edu.cn

(3190)
The Influence of Belief States on Memory and Prediction. PERNILLE HEMMER, TALIA ROBBINS, KIMELE PERSAUD and YUBEI TANG, *Rutgers University*. — How we update beliefs given environmental changes is a fundamental component of human behavior, including memory, decision making and prediction. Bayesian models of cognition give a principled account of how beliefs are updated given observed data, and predict a tradeoff between prior beliefs and observed evidence. However, it is unclear how people weight evidence based on the source, e.g., internal evidence may be weighted differently than external evidence. In a series of experiments, we quantify belief updating as a function of the evidence source, and assess the influence of belief states on memory and prediction. The results suggest that people hold multiple belief states – e.g., one based on the most current evidence, and one based on the long-term evidence accumulation. We

implement a simple rational model that assumes beliefs to be a mixture of different belief states, and weighed by the source of the evidence, i.e., internal versus external.
Email: Pernille Hemmer, pernille.hemmer@rutgers.edu

(3191)
Decisions From Memory: Modeling Behavioral and fMRI Data in a Cognitive Architecture. HANNA FECHNER, *Max Planck Institute for Human Development*, JELMER BORST and KATJA MEHLHORN, *University of Groningen*, LAEL SCHOOLER, *Syracuse University*, THORSTEN PACHUR, *Max Planck Institute for Human Development*, CEREN BATTAL, *University of Trento*, KIRSTEN VOLZ, *University of Tuebingen*. — How do people use their real-world memories to choose between alternatives? Two kinds of decision strategies have been proposed: The first one relies solely on recognition and chooses the alternative that was recognized or recognized most quickly. The other retrieves knowledge about the alternatives and bases its decision on this knowledge. We created computational models of these strategies within the cognitive architecture ACT-R to explain behavioral and fMRI data. Results showed that neither the recognition-based nor the knowledge-based model explained the full data pattern. Instead, a mixture model that selects between the two kinds of strategies provided a better account of the data. The mixture model evaluates recognition times of alternatives to determine if the decision should be based on recognition or if further knowledge should be retrieved. We demonstrate how computational models can be combined with fMRI and behavioral data to help explain how people select and apply strategies.
Email: Hanna Fechner, hfechner@mpib-berlin.mpg.de

(3192)
Working Memory Training Enhances Reflective Decision-Making in Individuals With Depressive Symptoms. JESSICA COOPER and MARISSA GORLICK, *University of Texas at Austin*, DARRELL WORTHY, *Texas A&M University*, CHRISTOPHER G. BEEVERS and W. TODD MADDOX, *University of Texas at Austin* (Sponsored by William Maki). — Individuals with depressive symptoms show deficits in both reflective decision-making that requires the use of working memory resources, and reflexive decision making that does not depend on working memory resources, but on learning via reinforcement. Reflexive decision-making deficits can be attenuated using attention-training methods that train attention toward positive information. In the current study we first test the hypothesis that attention training also attenuates reflective decision-making deficits in individuals with depressive symptoms and find that it is unsuccessful in improving reflective decision-making. We next test the hypothesis that deficits in working memory processes underlie the reflective decision-making deficit using a novel working memory training paradigm. We find that working memory training is successful in attenuating reflective decision-making deficits in individuals with depressive symptoms. Our

results suggest that deficits in reflective and reflexive decision-making tasks are attributable to different underlying processes and can be attenuated using targeted training.
Email: Jessica Cooper, jessica.cooper@gmail.com

(3193)
Using Machine Learning to Identify Candidate Cues for Cognitive Modeling in Naturalistic Settings. MIRJAM JENNY, *Max Planck Institute for Human Development* (Sponsored by Eric-Jan Wagenmakers). — In small-world, laboratory settings, experimenters control which—typically little—information people can use, whereas in large-world, naturalistic settings, people are free to choose between many possible cues. Cognitive models that successfully describe behavior in laboratory tasks often fail to scale up to naturalistic settings when fed with large numbers of (possibly interrelated) cues; the estimation of model parameters suffers from the data's high dimensionality. We therefore propose that dimensionality is reduced before cognitive modeling techniques are applied in naturalistic settings. This can be achieved by identifying those cues that are statistically related to people's responses as promising "candidate cues". Because many machine learning algorithms (e.g., random forests, mutual information criterion) capture nonlinear and nonmonotonic cue–criterion relationships (missed by linear models), we propose using the variable importance measures produced by those algorithms to screen cues. We illustrate our approach by modeling emergency doctors' judgments of how ill patients look.
Email: Mirjam Jenny, jenny@mpib-berlin.mpg.de

(3194)
Signal Detection Theory in the Wild: Reverse-Engineering Error Preferences in Naturalistic Settings. STEFAN HERZOG, *Center for Adaptive Rationality, Max Planck Institute for Human Development* (Sponsored by Timothy Pleskac). — In yes/no decisions, there is an inevitable trade-off between misses and false alarms. Signal detection theory (SDT) prescribes that, when choosing a decision threshold, one should consider both error preferences (i.e., lenient to avoid misses vs. conservative to avoid false alarms) and beliefs about the base-rates of positive and negative events (i.e., conservative if the event is unlikely). In naturalistic settings (e.g., meteorology, medicine), to-be-detected events are typically rare (i.e., asymmetrical base-rates) and estimated decision thresholds thus reflect both error preferences and base-rate beliefs—unlike in typical experiments, where base-rates are symmetrical and thresholds thus reflect preferences only. I present an augmented Bayesian SDT model (reverseSDT) that reverse-engineers error preferences by partialing out base-rate beliefs. In the model, the precision with which one assumes those beliefs is mirrored in the precision with which preferences can be inferred. The approach is illustrated using tornado forecasts and emergency medicine decisions.
Email: Stefan Herzog, herzog@mpib-berlin.mpg.de

(3195)

Let's Make a Deal: The Impact of Individual Differences on Plea Decisions. MIKO WILFORD and GARY WELLS, *Iowa State University*. — Every day, an average of 2,956 Americans are faced with a difficult decision—a plea dilemma. They are forced to choose between a certain punishment and an uncertain worse punishment. Faced with this dilemma, people typically prefer certainty. In fact, 95% of criminal convictions are reached during plea negotiations, not trials. The present research is one of the first to experimentally investigate variables that could impact plea decision-making. Participants engaged in problem-solving activities with confederates— half were induced to cheat on one of the problems and half were not. All participants (whether innocent or guilty) were later accused of cheating on one of the problems. Self-esteem interacted with innocence-guilt to impact plea decisions. However, plea decision outcomes were not reliably moderated by intelligence or beliefs in a just world. Further experimental research is necessary to ensure that the plea system protects the innocent with as much vigor the trial system.
Email: Miko Wilford, mwilford@iastate.edu

(3196)

Working Memory Load Impairs Iowa Gambling Task Performance. BO PANG, KAILEIGH A. BYRNE and DARRELL WORTHY, *Texas A&M University*. — The Iowa Gambling Task (IGT) is widely used to assess decision making under uncertainty. However, there is still a debate on whether performance in this task is reliant on working memory (WM) or whether participants can develop implicit 'somatic markers' that represent each deck's value. Participants completed the IGT with or without a secondary task. Results showed that, overall, participants in the single task condition performed better than participants in the dual task condition. We also found an interaction of Block and Condition on the proportion of Deck B selections, which was a disadvantageous deck due to its large, but infrequent losses. Single-task participants learned to select Deck B less often as the task progressed, while dual-task participants selected Deck B more often as the task progressed. Choice behavior in both conditions could be accounted for by a Value-Plus-Perseveration reinforcement learning model, and the model's best-fitting parameter values suggested reduced loss aversion for dual-task participants. These results do not support the somatic marker hypothesis, and suggest that avoiding losses, particularly rare or infrequent losses, requires sufficient WM resources.
Email: Darrell Worthy, worthyda@tamu.edu

(3197)

Controlled and Automatic Retrieval Processes in Heuristic Memory-Based Decision Making. PATRICK H. KHADER, *Ludwig-Maximilians-Universität München*, THORSTEN PACHUR, *Max Planck Institute for Human Development*, KERSTIN JOST, *RWTH Aachen University*, LILIAN A.E. WEBER, *Philipps-University Marburg*. — In memory-based decision making, people often rely on heuristics such as take-the-best (TTB), which processes attribute information sequentially and stops as soon as a decision can be made. Here, we examined two fundamental aspects of memory retrieval in TTB, i.e., automatic activation of all attributes associated with a decision option and controlled retrieval of task-relevant attributes. Participants decided on the relative success of two companies. Importantly, the numbers of required (according to TTB) and associated attributes (i.e., the level of associative fan) were systematically varied and found to affect both RTs and error rates. This suggests that controlled and automatic retrieval processes contribute to heuristic decision making. Furthermore, in an fMRI study with the same paradigm, we found that a fronto-parietal network of retrieval-related brain areas was differentially involved in automatic vs. controlled retrieval, showing that the memory processes involved in TTB can also be dissociated on a neuronal level.
Email: Patrick Khader, Khader@lmu.de

(3198)

Experience of Variation: Asymmetric Influences on Criterion in Unfamiliar Face-Matching. NADIA MENON, RICHARD KEMP and DAVID WHITE, *University of New South Wales*. — When matching unfamiliar faces people tend to be overly-conservative; failing to accept that considerable variation occurs between images of a single face. We explored whether past experience of this "within-face" variation affected subsequent matching criteria. Participants decided if two photos were the same person. In match trials, the two images were the same person, and were either similar or dissimilar in appearance. In mismatch trials the images were different people. Match trials were blocked by similarity, and feedback was provided (Experiment 1), or withheld (Experiment 2). In both experiments mismatch accuracy was higher in the similar-match block, indicating a more conservative criterion (i.e. more likely to respond 'different'). Therefore, face-matching decisions are influenced by the similarity of face-pairs on preceding trials. Moreover, this criterion-shift was asymmetric, being greatest when the similar-match block was first. Thus, participants were more willing to adjust criteria to include variance than to exclude it.
Email: Nadia Menon, nadiamenon000@gmail.com

(3199)

Decomposing Bias With Choice Response Time Models. COREY WHITE, *Syracuse University*. — Response bias, or preference for one response over another, can result from two distinct processes. Stimulus evaluation bias reflects a shift in how the stimuli are evaluated for classification, whereas response expectancy bias reflects a shift in how the two response options are evaluated (White & Poldrack, 2013). Importantly, these biases have distinct effects on response time distributions which allow them to be dissociated using decision models like the drift-diffusion model. To demonstrate the utility of this approach, we fitted diffusion models to data from two studies of emotional classification: one where music-induced mood shifted responses from a positive to a negative bias, and another where individuals with high trait anxiety demonstrated bias for classifying words as threatening relative to nonaxious individuals. The modeling endeavor showed that music-induced bias affected response expectancy bias specifically, whereas trait anxiety affected

both response expectancy and stimulus evaluation bias. This approach allows deeper exploration of the cognitive processes underlying observed decision bias. Results are discussed relative to emotional classification specifically, and analysis of decision bias more generally.
Email: Corey White, cnwhite@syr.edu

(3200)
Sharing and Taking: An Eye-Tracking Analysis of Interdependent Decisions About Gains and Losses. SUSANN FIEDLER and ADRIAN HILLENBRAND, *Max Planck Institute for Research on Collective Goods.* — Previous work has demonstrated that task properties as well as individual factors have an influence on decision making. However, little is known concerning the underlying processes. In multiple eye-tracking studies we examined the influence of outcome valence and individual differences in social value orientation on the information search and processing in simple allocation tasks. The results show that participants invested more time and showed more intensive search in negatively versus positively valenced allocation tasks. This effect is driven by participants having a pro-social value orientation whereas individualists do not react to the valence differences. By capturing the effects of these factors on the cognitive process the question of how decision makers search and process information in multi-attributive decision situations will be answered. Simultaneously, the experiments will be used to investigate which decision models describe the underlying cognitive processes of decision making best.
Email: Susann Fiedler, susann.fiedler@gmail.com

POSTER SESSION IV
Saturday Noon
Grand Ballroom, Long Beach Convention Center
Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• MULTI-SENSORY INTEGRATION •

(4001)
Varying Stimulus Modality and Intensity Have Different Effects on Duration Estimation. ANDREE-ANNE OUELLET and CLAUDETTE FORTIN, *Universite Laval*. — An auditory stimulus is perceived longer than a visual stimulus of same duration. Similarly, a more intense stimulus is perceived longer than a less intense stimulus. To determine if these phenomena refer to similar attention-related timing mechanisms, participants produced two overlapping 2.5-s intervals defined by auditory or visual stimuli in two experiments. Stimulus modality (auditory, visual) and auditory stimulus intensity were varied in Experiments 1 and 2, respectively. Duration of overlap between the two stimuli varied in both experiments. It was expected that time productions would lengthen with increasing overlap duration because of attention sharing, and that modality and intensity would interact similarly with duration of overlap. The lengthening of time productions with increasing overlap duration was more important with visual than auditory stimuli, but there was no interaction between overlap duration and tone intensity. Results suggest that modality and intensity have different effects on timing mechanisms.
Email: Claudette Fortin, claudette.fortin@psy.ulaval.ca

(4002)
Factors of Auditory Distraction in Serial Recall in Adults. COREY MCGILL and EMILY ELLIOTT, *Louisiana State University*. — In adults, irrelevant sound is believed to cause deficits in serial recall through interference with rehearsal; however, the amount of shared variance between the size of the irrelevant sound effect (ISE) and rehearsal processes is not well established. With a focus on individual differences, we investigated the relationship between rehearsal processes and the size of the ISE, as well as attention control and working memory factors that have also been investigated as contributors to the ISE. We found that in adults, the size of the ISE was significantly correlated with rehearsal processes (the amount that recall performance decreased when rehearsal was impaired using concurrent articulation), and neither working memory capacity nor attention control significantly correlated with the size of the ISE. The results indicate that while a significant amount of variance in the ISE can be attributed to processes shared with rehearsal, there remains significant unexplained variance in the ISE.
Email: Corey McGill, cmcgil1@lsu.edu

(4003)
Can Sound Location and Movement Affect Saccadic Accuracy While Reading? JEFFREY ANDRE, TYLER SCHREFFLER, MICHAEL HALL and ASHLEY KALAVRITINOS, *James Madison University*. — There is evidence of shared mechanisms for attending to auditory and visual locations (from spatial cueing), as well as for cross-modal planning for locations in posterior parietal cortex. Cross-modal interference from auditory attention thus should occur across various visual tasks, including reading. The current study evaluated effects of moving auditory locations on reading during eye-tracking. In Experiment 1 participants read sentences paired with 6s sawtooth tones that were centrally located or moved left-to-right, right-to-left, or oscillated between lateralized positions (rate = 2 Hz). Moving sounds increased reading times and number of fixations. Experiment 2 further examined impacts of panning speed by pairing sentences with either the centered tone or left-right oscillating versions at 0.5, 1, 2, or 4 Hz. Slow-moving tones tended to slow reading times relative to centered tones. Implications for orienting in complex visual tasks will be discussed, including the effectiveness of common reading practices (e.g., using earphones).
Email: Jeffrey Andre, andrejt@jmu.edu

(4004)
Synaesthesia and Schizotypy: Variety of Synaesthesia Matters. MARGARET WILSON, BRIANNA JESKA and AKALKA BARATH, *University of California, Santa Cruz*. — An individual-differences approach can shed light on the neurocognition of synaesthesia. A previous study (Banissy et al., 2011) found a relationship between synaesthesia and two subscales of schizotypy, which is a propensity for dissociative and imaginative states and unusual sensory experiences. However, that study (like much groundbreaking work on synaesthesia) used self-referred synaesthetes, which we now know are not a representative sample. Furthermore, that study mixed quality-quality (music-color) and sequence-quality (grapheme-color) synaesthesia, which may be different phenomena. Using participants screened for synaesthesia but blind to why they were solicited, we found a correlation only for quality-quality, not sequence-quality (the most common variety of synaesthesia). We conclude that type of synaesthesia matters; that using grapheme-color synaesthesia as a proxy for all synaesthesia, as is often done in synaesthesia research, may be problematic; and that the most common form of synaesthesia carries no relationship to a schizotypic personality.
Email: Margaret Wilson, mlwilson@ucsc.edu

(4005)
Growing a 3-Feet-Long Phantom Finger Using Mirror Visual Feedback. CHAIPAT CHUNHARAS and VLAYANUR RAMACHANDRAN, *University of California, San Diego*. — Using the "mirror box" we created a novel visual illusion of being touched on an invisible 3 -foot long ghost finger in empty space. First, the subject places his two hands, palm facing down, in the box –one on either side of the mirror then shifts the vantage point of his head and views

the reflection of his left hand optically superposed of the felt location of the hidden right hand. The subject flexed one finger on his left hand so his couldn't see its reflection. The experimenter stroked the "unseen" finger on subject's right hand while stroked the "empty space" that superposed the the missing finger of subject's left hand in perfect synchrony. In a second experiment, using the same method we projected tactile sensations on to long , thin inanimate objects such as a measuring tape that could be extended to anatomically absurd lengths.
Email: Chaipat Chunharas, cchunharas@ucsd.edu

(4006)

Are Body Odors Modulating Linguistic Processes? PATRIZIA D'ETTORRE, STEVE BUENO, HAKIMA MEGHERBI and ALIX SEIGNEURIC, *Universite Paris.*— Human beings are constantly exposed to olfactory stimuli from their environment. Some of these molecules are dimly produced by humans themselves (e.g. androstenes from axillary areas), and may act as chemosignals. Indeed, androstenes have been shown to elicit gender-dependent effects on emotional or physiological states (review in Havlicek et al., 2010). The aim of this study was to investigate an underexplored issue: can such effects be observed on processing of emotional words? (cf. Hummer & McClintock, 2009). Participants were administrated a Lexical Decision Task while exposed to one of three different androstenes or to a control condition (solvent). Three types of emotional target words were used: positive, competitive, and neutral words (e.g. hope, war, and century, respectively). Results show that Response Times were modulated by Odor condition and by emotional Valence of words. Moreover, this pattern of results differed as a function of participants' gender. - Havlicek J, Murray AK, Saxton TK, Roberts SC (**2010**)
In: G. Litwack (Ed), Vitamins and Hormones, Vol. 83 (pp. 47-82) Burlington: Academic Press.- Hummer TA, McClintock MK (2009) Horm Behav 55, 548–559.
Email: Patrizia d'Ettorre, dettorre@leec.univ-paris13.fr

(4007)

What You See Isn't Always What You Get: Auditory Word Signals Trump Consciously-Perceived Words in Early Lexical Access. RACHEL OSTRAND, *University of California, San Diego*, SHEILA E. BLUMSTEIN, *Brown University*, VICTOR FERREIRA, *University of California, San Diego*, JAMES L. MORGAN, *Brown University*. — Speech perception involves the integration of audio and visual components. A mismatch between these causes the McGurk illusion, in which listeners perceive a fusion of the two streams, implying each contributes to speech perception. Two semantic priming experiments assessed whether the auditory signal alone versus the fused percept is lexically accessed. Participants performed a lexical decision task on target words related (or unrelated) to either the audio signal or the fused percept of McGurk stimuli (Bait[audio]—>Date[percept]). When primes and targets were separated by 50ms, McGurk stimuli primed targets related to the auditory signal (worm) but not the percept (time). With a 300ms ISI, this pattern flipped – priming was observed for the percept but not the auditory word (priming

"time" but not "worm"). Thus, early lexical access is based on the auditory word, whereas later lexical access is based on the additional, updated information from the integrated audio-visual percept.
Email: Rachel Ostrand, rostrand@cogsci.ucsd.edu

(4008)

An Elaborated Diffusion Process Model Explaining Different Shapes of Delta Plots Observed in Standard Conflict Tasks. ROLF ULRICH, HANNES SCHROETER, HARTMUT LEUTHOLD and TERESA BIRNGRUBER, *Universität Tübingen.* — Cognitive models aim to explain typical reaction time (RT) patterns observed in standard conflict tasks (e.g., Eriksen flanker, Simon, Stroop). One particularly challenging finding is the observation of negative-going delta plots in some of these tasks. Such plots result when the standard deviation of the RT distribution is larger for the non-conflicting than for the conflicting condition, even though the mean RT is shorter in the non-conflicting condition. Prominent cognitive models, including standard diffusion models, cannot account for this negative relationship. An elaborated diffusion model is presented which assumes that the activation of an automatic process (driven by response-irrelevant information) and the activation of a controlled process (driven by response-relevant information) superimpose. Monte Carlo simulations demonstrate that the unfolding of the automatic activation in time largely determines the shape of delta plots, whereby early automatic activation results in negative-going delta plots. Thus, this model is capable of predicting most empirical phenomena observed in different conflict tasks without the need to assume qualitatively different mechanisms.
Email: Rolf Ulrich, ulrich@uni-tuebingen.de

(4009)

The N200 Lexicality Effect Is Unaffected by Lip-Read Context. MARTIJN BAART, *Basque Center on Cognition, Brain and Language*, ARTHUR SAMUEL, *Stony Brook University and the Basque Center on Cognition, Brain and Language* (Sponsored by Jean Vroomen). — About 200 ms after the lexical status of an auditory item is defined (e.g., after hearing 'ga' in the Spanish word 'lechuga', versus 'da' in the pseudoword 'lechuda'), pseudowords elicit more negative ERPs than words (i.e., an N200 effect; Baart & Samuel, submitted). Because visual lip-read context affects auditory processes within the same time-frame (i.e., at the P2; see e.g., Besle, Fort, Delpuech, & Giard, 2004; van Wassenhove, Grant, & Poeppel, 2005), we investigated whether the lexical N200 effect is modulated by lip-read information. We presented listeners with auditory-only, audiovisual, or lip-read-only stimuli, and replicated the N200 effect of stimulus lexicality. We also observed substantial effects of audiovisual speech integration for both words and pseudowords. However, we found no evidence of cross-talk between the two speech contexts: Lexical context and visual speech context both affect auditory processing within approximately 200 ms, but the two effects operate independently of each other.
Email: Martijn Baart, m.baart@bcbl.eu

(4010)

The Influence of Face and Mouth Orientation on Audiovisual Speech Perception. JAMES W. DIAS and LAWRENCE D. ROSENBLUM, *University of California, Riverside* (Sponsored by Curt Burgess). — Rosenblum, et al. (2000) found that an inverted mouth in the context of an upright face (a "Thatcherized" visual-speech-stimulus) disrupts the influence of visible speech on perception of auditory speech. However, a question remains regarding the degree of rotation at which face and mouth mis-orientation disrupts audiovisual speech perception. As a Thatcherized face is rotated from upright (upright face, inverted features) to inverted (inverted face, upright features) face identifiability shifts as the image rotates between 0O and 180O (e.g., Lewis, 2001). The current investigation demonstrates how shifts in phonetic perception of audiovisual speech result from rotations of facial context around an inverted mouth, suggesting the influence of facial configuration on audiovisual speech perception follows the idiosyncratic influence of configuration on general face perception. The results add to the evidence that speech and face functions are not as modularly separate as has been assumed (e.g., Kanwisher, 2000; Tuomainen, et al. 2005).
Email: James W. Dias, jdias001@ucr.edu

(4011)

Learning to Identify Faces and Voices by How They Speak. LAWRENCE D. ROSENBLUM, DOMINIQUE SIMMONS, JOSH DORSI, JAMES W. DIAS and THERESA COOK, *University of California, Riverside.* — There is evidence that speakers can be identified based on isolated speaking style information. Sinewave auditory speech preserves speaker-specific phonetic properties which can support speaker identification in the absence of natural vocal quality (Remez et al., 1997; Sheffert et al., 2002). Analogously, observers can identify familiar faces using point-light displays containing reduced visible articulatory information (Rosenblum et al., 2007). We tested whether speaker learning is comparable across the two techniques. Nine utterances were videorecorded from ten speakers under point-light conditions. Audio signals were rendered into sinewave stimuli. Seventeen subjects trained to recognize speakers from point-light stimuli, while nineteen subjects trained on sinewave stimuli. All subjects underwent feedback and generalization tests. For both stimuli types, subjects learned to recognize speakers at better than chance levels, to comparable degrees, and at roughly the same rate. Results suggest analogous speaker learning for the two modalities possibly involving similar attunement to articulatory style.
Email: Lawrence D. Rosenblum, lawrence.rosenblum@ucr.edu

(4012)

Infants Perceptually Tune to Multisensory Speech. KATHLEEN SHAW and JESSICA GAAFAR, *University of Connecticut*, MARTIJN BAART, *Basque Center on Cognition, Brain, and Language*, HEATHER BORTFELD, *University of Connecticut.* — In the current studies, we tested infants' sensitivity to audiovisual native (English) and non-native (Spanish) speech samples in which the audio and visual speech streams were either congruent or incongruent. Infants were split into two age groups (<7 months, >7 months), and both initial preferential attending (Exp. 1) and overall preferential attending (Exp. 2) were measured. Results suggest that older infants, but not younger infants, initially looked longer to congruent AV-English displays than to congruent AV-Spanish displays (Exp. 1). Moreover, younger infants attended to a congruent visual display for both English and Spanish stimuli, while older infants did so only for English stimuli (Exp. 2). These results are consistent with previous work suggesting that infant sensitivity to audiovisual cues in the native language increases across the first year of life as a function of experience. These findings provide further support for the view that perceptual narrowing is a multisensory, domain-general process.
Email: Heather Bortfeld, heather.bortfeld@uconn.edu

(4013)

Temporal Perception of Overlapping Intervals Within and Across Senses: Evidence for a Weighted Sum of Segments Account. DANIEL BRATZKE, DONNA BRYCE and TANJA SEIFRIED-DÜBON, *University of Tübingen.* — This study investigated the way in which people temporally perceive two overlapping intervals. We conducted two unimodal experiments (in which each to-be-timed interval was visual) and one bimodal experiment (in which one to-be-timed interval was auditory and the other visual). We found that the estimate of the first interval was either unaffected or increased, and the estimate of the second interval consistently decreased with increasing overlap. This result pattern could be best explained by a weighted sum of segments account (Matthews, 2013). Accordingly, participants segment the two overlapping intervals into three segments, time these segments separately, and then combine them to estimate each interval. Importantly, since these segments are weighted according to their recency, estimates vary with the degree of overlap.
Email: Daniel Bratzke, daniel.bratzke@uni-tuebingen.de

(4014)

Vision During Tool Use Is Sufficient to Incorporate Tools Into Mental Body Representations. LUKE MILLER, *University of California, San Diego*, MATTHEW R. LONGO, *Birkbeck, University of London*, AYSE P. SAYGIN, *University of California, San Diego* (Sponsored by Lera Boroditsky). — We recently found that visual feedback during tool use may be critical for the embodiment of the tool: plasticity of tactile representations were abolished if subjects were blindfolded during tool use (Miller et al., 2014, JEP:HPP). Here, we asked if vision is sufficient for tool embodiment using the mirror box illusion. Participants viewed the reflection of their right arm as they used a grabber, leading to the illusion of seeing their left arm using the tool. Their actual left arm was stationary behind the mirror. Tactile perception was measured on the left arm before and after tool use, revealing significant tactile plasticity on the left arm, even though it remained completely stationary. Control studies ruled out general effects of visuo-proprioceptive decoupling or interhemispheric plasticity as

explanations of this effect. Thus we demonstrate that visual feedback during tool use is sufficient to incorporate a tool into the user's tactile body representations.
Email: Luke Miller, lumiller@ucsd.edu

• EVENT COGNITION •

(4015)

Listen to the Radio: The Role of Semantic and Non-Semantic Information for Understanding Audio-Dramas. ANNIKA MAURER, FRANK PAPENMEIER and MARKUS HUFF, *University of Tuebingen*. — Humans perceive dynamic information by segmenting the continuous stream of information into discrete events. The current study examined the role of semantic (e.g., speech) and non-semantic (e.g., ambient noise) information for the perception of audio-dramas. We compared segmentation behavior of participants speaking and understanding German (the language of the audio-drama) with participants who neither speak nor understand German. While German speakers could make use of semantic and non-semantic information during listening non-German speakers could only use non-semantic information. We hypothesized that non-German speakers' segmentation behavior is less hierarchically structured (one coarse event consists of several fine events) than those of German speakers. In two experiments 60 participants (German and non-German speakers) segmented an audio-drama into coarse and fine events. Consistent with our hypothesis we found that the hierarchical segmentation structure was less pronounced for non-German speakers than for German speakers. These results provide strong support for the importance of hierarchically structured event perception processes (including semantic and non-semantic information) for understanding dynamic events.
Email: Annika Maurer, annika.maurer@uni-tuebingen.de

(4016)

Effective Event Segmentation Improves Memory for Everyday Events Over Time. SHANEY FLORES, *Washington University in St. Louis*, HEATHER BAILEY, *Washington University in St. Louis, Kansas State University*, MICHELLE L. EISENBERG and JEFFREY M. ZACKS, *Washington University in St. Louis*. — When people observe activity, they spontaneously parse this activity into discrete meaningful events. Individuals with more normative segmentation show better subsequent memory for events. If effective segmentation leads to effective memory, then encouraging people to attend to effective segmentation should promote better memory. To test this hypothesis, participants viewed movies of everyday activities and were instructed to either segment the movies at natural event boundaries, to segment at points not aligned with event boundaries (i.e., every 15 s), or to passively view the movies. Recognition and recall memory for the movies were assessed after 10 minutes, 1 day, and 1 week. Participants instructed to segment at event boundaries demonstrated

better memory for the events than either comparison group up to 1 week later. This encoding manipulation could prove helpful for improving memory for everyday events.
Email: Shaney Flores, shaney.flores@gmail.com

(4017)

New Events Trigger Updating of Visual Properties. LEWIS BAKER and DANIEL LEVIN, *Vanderbilt University*. — Research exploring visual attention demonstrates that people are aware of only a small proportion of visual properties, and that these properties are tracked over a subset of moments in time. This makes it critical to understand how our cognitive system selectively leverages its limited capacity, such that properties are tracked only when they can support an understanding of meaningful events. Recent evidence suggests that features may be preferentially encoded when one event ends and another begins – an event boundary. Such evidence converges with film editing conventions that facilitate representation of a continuous event while effectively blinding viewers to edits within that event. Participants viewed a short film and answered questions assessing their awareness of visual properties. Incidental change detection increased significantly on event boundaries. Furthermore, perceptual cues associated with event boundaries, such as violations of cinematic heuristics for spatial continuity, were also sufficient to direct awareness to changing properties.
Email: Lewis Baker, lewis.j.baker@vanderbilt.edu

(4018)

Event Representation Across Different Time Scales. ELAINE NIVEN, MARIA K. WOLTERS and ROBERT H. LOGIE, *University of Edinburgh*. — A defined event with follow-up interviews was employed to assess episodic detail changes in event memory over time. At a busy street festival, participants took snapshots every three minutes for an hour. Participants then immediately recalled their experience; after a delay of a day, a week, or a month this interview process was repeated. We examined three factors of participants' representation of the event: which photographs they chose to keep, their methods for organizing photographs into meaningful groups, and the contribution of episodic detail to their recall. Participants kept on average only one less photo at second interview and the ratio of kept to deleted pictures was constant across time delays. However, participants arranged their photographs into groups that were more detail-driven at initial compared to subsequent interview. The Autobiographical Interview (Levine et al., 2002) scoring technique revealed the degree of episodic information contribution to recall across time delays.
Email: Elaine Niven, E.H.Niven@ed.ac.uk

(4019)

Events Organize Memory for Autobiographical Experience. CHRISTOPHER KURBY and LOGAN T. BEZY, *Grand Valley State University*. — People spontaneously segment their subjective perceptual experiences into discrete events, such as parsing a trip to the zoo as entering, visiting exhibits, and exiting. How we segment our experiences may be important for how we remember them. Here we tested whether

memory for one's autobiographical experience is organized by events. We tested this by giving participants a tour of six different buildings, then assessing memory with picture cues. We varied whether adjacent trials probed the same event (building) or different events (buildings). We found evidence for event-based organization: Retrieval of location and event information was better when assessing the same event as the previous trial than when switching to a new event. We also found that picture cues from the beginning of events served as better cues for recall of the tour than pictures from the middle of events. These findings suggest that memory for everyday autobiographical experience is organized by the perception of boundaries between events.
Email: Christopher Kurby, kurbyc@gvsu.edu

(4020)
Primacy and Recency Effects in Children's Memory for Instances of an Active, Repeated Event. DAYNA GOMES, KULNOOR K. SANDHU, HONGYUAN QI, CHELSEY M. LEE and DEBORAH A. CONNOLLY, *Simon Fraser University* (Sponsored by Dustin Calvillo). — Memory for repeatedly experienced events tends to show a serial position effect, with the first and last occurrences remembered best. Most research examining serial position effects have used word lists or simple tasks with adults. It is unclear whether these findings generalize to children who experience a participatory, repeated event and if recency and primacy effects will hold when something atypical occurs. Children (N = 146, 5-11 year olds) participated in four magic shows. For some children, a deviation occurred in the last instance. Children were interviewed 1-2 days after the last instance. Responses to cued recall questions indicated a clear primacy and recency effect across ages and deviation conditions: children were more correct and made fewer internal intrusion errors in their reports about sessions 1 and 4 than sessions 2 and 3. These findings suggest that previous research on serial position effects generalize to children's memory for participatory, repeated events.
Email: Dayna Gomes, dgomes@sfu.ca

(4021)
The Mental Organization of Permanent and Situational Character Attributes. KATHLEEN LARSON and DAVID COPELAND, *University of Nevada, Las Vegas.* — According to the situation model explanation of the fan effect (e.g., Radvansky, 2005), while an increase in the number of learned associations for a concept can result in an increase in retrieval times and error rates, there is typically not a fan effect when people are able to organize the related information into a single integrated situation model. The goal of this project was to investigate whether readers would integrate descriptions of characters into one coherent mental representation. Specifically, the current study examined whether situational and permanent attributes (either external or internal) from multiple sentences would be stored separately or integrated. Consistent with situation model theory, all experiments showed evidence of a differential fan effect; however, in some cases, integration did not occur in patterns that were predicted. For example, while complementary external attributes that

could occur simultaneously were integrated (e.g., brown hair, light skin, and overweight), people also integrated external attributes that conflicted (e.g., wearing boots, sandals, and high heels). Alternative explanations for these patterns of results are discussed.
Email: David Copeland, david.copeland@unlv.edu

(4022)
False Belief Reasoning Ability and Empathy: Evidence of a Relationship From the N400. JAMES CANE, HEATHER FERGUSON, MICHELLE DOUCHKOV and DANIEL WRIGHT, *University of Kent.* — Interpreting others' actions relies on an understanding of their current mental state. Here we report a false belief study using ERPs where participants (N=28) read contexts that described a character having a true (TB) or false belief (FB) about an object's location. A target sentence described where that character would look for the object - including a sentence-final noun that was either consistent or inconsistent with the character's belief. When the character held a TB about the object's location, the N400 waveform was more negative-going for belief inconsistent vs. consistent critical words [t=2.79, p<.01]. However, the opposite pattern was found when the character held a FB about the object's location [t=-2.39, p<.03]. Intriguingly, analyses between the N400 inconsistency effect and empathy scores showed a significant correlation for FB (r=-.51, p<.003) but not TB, indicating that high empathisers successfully interpreted events according to the character's FB, while low empathisers interpreted events egocentrically.
Email: James Cane, j.e.cane@kent.ac.uk

(4023)
The Impact of Music on Neural Activity During Suspenseful Film Viewing: An fMRI Study. MATTHEW BEZDEK, *Georgia Institute of Technology*, WILLIAM WENZEL, *Stony Brook University*, ERIC SCHUMACHER, *Georgia Institute of Technology.* — The theorized functions of film music include shading the emotional tone of narrative events and directing attention to important onscreen information. Behavioral research suggests that the congruency between the mood of music and the mood of narrative content can affect comprehension and memory encoding (Boltz, 2004). We investigated brain activity related to increases in narrative suspense, contrasting mood-congruent suspenseful music with mood-incongruent calm music and no music conditions. While undergoing fMRI, participants viewed film excerpts edited for these three music versions. Following the scan, participants completed a surprise recall test for narrative events. We found that mood-congruent music produced increased activity in occipital visual processing regions, compared to mood-incongruent and no music conditions. Although insensitive to the congruency of the music, memory for film events was influenced by the level of narrative suspense. These results add to our understanding of how music influences the cognitive processing of narrative films.
Email: Matthew Bezdek, mbezdek@gatech.edu

(4024)

Oculomotor Correlates of Event Structure in Everyday Activity. MICHELLE L. EISENBERG, JEFFREY M. ZACKS, MOBOLAJI FOWOSE and SHANEY FLORES, *Washington University in St. Louis* (Sponsored by Rose Zacks). — The ability to segment ongoing activity into meaningful units is integral for event understanding and memory. At boundaries between events, changes in visual information typically occur at an accelerated rate, and the visual system may have to shift from a mode of processing ongoing information sparsely to a mode of intensive visual processing. If that is the case, we ought to see this shift reflected in the pattern of saccades and changes in pupil size around event boundaries. To investigate, 25 naïve adults passively watched movies of everyday events while their eyes were tracked and then segmented these movies. During passive viewing, we observed larger saccades around the times viewers would later identify as event boundaries. We also investigated the relationship between visual properties of the movies and oculomotor measures. Our results suggest that the oculomotor system likely plays a role in ongoing comprehension by shifting the patterns of saccades around event boundaries to allow for intensive capture of rapidly changing visual information.
Email: Michelle L. Eisenberg, mleisenb@wustl.edu

(4025)

If Target Detection Boosts Memory for Context, Then What About Reward? KHENA SWALLOW and STAV ATIR, *Cornell University*. — The context of a goal-relevant item is remembered better than the context of a distracting item. In this study we examine a natural explanation for this effect: that it reflects enhanced memory for reward and its context. In one experiment, participants learned to associate a color (e.g., blue) with a monetary reward. They then monitored a series of colored squares (e.g., blue and green squares) for a target (e.g., red square) as they encoded a series of pictures for a later memory test. A second experiment asked participants to perform the detection task while they encoded pictures of rewarding and neutral objects. Despite finding clear and replicable effects of target detection on picture memory, we found no effects of rewarding stimuli. These data provide additional, but preliminary, support for the claim that the decision to respond to goal-relevant stimuli boosts the encoding of concurrent information.
Email: Khena Swallow, kms424@cornell.edu

• AUTOBIOGRAPHICAL MEMORY •

(4026)

Will You Marry Me? Consistency, Phenomenology and Narrative Characteristics of Positive Flashbulb Memories. MÜGE ÖZBEK, MÜGE ÖZVAROL and ALI TEKCAN, *Bogazici University*. — Only a few studies exist on flashbulb memories for positive events. To address consistency, narrative and phenomenological characteristics of flashbulb memories associated with positive events, we asked young adult couples to describe the circumstances in which they (were) proposed marriage. As a control event, they were also asked to describe the first time the parents met. Marriage proposals were recalled better than the control event and were rated higher in measures of recollection and imagery. Moreover, both partners showed very detailed and comparable recall of the circumstances of the marriage proposal. Partners' memories also showed substantial consistency. The only differences between the partners were that women reported higher visual imagery and covert rehearsal ("thought about") of the proposal.
Email: Ali Tekcan, ali.tekcan@boun.edu.tr

(4027)

Narrating as an Observer: The Effect of First- vs. Third-Person Perspective on Autobiographical Memory in a Non-Clinical Population. XUAN GU and CHI-SHING TSE, *Chinese University of Hong Kong*. — Autobiographical memory can be retrieved from the first-person or third-person perspective. In our study, we manipulated the narrative perspective (i.e., first-person vs. third-person pronouns—I vs. He/She) in autobiographical memory recall and examined how this influenced university students' retrieval perspective, and in turn modulated their emotional intensity of positive and negative memory. Psychological distance, other distance-related characteristics of memory (e.g., memory age), and participants' depression level were measured. Results showed that the first- (or third-) person pronouns in recall triggered the first- (or third-) person retrieval perspective in all participants, but the third-person pronouns only reduced the emotional intensity of negative memory in high-depression participants. While psychological distance mediated the relationship between memory age/vividness and emotional intensity of negative memory in high-depression participants, neither psychological distance nor other distance-related characteristics mediated the relationship between narrative perspective and emotional intensity. The implications of these findings on the construal-level theory are discussed.
Email: Chi-Shing Tse, cstse@cuhk.edu.hk

(4028)

Allocation of Attention in the Flanker Task Is Modulated by Relevance of Intentions. ANNA-LISA COHEN, *Yeshiva University*, GESINE DREISBACH, *University of Regensburg*. — Participants performed an Eriksen Flanker task with an embedded prospective memory (PM) task (instructed to press F1 if they see the pre-specified cue). In Study 1, participants were randomly assigned to a standard PM condition or a delayed PM condition. We examined whether attention would be captured by the PM cue in the delayed PM condition even though it was not relevant. In study 2, we compared a PM condition (exactly as in Study 1) to a PM forget condition in which participants were told at a certain point during the Flanker task that they no longer had to perform the PM task. Results from both studies demonstrated the flexibility of monitoring as participants were able to switch off attending to PM cues when the PM task was delayed or when they were instructed to forget the PM task.
Email: Anna-Lisa Cohen, acohen11@yu.edu

(4029)
Anchoring Effects on Earliest Autobiographical Memories.
MARINO MUGAYAR-BALDOCCHI, ANTHONY
BISHARA and DANIEL GREENBERG, *College of Charleston*.
— In this study, we investigated the malleability of earliest
autobiographical memories, specifically whether malleability
could result from a single word change in a question.
Previous studies have shown that social manipulation affects
autobiographical memories, but the effect of nonsocial
methods on the episodic component of memory has remained
largely unexplored. We specifically used the anchoring effect
to influence the participants' autobiographical memory.
Participants (n=438) were recruited nationwide from
Mechanical Turk. They experienced a high anchor, a low
anchor, or no anchor. Then, participants were asked to give
an exact age estimate of their earliest memory. The reported
age of earliest memory was significantly influenced by the
high anchor. Thus, dating of early autobiographical memories
was susceptible to subtle anchoring effects. Additionally,
anchoring effects were most pronounced in third-person
perspective memories. These results have implications for the
validity of childhood recollections in legal contexts.
Email: Anthony Bishara, bisharaa@cofc.edu

(4030)
**Does Self-Deception Enhance the Belief That the
Retelling of Personal Memories Is Helpful?** KAZUHIRO
IKEDA, *Shokei Gakuin University*. — This study examined
the psychological variables that increased the belief that the
retelling of personal memories is helpful. 196 undergraduate
students responded to a survey consisting of 20 items that
measured belief that the retelling of the past is helpful, 12 items
measuring self-deception, 14 items measuring resilience, and
12 items measuring the ability to use humor to cope with
interpersonal stress. Path analysis was conducted by linear
regression. The results revealed a positive correlation between
self-deception and the belief that retelling one's past is a useful
tool for increasing one's resilience. Immoderate self-deception,
on the other hand, decreased the belief that retelling the past
is useful in this way. This suggests that the success of positive
perspective switching when recalling negative events requires
a moderate level of self-deception.
Email: Kazuhiro Ikeda, hiro272003@gmail.com

(4031)
**Playing to the Crowd: Conversation Partner Determines
Temporal Distance of Past and Future Autobiographical
Events.** SARAH DRIVDAHL, RACHEL HIATT and
MATHEW ARNOLD, *Northwest University*, IRA HYMAN,
Western Washington University. — The extension of the
memory event horizon is partly determined by the social
context. We asked participants to think about different
possible conversation partners with whom to share past
and future events. Participants thought about someone they
talked with daily, only once or twice per month, or only two
to four times per year. Participants then retrieved three past or
future autobiographical events that they would share with that
person during their next conversation. The temporal distance
was determined by the potential conversation partner such

that people chose events further away for less frequent
conversation partners. Future events were also rated as more
important and positive whereas past events were rated as
more clear. Autobiographical memory regularly serves social
functions particularly in terms of updating important others
about past and possible future events.
Email: Sarah Drivdahl, sarah.drivdahl@northwestu.edu

(4032)
**Changes in Remembering as a Function of Identity: A
3-Year Longitudinal Study.** SAMANTHA DEFFLER and
DAVID RUBIN, *Duke University*. — Personal memories are
not exact replicas of events. Rather, remembering is shaped
by our current emotions, motivations, and identity. We
followed the trajectories of undergraduates who entered their
first year of college with a particular academic identity (pre-
med students). Detailed narratives and phenomenological
characteristics of three memories related to this identity and
three control memories were collected within one month of
the participant's arrival at college. Later, those that transitioned
out of pre-med (and matched controls; N = 28) rated the
same six memories. For the transitioned participants, the
identity-relevant memories were rated less central to their
lives; no such change was found for the control subjects.
When remembering the identity-relevant events, transitioned
students reported less reliving and less emotionality than the
control students. This is the first longitudinal study to show the
theoretically-predicted pattern of change when remembering
events no longer central to one's identity.
Email: Samantha Deffler, samantha.deffler@duke.edu

(4033)
**How Do We Remember Repeated Experiences? A Case of
Dancers.** BERIVAN ECE, SEZIN ONER and SAMI GULGOZ,
Koç University. — Studies on autobiographical remembering
usually focus on unique, first-time, last-time, emotional,
or important life events. The present study contributes to
limited research on memory for repeated life events. A
total of 57 dancers (25 female) reported memories of three
competitions and shows (Age, M = 27.65, SD = 4.17). They
further reported memories for a movie as a control event. For
each event they reported, they were asked to rate the event
characteristics and phenomenological qualities. Results
indicated that competition, show, and movie memories
were different in event qualities such as importance and
emotional intensity. However, there were no differences in the
phenomenology of remembering. For dancers, remembering
shows and competitions were as ordinary as remembering a
movie. Analyses of retrieval order showed that first reported
events were the most important, emotionally positive, and
intense memories. Event qualities declined as a function of
the retrieval order.
Email: Sami Gulgoz, sgulgoz@ku.edu.tr

(4034)
What You Just Remember Changes the Ambiguity. SEZIN
ONER, BERIVAN ECE and SAMI GULGOZ, *Koç University*.
— Based on a model of autobiographical remembering (Oner &
Gulgoz, 2014), we examined the influence of autobiographical

memory characteristics on perception of ambiguous situations. We focused on frustration and achievement- related memories and tested their influence on risk behavior. There were 159 participants randomly assigned to two conditions (GA or GB). They reported memory of an achieved goal (GA condition) or a blocked goal (GB condition). After narrating the memory, they rated memory characteristics and judged valence of ambiguous scenarios. For the GB group, higher significance of the event and more frequent rehearsal predicted more negative attitudes towards ambiguous situations. For the GA group, however, phenomenology at retrieval was more vivid and individuals tended to perceive ambiguous situations more positively. Findings confirmed our prediction that the effect of autobiographical retrieval varies depending on the qualitative aspects of the memory.

Email: Sezin Oner, seoner@ku.edu.tr

(4035)

The Characteristics of Remembered and Imagined Future Events That Serve a Directive Function. MEVAGH SANSON, *Victoria University of Wellington*, ERYN J. NEWMAN, *University of California, Irvine*, MARYANNE GARRY, *Victoria University of Wellington* (Sponsored by Todd Jones). — People can mentally travel through time to relive experiences from their past and "pre-live" experiences that could happen in their future. People report using specific events they remember to help guide, or "direct" their behavior in the present. Do people also use imagined future events to direct their behavior and, if so, how do these directive future events compare to directive memories? Subjects described a remembered event or an imagined future event that they had thought of to help them, and rated various phenomenological and memorial characteristics of their event. Across two studies, directive future events were reported to be just as vivid as directive memories, and even more emotional, more positive, and more frequently rehearsed. These results suggest that imagined future events do serve a directive function, but perhaps not in the same way as remembered events. The consequences of imagining future events on behavior warrant further study.

Email: Mevagh Sanson, mevagh.sanson@vuw.ac.nz

(4036)

Goal Strength and Recall of Autobiographical Memory. STEPHANIE BERGER, *College of Mount St. Vincent.* — Autobiographical memory helps us track progress towards goals. In a prior study, students with strong general academic goals recalled a higher percentage of good grades than students with weak academic goals, but all students had low recall for poor grades. This study tested the importance of more specific academic goals for recall of autobiographical memory of grades. During the last week of the spring semester, 92 students from 14 psychology classes recalled exam and quiz grades and completed measures of academic goals—to master the material, to gain a good grade or to avoid a bad grade—for one specific course. Multilevel logistic regression will determine to what extent different academic goals

contribute to the likelihood of recalling good and poor grades after controlling for individual differences in GPA and grade rehearsal. If specific goals predict recall accuracy as expected, results will support the organization of autobiographical memory by goals.

Email: Stephanie Berger, stephanie.berger@mountsaintvincent.edu

(4037)

An Examination of the Impact of Methodology on Autobiographical Memory Specificity. NICOLA HERTING and JOHN-PAUL LEGERSKI, *University of North Dakota*, SARAH BUNNEL, *Ohio Wesleyan University*, BETH BRAY and THOMAS PETROS, *University of North Dakota*. — There is overwhelming evidence for the association between reduced autobiographical memory (AM) specificity and impaired psychological wellbeing. Methods for assessing AM specificity are variable; tools include sentence completion tasks, semi-structured interviews, and the most commonly used method, the Autobiographical Memory Test (AMT). The AMT employs a series of cue words, in which individuals are asked to provide memories of specific, one-time personal events in response to each cue. However, a number of limitations with the AMT have been raised (Griffith, Sumner, Raes, Barnhofer, DeBeer, & Hermans, 2012). This study was designed to experimentally compare the specificity of AMs recalled on the AMT to a naturalistic and open-ended prompt asking participants to identify a most important AM. Furthermore, this allowed exploration of whether the AMT captures AMs identified as most important. Data from 177 participants was collected on the AMT, Most Important Memories Scale (MIMS), and measures assessing psychopathological symptoms and executive functioning.

Email: Nicola Herting, nicola.rodwell@my.und.edu

(4038)

Memory Search With Short and Long Lists Viewed From the Perspective of an Exemplar-Familiarity Model. ROBERT NOSOFSKY, GREGORY COX, RUI CAO and RICHARD SHIFFRIN, *Indiana University*. — Experiments were conducted to investigate predictions from a modern exemplar-familiarity model of memory search. Subjects saw lists of from 1 to 16 items followed by a single item recognition probe: a target (from the list) or a foil. Relations between targets and foils across trials were manipulated. In a varied-mapping (VM) condition, targets and foils could switch roles across trials; in a consistent-mapping (CM) condition, targets and foils never switched roles; and in an all-new (AN) condition, on each trial a completely new set of items formed the memory set. In the VM and AN conditions, mean correct response times (RTs) and error proportions were curvilinear increasing functions of memory set size. In the case of old probes, however, the increase in RTs was due almost entirely to effects of changing study-test lags across different memory set sizes. The exemplar-familiarity model was used to account for the complete set of results.

Email: Rui Cao, caorui.beilia@gmail.com

• RECALL II •

(4039)

Elaborative Retrieval: Do Semantic Mediators Improve Memory? MELISSA LEHMAN and JEFFREY KARPICKE, *Purdue University*. — The elaborative retrieval account of retrieval-based learning proposes that retrieval enhances retention because the retrieval process produces the generation of semantic mediators that link cues to target information. We tested two assumptions that form the basis of this account: that mediators are more likely to be generated during retrieval than during restudy and that the generation of mediators facilitates later recall of targets. We conducted a series of experiments to measure the generation of mediators during retrieval and restudy and to examine the effect of the generation of mediators on later target recall, and we found that the generation of mediators was not more likely during retrieval (and may be more likely during restudy), and the activation of mediators was unrelated to free recall of targets and was negatively related to cued recall of targets, contradicting both assumptions of the elaborative retrieval account.
Email: Melissa Lehman, lehman8@purdue.edu

(4040)

The Role of Retrieval During Study: Evidence of Reminding From Self-Paced Study Time and Overt Rehearsal. GEOFFREY LOGAN MCKINLEY, AARON BENJAMIN and BRIAN ROSS, *University of Illinois*. — The concept of reminding is central to theorizing in many higher-order cognitive domains, including category learning and generalization. Recently, evidence for reminding has been found in simple memory tasks. The reminding effect (Tullis, Benjamin, & Ross, 2014) describes the increase in recall for a study word when a related word is presented later in the study list. The present research seeks evidence of reminding during encoding, and relates those study behaviors to the more remote consequences at test. We examined self-paced study time (E1) and patterns of overt rehearsal (E2) for related and unrelated pairs of words interspersed throughout a study list. In both experiments, evidence for reminding was apparent during encoding, and the reminding effect was present at retrieval. In E1, more study time allotted to an associate of an earlier item predicted better memory for its earlier counterpart. Similarly, in E2, additional rehearsal of an earlier item induced by a later associate predicted better memory for the earlier item. These two different online measures of reminding at study help establish a causal link between the action of reminding at study and its later consequences at test.
Email: Geoffrey McKinley, Geoffmck59@gmail.com

(4041)

The Effect of Sleep on Savings in Relearning. EMILIE GERBIER, *Université Lyon*, OLIVIER KOENIG and STEPHANIE MAZZA, *Université Lyon 2*. — Memory is better after an episode of sleep than after a wake interval. What is the effect of sleep interspersed between learning and relearning of the same material? French subjects practiced a set of Swahili-French vocabulary pairs through cued recall with feedback until each pair was correctly recalled exactly once. They practiced again the same items 12 hours later, after either a night of sleep or a waking day. At relearning, the Sleep group performed better (64%) than the Wake group (46%) during the first re-encounter with the items, and needed fewer cycles through the list (4.24 versus 6.90) before they could correctly recall exactly all the items of the list. They also outperformed the Wake group in a final cued recall one week later (96% versus 70%). Thus, a night of sleep between study and relearning leads both to better savings in relearning and to a better delayed memory.
Email: Emilie Gerbier, Emilie.Gerbier@univ-lyon2.fr

(4042)

Delayed Testing Eliminates the Beneficial Effect of Sleep on Memory. MEIKE KRONEISEN, *Universität Mannheim*, CAROLINA E. KUEPPER-TETZEL, *Washington University in St. Louis*. — Several studies have demonstrated a beneficial effect of sleep compared to wakefulness on memory performance. This sleep effect is generally attributed to a consolidation process that reactivates fragile memory traces during sleep, thereby stabilizing and strengthening recently encoded contents. Another strategy that has been shown to benefit memory performance and to reduce forgetting is delayed testing of the to-be-learned material. In our experiment, we examined to what extent delayed testing alters the effect of sleep on memory. Participants were administered a test either immediately after practice or two hours later; final memory performance was assessed 12 hours after a period of sleep or wakefulness. Our results reveal that the benefit of sleep was conditional on the time of the first test after practice: While immediate testing yielded the well-known sleep benefit, delayed testing eliminated the benefit of sleep on memory.
Email: Meike Kroneisen,
kroneisen@psychologie.uni-mannheim.de

(4043)

A Sensitive Measure for Cue-Independent Forgetting. THOMAS M. BOBBITT and DANIEL KIMBALL, *University of Oklahoma*, MARTHA MANN, *University of Texas, Arlington*. — Researchers disagree as to whether people can inhibit memories. Unequivocal support for inhibition would exist if cue-independent forgetting occurs; however, current evidence is inconsistent. Thus, this experiment was designed to provide a sensitive measure for cue-independent forgetting. Subjects first studied category-exemplar pairs, then attempted to generate new exemplars for half of the studied categories, and lastly were tested for memory of the exemplars they originally studied. If inhibition occurs, then half of the studied exemplars should be inhibited (i.e., Rp- items) when generating new exemplars, whereas the other half should be unaffected (i.e., Nrp items). During testing, subjects were given extra-list cues that could each be used to retrieve either an Rp- or an Nrp item. If Rp- items were inhibited, then fewer of them should be reported first in comparison to Nrp items. Results are discussed in terms of inhibition theory.
Email: Martha Mann, mann@uta.edu

(4044)

Adaptive Memory: Animacy Enhances Free-Recall but Impairs Paired-Associates Recall. EARL Y. POPP and MICHAEL SERRA, *Texas Tech University*. — Adaptive-memory theories suggest that human memory systems evolved abilities that helped our species to survive. For example, animals were relevant to our survival, and recent research has demonstrated a memory advantage for animate versus inanimate items on free-recall tests. If human memory evolved to better remember animate things, however, then we expect this effect of animacy (the characteristic of animate things) to extend to other measures of memory. As such, we compared the effects of animacy on free-recall with that on paired-associates recall. Although we successfully replicated the enhancement effect of animacy on free-recall, participants' paired-associates recall was actually impaired for pairs containing any animate words compared to pairs that did not contain any animate words. These findings rule out a generalized positive effect of animacy on human memory. Instead, we suggest that these findings indicate an effect of animacy on attention that aids free-recall encoding but impairs paired-associates encoding.
Email: Michael Serra, michael.serra@ttu.edu

(4045)

The Effect of Stimulus Presentation Time on the Recall of Sounds and Words. ROBERT CRUTCHER, *University of Dayton*. — Environmental sounds are remembered better than words (e.g. a recording of someone laughing vs. the word "laughing"). Dual Coding Theory (Paivio, 2007) explains this advantage of sounds, as well as that of pictures, by positing that a picture (or sound) is more likely to activate a corresponding verbal code than a word is to activate its corresponding visual or auditory codes. DCT also correctly predicts that with shorter presentation times the probability of activating verbal codes decreases and the memory advantage of pictures over words is reduced or eliminated (Paivio & Caspo, 1971). An initial test of this prediction for sounds and spoken words (Crutcher, 2013) found that sounds were recalled better than words, regardless of presentation time (4, 6, or 8 seconds). The current follow-up study, employing a stronger manipulation of stimulus presentation time (3, 6, and 9 seconds) found that sounds were always recalled better than words.
Email: Robert Crutcher, crutcher@udayton.edu

(4046)

Overloading the Cue: The Cost of Expertise Is Domain-Relevant Memory Intrusions. PATRICIA DEWINSTANLEY, SARAH COX, HANNAH GOLAY and TALIA GREENBERG, *Oberlin College*. — Not surprisingly, domain experts remember more domain-relevant information than non-experts. Recently, Castel, McCabe, Roediger, and Heitman, (2007) demonstrated that experts' enhanced memory comes with a cost, specifically increased domain-relevant intrusions. Like Castel, et al., we demonstrated that experts correctly recalled more domain-relevant information. However, we found that non-experts made as many intrusions as experts—but, the type of intrusions differed with experts making domain relevant intrusions and non-experts making domain non-

relevant intrusions. In a second experiment, when participants studied lists of items from two domains (e.g., "quarter, play, score" which are from both sports and music), experts made expertise related intrusions, but made little or no intrusions in the other domain. Moreover, cueing participants with one domain type (e.g., sports) at study and cueing with either the same domain or both related domains at test eliminated both benefits and costs of expertise. We discuss a cue-overload account of our results.
Email: Patricia deWinstanley, pdewinst@oberlin.edu

(4047)

Dual-Retrieval Conceptions of Free Recall. CARLOS GOMES and CHARLES BRAINERD, *Cornell University*. — The notion that retrieval is supported by recollection and familiarity is a central tenet of contemporary dual-process theories of recognition. However, in free recall, it has been claimed that retrieval is purely recollective, which is also consistent with a tradition that defines recollection itself as a recall-like process. In the dual-retrieval model, on the other hand, recall is controlled by recollective and nonrecollective forms of retrieval, and therefore, it assumes that recall is an impure measure of recollection. In three experiments, we tested this hypothesis using three traditional methods of measuring dual-retrieval processes—remember/know judgments, confidence ratings, and source judgments—as well as the dual-retrieval model. Consistent with the dual-retrieval model, estimates of nonrecollective retrieval were consistently above zero, and an alternative model that conceptualizes recall as a process pure measure of recollection was rejected by wide margins. In addition, remember judgments and confidence ratings were positively correlated with the dual-retrieval model's estimates of recollective retrieval rather than its estimates of nonrecollective retrieval.
Email: Carlos Gomes, cf365@cornell.edu

(4048)

Can We Protect Our Own Ideas From Thinking-Induced Forgetting? ANNIE STANFIELD DITTA and BENJAMIN STORM, *University of California, Santa Cruz*. — The present study examined participants' ability to generate and remember creative ideas. Using a modified version of the Alternative Uses Task, we found that instructing participants to think of new uses for an object caused them to forget uses for that object that they had previously generated, and that such forgetting occurred even when participants were highly motivated to remember their old uses. Moreover, forgetting was observed not only when participants generated new uses, but also when they were asked to think about or evaluate new uses more generally. We did find some evidence, however, at least under certain conditions, that participants could protect themselves from thinking-induced forgetting, such as when they used their old uses as hints to help them think of new uses. Taken together, results suggest that people may be just as susceptible to forgetting their own ideas as they are to forgetting the ideas of others.
Email: Benjamin Storm, bcstorm@ucsc.edu

(4049)
The Tip-of-the-Tongue Heuristic: Inferring Characteristics of Unretrieved Words From the Presence of a Tip-of-the-Tongue State. ALEXANDER CLAXTON and ANNE CLEARY, *Colorado State University*. — This study shows that participants use the presence of a tip-of-the-tongue (TOT) state to infer that an unretrieved word likely has characteristics consistent with high word fluency. When reporting a TOT state, participants judged an unretrieved word as more likely to have previously appeared in a darker and clearer font (Experiment 1) or in a larger font (Experiment 2). This is not because increased word perceptibility at encoding led to TOT states: Increased word perceptibility at encoding (e.g., clearer or larger font) did not increase the likelihood of a TOT state for words whose retrieval later failed; additionally, the TOT state was undiagnostic of unretrieved words' relative perceptibility at prior encoding. The full pattern of results suggests that during the uncertainty of a word's retrieval failure, the presence of the TOT state itself is used to infer a high likelihood of fluent word characteristics for that word.
Email: Alexander Claxton, aclaxton@rams.colostate.edu

(4050)
The Accessibility of Subjectively Important Information From Memory. AIKATERINI STEFANIDI and GENE BREWER, *Arizona State University*. — Very little theoretical and empirical development exists to account for the organization and search of subjectively important information stored in memory. We addressed this topic by examining recall organization for subjectively important information using semantic fluency tasks. All participants first performed an animal fluency task and then half of the participants performed an importance fluency task ("Category: Important Things") and the other half performed an unimportance fluency task ("Category: Unimportant Things"). We will report a comparative analysis between the dynamics of memory search between animals and important/unimportant objects. Similar to the animal fluency task, the importance fluency results are consistent with a two-stage cyclical search process where individuals first generate an overarching category (i.e. important people, values, etc.) and then search for specific items within that category. These results suggest that semantic memory can be organized and searched along the dimension of subjective importance.
Email: Aikaterini Stefanidi, astefan2@asu.edu

(4051)
Predicting Memory Retention From an Initial Quiz. DANIEL CORRAL, ERICA V. ROZBRUCH, ALICE F. HEALY and MATT JONES, *University of Colorado, Boulder*. — How well does memory performance predict success on a later test? The answer may depend on how memory is initially assessed. This study examined how two types of memory assessment (recall and recognition) predict subsequent retention. Subjects studied and were quizzed on materials from a research methods lecture. Quiz format differed by condition: One group did recall (typing their answers), one did recognition (multiple choice), and one did recall followed by recognition; all groups answered the same set of

questions. Subjects then completed two recognition memory tests (immediately after being quizzed and a week later) comprising old and novel items. Although no differences were found in overall test performance among conditions, quiz performance predicted test performance at the subject level, at the item level, and within subjects and items. Predictiveness was highly specific: Recognition quizzes (which matched the test format) predicted better than recall quizzes, and old test questions were predicted better than new questions on the same concepts. These findings are particularly relevant to formative assessment in educational settings, in which ongoing evaluation is used to guide allocation of subsequent instruction time.
Email: Daniel Corral, daniel.corral@colorado.edu

(4052)
Relational Encoding and Memory for Order. TANYA JONKER and COLIN MACLEOD, *University of Waterloo*. — McDaniel and Bugg (2008) proposed that relatively uncommon stimuli and encoding tasks encourage elaborative encoding of individual items (item-specific processing) whereas relatively common tasks encourage associative encoding among list items (relational processing). Relational processing is thought to result in better memory for the serial order of a study list. We examined the effects of several encoding tasks on memory for order and found that those requiring some type of response (item-specific or otherwise) impaired memory for order, unless they involved relational processing. These findings suggest that an encoding task will disrupt order memory only when it is both attention-grabbing (either through its atypicality or by requiring an overt response) and item-specific (i.e., does not encourage relational encoding among list items).
Email: Tanya Jonker, trjonker@uwaterloo.ca

(4053)
Body Mass Index and Memory Function in Young Adults. MITCHELL METZGER, MORGAN MYERS, EMILY EMBRESCIA and DAVID F. VANATA, *Ashland University*. — Prior research has shown the relationship between high body mass index (BMI) and reduced cognitive function in older adults; however, fewer studies have reported similar findings in younger individuals. One explanation is that reduced cognitive function in in high-BMI older adults is secondary to diabetes, high blood pressure, and other physical ailments that are more common in overweight, older individuals. The aim of this study was to further investigate the BMI-Cognition relationship among a sample of college-aged young adults. Participants (N=101) completed several cognitive tasks (story recall, directed forgetting (DF), and picture recognition using food and non-food stimuli), and were measured for height and weight as well as waist/hip circumference. While no significant differences were observed between normal-BMI and high-BMI participants on these measures, significant differences in processing of food-related stimuli were observed. For DF and picture recognition, participants made significantly more false alarms and had longer response times for food-related stimuli

compared to non-food stimuli. Additionally, participants remembered significantly fewer food-related items from the story recall procedure.
Email: Mitchell Metzger, mmetzger@ashland.edu

(4054)
External Context and Directed Forgetting. MORGAN MYERS and MITCHELL METZGER, *Ashland University*. — Sahakyan and Kelly (2002) showed that changes of internal context, in the absence of a forget cue, produced directed forgetting (DF) results similar to that observed in list method DF. Thus, one mechanism that produces DF effects may be the result of changes in context. This experiment was designed to determine if changes of external context (in the absence of forget cues) could also produce the same DF effects as those observed by Sahakyan et al. (2002). Using a 2×2 between subjects design, 148 participants studied words on List 1 and were given instructions to either remember or forget those items for a later memory test. Prior to exposure and testing on a second group of words on List 2, one-half of the participants were moved to a different room (changed external context) while the other one-half of participants studied and recalled List 2 in the same room (same external context). Results show that the expected DF effects were observed, but no significant effect of changing contexts was revealed. This suggests that (1) the context change wasn't salient enough to produce the DF effects observed by Sahakyan and Kelly (2002), or (2) external context is not as critical to DF as is internal context.
Email: Morgan Myers, mmyers13@ashland.edu

(4055)
Expertise Effects in the Moses Illusion: Detecting Contradictions With Stored Knowledge. ALLISON CANTOR and ELIZABETH MARSH, *Duke University*. — Are experts better at catching contradictions with stored knowledge? Biology and History graduate students answered questions about biology and history that contained erroneous presuppositions ("What year did Thomas Jefferson write the Constitution?"; variant of the Moses Illusion, Erickson & Mattson, 1981)), noting if questions contradicted the world. In 3 Experiments, expertise helped: participants were less likely to fall for the illusion in their domain of expertise. Surprisingly, experts also missed a third of contradictions in their expert domain. The main benefit of expertise was that experts were less likely to later repeat the errors. Drawing attention to the presuppositions reduced the illusion equally regardless of expertise. Our findings support the idea that experts also use a "partial match" strategy (Reder & Kusbit, 1991), where they only partially match questions to knowledge structures, causing them to miss occasional discrepancies.
Email: Elizabeth Marsh, emarsh@psych.duke.edu

(4056)
Is Anchorage the Capital of Alaska: Catching Errors With Recent Experience vs. One's Own Knowledge. KATHLEEN ARNOLD, *Duke University*, SHARDA UMANATH, *Washington University in St Louis*, ELIZABETH MARSH, *Duke University*. — In daily life, we are exposed to errors from many sources, including other people, the internet,

books, and television. Does one's ability to notice such errors depend upon whether the error contradicts one's stored knowledge (e.g., that Juneau is the capital of Alaska) versus one's episodic memory (e.g., remembering your friend's claim about the capital of Alaska at trivia night)? The first judgment likely depends on whether the claim elicits fluent processing, whereas the second involves recollecting back to a particular time and place. In three studies, we compared these two situations. Subjects studied well-known facts and contradictions of others before reading a story containing factual errors. Critically, one group of subjects indicated whether story sentences contradicted the earlier study phase, whereas another group indicated if sentences contradicted their own knowledge. Subjects were better at setting aside their stored knowledge than the recent study episode, with consequences for error detection.
Email: Kathleen Arnold, kathleen.arnold@duke.edu

• TESTING EFFECTS •

(4057)
Extending the Boundaries of the Testing Effect: A Look at Verbal and Nonverbal Components. CHAD FERNANDEZ and SHANA CARPENTER, *Iowa State University*. — Retrieval practice has been shown to produce positive effects on memory for verbal material, but its effects on memory for complex visuospatial material are less certain (e.g., Carr et al., 2014). The current study explored whether verbal processing is a key contributor to learning from retrieval. Participants learned a series of complex line drawings that, when rotated 90 degrees, spelled a familiar word. Participants learned these line drawings via either retrieval practice (draw from memory) or restudy (copy), and they were either informed or uninformed of the embedded words. Performance on a final test requiring participants to draw the images indicated that overall accuracy, as well as the advantage of retrieval practice over restudy, depended on the degree to which participants could process the image verbally as well as visually.
Email: Chad Fernandez, chadfz@iastate.edu

(4058)
Repeated Quizzing Enhances Learning: The Case of Spelling. ANGELA JONES, *John Carroll University*, LIANE WARDLOW-LANE, CRISTINA ZEPEDA, STEVEN PAN and GAIL HEYMAN, *University of California, San Diego*, JOHN DUNLOSKY, *Kent State University*, TIMOTHY RICKARD, *University of California, San Diego*. — In three experiments, we compared the effectiveness of rainbow writing and practice quizzing, two common methods of spelling instruction. In Experiment 1, second graders completed two days of spelling practice, followed by spelling tests one day and five weeks later. On both tests, spelling accuracy for words practiced with quizzing was higher than for words practiced with rainbow writing. In Experiments 2 (with second graders) and 3 (with first graders), students completed two days of spelling practice followed by a spelling test one day later. Results replicated Experiment 1; spelling accuracy was higher for words

practiced with quizzing. Furthermore, students endorsed both liking and learning more from quizzing practice than rainbow writing. Thus, results demonstrate that practice quizzing is a more useful and engaging practice method than rainbow writing and extend well-established testing effects to children's spelling.
Email: Angela Jones, acjones@jcu.edu

(4059)

Pretesting Directs Attention to Structure-Based Features of Statistics Concepts. FARIA SANA, *McMaster University*, COURTNEY CLARK, NICHOLAS SODERSTROM, ELIZABETH BJORK and ROBERT BJORK, *University of California, Los Angeles*, JOSEPH KIM, *McMaster University*. — Research in problem solving suggests that novices can learn expert-like strategies via exposure to illustrative examples that direct attention to structural features (i.e., principles, equations, procedures) rather than surface features (i.e., storyline, events, names) of a concept problem. In the present research, learners studied surface- or structure-emphasizing examples of three statistical concepts and were then required to classify new examples of these concepts. We examined whether giving multiple-choice tests asking about structural features of a concept before or after participants studied examples of that concept would facilitate learning. Interim testing proved to be beneficial, with pretests being more effective than posttests for enhancing encoding of relevant structural features of concepts when learners studied surface-emphasizing examples. Additionally, this pretesting benefit arose from processes related to information retrieval during study of the examples rather than to exposure to the multiple-choice options (with correct answers highlighted) or to the correct answer option alone.
Email: Courtney Clark, courtneyclark@ucla.edu

(4060)

Testing the Testing Effect in a College Methods Course. DONALD FOSS and JOSEPH PIROZZOLO, *University of Houston*. — Results from laboratory experiments on the "testing effect" have shown that retention is improved with additional testing / retrieval efforts (e.g., Roediger & Karpicke, 2006). Further, there is some evidence that this effect generalizes to college courses (McDaniel, et al., 2007). We completed a series of studies attempting a highly "ecologically valid" test of the testing effect in two semesters of a college-level course: Methods in Psychology. In each term, two sections were taught in highly similar ways except for number of exams: "typical frequency" and "high frequency." Results in both semesters showed a benefit of frequent testing, even when the total number of test items was controlled. Exam items were also manipulated to compare the effect of recall v recognition tests on memory. As expected, we found that recall items were better remembered.
Email: Donald Foss, dfoss@uh.edu

(4061)

The Effect of Testing on Retrieval Monitoring. BENTON PIERCE and MELISSA HAWTHORNE, *Texas A&M University-Commerce*, DAVID GALLO, *University of Chicago*.

— Retrieval practice has been shown to enhance long-term retention and reduce the buildup of proactive interference (PI) (e.g., Szpunar, McDermott, & Roediger, 2008). In the present study, we investigated a retrieval-monitoring account of the effect of testing on PI. Participants visually studied five lists of unrelated words. Those in the study-only condition performed a distractor task following lists 1-4, whereas the test group attempted to recall each list following study. Following a short distractor task, both groups were tested on list 5 and were asked to report any items that came to mind during retrieval, but were not on list 5. Compared to the study-only group, the tested group reported fewer prior-list intrusions, despite reporting more items that came to mind during recall of the final list. These results suggest that testing not only reduces PI, but does so in part by improving retrieval monitoring.
Email: Benton Pierce, benton.pierce@tamuc.edu

(4062)

A Testing Effect During Reading? Stimulating Retrieval to Improve Word Learning. GESA VAN DEN BROEK, ATSUKO TAKASHIMA, ELIANE SEGERS and LUDO VERHOEVEN, *Radboud University Nijmegen* (Sponsored by James McQueen). — We investigated if the retrieval of word meanings from memory during reading improves the long-term retention of newly learned words. In two within-subject experiments, participants translated words that were presented in either uninformative contexts that required the retrieval of word meanings from memory ("I need the funguo.") or in more elaborate semantic contexts from which word meanings could be derived ("I want to unlock the door. I need the funguo."). Retention was measured one week later with cued recall tests. There were two main results: First, the retention of words from retrieval practice was significantly higher than the retention of words from context practice. Second, the advantage of retrieval practice was largest when it was combined with correct answer feedback but further adding a context sentence after retrieval had no effect. To conclude, we found a testing effect during reading: A sentence context that stimulated memory retrieval enhanced word learning.
Email: Gesa van den Broek, g.vandenbroek@pwo.ru.nl

(4063)

Retrieving the Question Does Not Enhance Learning of the Answer. NATE KORNELL and HANNAH HAUSMAN, *Williams College*. — Retrieving the answer to a question enhances learning. We predicted an additional benefit of retrieving the question itself. We assumed retrieving the question activates the surrounding semantic network, including mediators connecting the question to the answer, more so than retrieving the answer alone. We hypothesized activating these mediators would enhance learning of the answer. Participants studied 20 trivia questions. There were two restudy conditions. In one, the entire question was presented for 8 sec (e.g., What is the world's tallest grass?). In another, participants were prompted to retrieve the question and answer (e.g., What is the answer to the question about grass?) for 4 sec and then were shown the full question for

4 sec. On a final test a week later, in spite of our predictions, there was no evidence that retrieving the question enhanced learning.

Email: Hannah Hausman, hannah.erin.hausman@gmail.com

(4064)

Test-Potentiated Learning and Retrieval-Based Testing Effects for Tested and Unrelated Non-Tested Items. KIT CHO and JAMES NEELY, *University at Albany, SUNY.* — Participants studied two lists of Swahili-English word pairs, the second of which intermixed the previously studied pairs with new, unrelated previously nonstudied pairs. Participants were tested on or restudied the first list of pairs before (Experiment 1) or after (Experiment 2) studying the second list of pairs. Experiment 3 was identical to Experiment 1 except that the test and restudy trials were randomly intermixed. All subjects completed a final memory test for all pairs. Relative to restudy, testing enhanced memory in all experiments and to the same degree for both previously and newly studied pairs in Experiments 1 and 2. However, the magnitude of the testing effects differed across experiments. The results are discussed in terms of test-potentiated learning and retrieval-based testing effects.

Email: James Neely, jneely@albany.edu

(4065)

Confidence-Weighted Multiple-Choice Tests Enhance Retention of Non-Tested Related Information. ERIN SPARCK, ROBERT BJORK and ELIZABETH BJORK, *University of California, Los Angeles.* — Well-constructed multiple-choice practice tests (i.e., ones with competitive incorrect alternatives) have the power to aid in the recall of related information on later tests (Little, Bjork, Bjork, & Angello, 2012). This benefit appears to result from test-takers retrieving information about why a given incorrect alterative is incorrect, which can help them answer later questions when those alternatives are correct. Many students appear not to engage in such a strategy during testing unless they have been explicitly instructed to do so. In the present research, we compare conditions using a confidence-weighted multiple-choice format to ones using a standard multiple-choice format as well as a baseline non-tested condition to see if the use of confidence-based testing improves strategies that enhance retention of related information beyond those of standard initial multiple-choice testing. Results are discussed in terms of implications for optimizing use of different types of testing for enhancing retention of related information.

Email: Erin Sparck, emsparck@ucla.edu

(4066)

Retrieval Practice and Individual Differences. MEREDITH MINEAR, *University of Wyoming*, JENNIFER H. COANE and SARAH C. BOLAND, *Colby College*, MARISSA ALBAT, *University of Wyoming*, LEAH H. COONEY, *Colby College*, EVAN GRENDAHL, *University of Wyoming.* — Retrieval practice has a greater benefit on final testing compared to restudying or rereading material (Roediger et al., 2011). This is known as the Testing Effect. The role of individual differences in the testing effect is not well understood. Two

recent studies have reported that differences in WM capacity and test anxiety (Tse & Pu, 2013) and fluid intelligence (Brewer & Unsworth, 2012) may affect the magnitude of the testing effect. We report the results of an initial study (N=119) examining the relationship between the testing effect using a standard cued recall paradigm with Swahili-English word pairs and measures of working memory, fluid intelligence, personality, stress, test anxiety, and academic self-efficacy. Although fluid intelligence and working memory capacity were predictive of overall memory performance, none of the individual difference measures were related to the size of the testing effect.

Email: Meredith Minear, meredithminear@gmail.com

(4067)

The Pretesting Effect and Retrieval Practice. JOSH WHIFFEN and JEFFREY KARPICKE, *Purdue University* (Sponsored by Darryl Schneider). — Giving students a pretest is a common practice in education. Pretests are typically viewed as a way of gauging students' prior knowledge in order to better tailor instruction, however, recent research has revealed that a pre-test may also benefit learning (Richland et al., 2009). This research showed that giving students a pretest prior to study led to better retention than not being pretested. The present study sought to extend these results by investigating how the benefits of pretesting might interact with repeatedly studying or practicing retrieval. The results showed an overall advantage of retrieval practice, but no advantage for pretesting in either condition. Altogether the data indicate that any benefit of pretesting was eliminated after repeatedly studying or retrieving information.

Email: Josh Whiffen, jwhiffen11@gmail.com

(4068)

Testing Effect Covaries With Metacognitive Strategy Use and Reading Ability and Interacts with GPA. JOHN SCHUMACHER and ROMAN TARABAN, *Texas Tech University* (Sponsored by Tyler Davis). — The testing effect is the finding that testing oneself over previously studied information is more beneficial to retention than restudying. Little is known about how individual differences in metacognitive strategy, reading ability, and GPA impact the testing effect. College students either studied expository texts without interruption or were tested several times, before an immediate and 24-hour-delay final recall test. Self-reported study strategy use and reading ability estimated using SAT reading scores were found to be covariates, and cumulative grade-point-average (GPA) was found to be a moderator variable. Significant testing effects emerged on immediate and delayed tests, along with significant effects for strategy use and SAT scores. Significant interactions between GPA and study condition on immediate and delayed tests showed that high-GPA students benefitted from uninterrupted study; low-GPA students benefitted from testing. This experiment showed that the benefit of testing may be impacted by individual factors.

Email: John Schumacher, john.r.schumacher@ttu.edu

(4069)

Testing Effects in Recollection-Laden Recognition. YOOJIN CHANG and PETER DELANEY, *University of North Carolina-Greensboro*, PETER VERKOEIJEN, *Erasmus University Rotterdam*. — Four experiments investigated whether testing effects could be obtained on an immediate recollection-laden recognition test. In each experiment, participants studied a list of words and then half of them were restudied and half tested. On a final recognition test, they had to discriminate studied words from plurality-reversed words (e.g., dog/dogs). Experiment 1 obtained a marginal effect of testing, while in Experiment 2, increasing the number of study and test trials produced a significant testing effect. Experiment 3 replicated Experiment 2 using an online sample. In Experiment 4, we systematically varied the number of study and test trials (ST, SST, STT, and SSTT). Only the condition identical to Experiments 2 and 3 produced a testing effect (SSTT). The results are consistent with earlier results suggesting that testing effects can sometimes be obtained immediately in recognition when the test requires the use of contextual information, and therefore are broadly consistent with context-strength theories of the testing effect.
Email: Peter Delaney, p_delane@uncg.edu

(4070)

Does Test Enhanced Learning Transfer for Triple Associates? STEVEN C. PAN and TIMOTHY RICKARD, *University of California, San Diego*. — Transfer of test-enhanced learning in the case of tripled associate word stimuli was assessed in four experiments. In contrast with the robust transfer that has been demonstrated for paired associates, we observed minimal transfer from trained to untrained items for tripled associates. That result held when one or two items from each triplet was tested on during training, as well as when one item from each triplet was repeatedly tested on during training. However, testing on all possible items for each triplet resulted in an amplification of test-enhanced learning. Thus, although test-enhanced learning appears to transfer minimally for triplets, and likely other multi-element stimuli, where feasible, testing on many or all possible stimulus-response combinations can be highly productive for learning.
Email: Timothy Rickard, trickard@ucsd.edu

(4071)

Retrieval Practice Improves Maintenance in Memory—not Memory Retrieval. SIMONE MALEJKA and EDGAR ERDFELDER, *University of Mannheim*. — A robust empirical finding, known as the testing effect, demonstrates that intervening tests are more effective than restudy trials at improving memory performance on a delayed final recall test. Research on this effect has generated a multitude of explanations. In a deliberate attempt to simplify the theoretical controversy, a multinomial processing-tree model is proposed that disentangles the contributions of encoding, maintenance, and retrieval processes to recall performance. By applying this model to testing-effect data, we show that (a) testing primarily facilitates maintenance in memory (i.e., resistance against forgetting) and that (b) the critical interaction of testing versus study benefits with test delay is not driven by different

retrieval strengths at the final test. Our results thus support maintenance accounts of the testing effect and are difficult to reconcile with retrieval-based explanations.
Email: Simone Malejka, malejka@uni-mannheim.de

(4072)

The Testing Effect: Implications for Contemporary Educational Practice. STEPHEN WEE HUN LIM, *National University of Singapore*. — Learning is traditionally viewed as how much information we encode, whereas testing is used to assess learning. Yet, testing effectively promotes long-term retention of knowledge. In the standard retrieval-based learning paradigm, learners either studied educational materials repeatedly, or studied and then tested themselves by retrieving the materials, before taking a final test to assess their learning. Retrieval-based learning outcomes were assessed in a series of experiments involving (a) educational materials relating to psychological research and statistical methods, (b) online learning platforms, and (c) non-verbatim tests. Repeated studying – relative to repeated testing – improved learning performances, when a final test was immediately administered. More important, however, even though learners who studied repeatedly typically imagined that they would perform well on delayed tests (after a week) as compared to those who tested themselves repeatedly, repeated testing actually produced superior performances at the final test than did repeated studying. Implications for current educational practice will, in particular, be discussed.
Email: Stephen Wee Hun Lim, psylimwh@nus.edu.sg

• COGNITION AND TECHNOLOGY •

(4073)

Cognition in the Attention Economy. PAUL ATCHLEY, *University of Kansas*, SEAN MICHAEL LANE, *Louisiana State University*. — Our brain is adapted for simple environments but we live in an era in which we have access to tremendous amounts of information and are surrounded by multiple distractions vying for our attention. This "attention economy" is re-defining critical questions in cognitive science. The goal of the poster will be present a model of the effect of the attention economy on cognition (Cognition in the attention economy , Atchley & Lane, Handbook of Learning and Motivation, vol. 61, in press) and to explore how cognition works, or fails to work, when attention and cognitive capacity are overloaded. We discuss how this attention economy may influence a range of phenomena from safety and willpower to the appreciation of art and the ability to think creatively. The poster will include a discussion of the increasing relevance of cognitive science and a call for researchers to study and understand the problems of our distraction-rich world.
Email: Paul Atchley, patchley@ku.edu

(4074)

The Role of Pace and Difficulty on Video Game Play Arousal Across Genre. ADAM HUTCHESON, *Georgia Gwinnett College*. — Nervous system arousal (heart rate and

galvanic skin response) is a key factor in the study of attention, emotion, motivation, and many other topics in the field of psychology. The current study uses HR, GSR, and self report of emotion to assess the effect of pace and difficulty of video games across genre. It was found that regardless of genre, faster pace and higher difficulty lead to increased arousal. Most importantly, the level of violence found in the game had no impact on the level of arousal. Contrary to prior research suggesting that violence triggers the Fight or Flight response, these findings suggest a more nuanced impact involving attention and motivation to play games in general.
Email: Adam Hutcheson, ahutcheson@ggc.edu

(4075)

Tracking Joint Activities in Visual Analyses. LINDA TINA KAASTRA and RICHARD ARIAS-HERNÁNDEZ, *University of British Columbia*, BRIAN FISHER, *Simon Fraser University*. — Using a method we call "Pair Analytics," we have extended the application of Herbert H. Clark's Joint Activity Theory (JAT) to the study of analytical reasoning in computer-mediated, human-to-human interactions. The current study examines the coordinated analysis of aircraft safety concerns by a aircraft safety engineer and a graduate student analyst trained in the use of interactive visualization of information for data analysis and decision support.The knowledge needed to accomplish their analysis task is thus divided between them, with the more substantive knowledge about aircraft safety and general analysis process possessed by the safety engineer, and methods for creating and interpreting visualization of data are by the student. We document the process by which they attain common ground and the use of the visual interface as a signalling mechanism to support that process. We claim that coupling JAT and PA is an effective research strategy to capture and study three socio-cognitive phenomena in collaborative visual analytics: (1) structuring and navigation of joint analysis; (2) management of joint attention; (3) and signaling of cognitively demanding tasks.
Email: Brian Fisher, bfisher@sfu.ca

(4076)

To Reply or to Reply All: That Is the Question. LYNDSEY LANAGAN-LEITZEL and SUKESHINI A. GRANDHI, *Eastern Connecticut State University*. — Email is a required form of communication in today's workplace. Recipients are given the option of replying to the sender (Reply) or to all recipients on the email (Reply All). Reply All has the benefit of keeping all relevant parties informed, yet an accidental Reply All can be embarrassing and may result in unintentional dissemination of information. This study examines Reply and Reply All use experimentally and through interviews. Undergraduate students and faculty/staff responded to 108 simulated emails that differed in interface (proximity of Reply and Reply All buttons), To field contents (single list-serve email address or multiple individual email addresses), task (tell me requiring Reply, tell us requiring Reply All, or neutral), and content theme. Participants also completed a

brief survey of demographic and email use information plus provided a description of their erroneous Reply All use. To our knowledge, this is the first study examining Reply All use.
Email: Lyndsey K. Lanagan-Leitzel, lanaganleitzell@easternct.edu

(4077)

More Than Just the Medium: Factors Affecting False Memory From Twitter. CORY R. FLECK, NICHOLAS R. GRIFFIN, MITCHELL G. UITVTLUGT, SUSAN RAVIZZA and KIMBERLY M. FENN, *Michigan State University*. — Previously, we found that false information was less likely to be incorporated into memory if it was presented in a Twitter feed than a non-social media format. Here, we further investigated false memory from Twitter by manipulating familiarity of studied information and the relationship between "tweeters" and studied information. Participants read an article about MSU (high familiarity) or University of Iowa (lower familiarity) and viewed a Twitter feed containing false information, purportedly written either by MSU or Iowa students. Correct recognition and false recognition were similar. However, participants were more likely to report that false information was from the original article if they read the Iowa story and were more likely to attribute false information to the article if the "tweeter" was from a different school than the article. This suggests that individuals take into account the relationship between the source of the information and the "tweeter", when integrating information from Twitter into memory.
Email: Kimberly M. Fenn, kfenn@msu.edu

(4078)

Recall Based on Notetaking Aided by Transcription Fluency. EEVIN JENNINGS and ROMAN TARABAN, *Texas Tech University*. — Lecture notes serve an encoding function (aid subsequent memory by writing notes) and external storage function (aid studying), and depend on transcription fluency (transcription rate). Research has not compared computer-based to paper-pencil note-taking to simply listening. In two experiments, undergraduates viewed a 30-minute video lecture on language and took notes with computer, paper and pencil, or simply listened. In Experiment 1, computer note-takers recalled significantly more idea units than the other conditions immediately after the lecture. After the initial recall test and study, and also after a 24-hour delay, computer note-takers did not differ from paper-and-pencil note-takers, but did recall significantly more than listeners; the latter two conditions did not differ. Experiment 2 replicated the 24-hour-delay tests in Experiment 1. Separate measures indicated that computer transcription is significantly faster than paper-pencil transcription. These measures, together with significantly more notes in the computer condition, suggest a transcription-fluency advantage for computer note-takers.
Email: Eevin Jennings, eevin.jennings@ttu.edu

(4079)

Stimulus- and Goal-Driven Influences on Visual Searches in Webpages. JEREMIAH STILL, *San Jose State University*, CHRIS MASCIOCCHI, *Frostburg State University*, MARY STILL, *San Jose State University*. — Although many studies have examined the processes that guide visual search, relatively few have used realistic tasks. This is problematic because, although it is assumed both stimulus-driven features and search goals contribute to real world visual search, the interaction between these two influences is ill defined. This makes predicting where users will look during naturalistic visual searches difficult for interface designers. Masciocchi and Still (2013) began addressing this issue by tracking participants' eye movements while they free viewed webpages. They found that visual salience predicted users' initial fixations, demonstrating that stimulus-driven features pull attention even in complex, naturalistic displays. The present study expands on that research by having participants perform a realistic task - searching for specific items on webpages - while manipulating the saliency of the target's location (high versus low). Results of this study thus address the interaction between stimulus-driven and goal-driven processes within realistic tasks and stimuli.
Email: Mary Still, marylstill@gmail.com

(4080)

Interrupt Me! Why Forced Interruptions Are Better for Performance Than Voluntary Interruptions. IOANNA KATIDIOTI, JELMER BORST and NIELS TAATGEN, *University of Groningen*. — The objective of this multitasking study was to examine the processes behind switching tasks. There were two main conditions: either participants decided themselves when to switch (Voluntary) or they were externally interrupted (Forced). During the task pupil dilation was measured to create a time course of switching between tasks. Results showed a significantly greater increase in pupil dilation some seconds before the switch in the Voluntary condition when compared to the Forced condition. Surprisingly, participants were significantly slower in the Voluntary blocks than the Forced blocks. These findings suggest that the increase in pupil dilation is due to the decision to switch tasks, which takes time, and causes a decrease in performance on the primary task. We therefore propose that it might be more efficient to force people to switch tasks than having them decide themselves.
Email: Jelmer Borst, jelmerborst@gmail.com

• IMPLICIT MEMORY •

(4081)

Effects of Stimulus Periodicity on Temporal Position Learning in a Rapid Serial Visual Presentation (RSVP) Task. MICKEAL KEY, LOGAN POLLARO, AUBRIE MUSSELMAN and JACQUELINE SHIN, *Indiana State University*. — Stimulus periodicity can enhance perceptual processing through attentional entrainment. Can periodicity

influence attentional control through facilitated temporal learning? In an RSVP task, participants identified a colored target letter among distractor letters, which were presented at 10 Hz periodically or non-periodically for different participant groups. The target occurred slightly before, on, or after ("jittered around") the 100 ms point of the relevant serial position. The number of possible target positions in the RSVP stream varied between experiments, and the frequency of target presentation was manipulated among possible target positions. Benefits of periodic stimulus presentation were found with respect to overall performance and target frequency effects. Also, consistent effects of target "jitter" indicated rapid oscillatory attentional modulation during the RSVP series. The results will be discussed with respect to a possible role for periodicity in target position learning and the temporal control of attention necessary for higher-level cognitive processes.
Email: Jacqueline Shin, jacqueline.shin@indstate.edu

(4082)

Artificial Grammar Learning in Children. DAISUKE TANAKA, *Tottori University*. — In order to evaluate implicit learning ability in children, a dance step training task was devised based on a standard artificial grammar learning (AGL) task comprising learning and test phases. In the learning phase, character strings governed by artificial grammar rules were presented, and participants were required to step sequentially on foot switches corresponding to characters. In the test phase, participants judged the grammaticality of grammatical or ungrammatical strings. As indices of implicit learning ability, we recorded decreases in reaction times to character strings in the learning phase and rates of correctly judging grammaticality in the test phase. The participants were 18 elementary school children aged 11–12 years. While there was no significant decrease in reaction times in the learning phase, rates of correctly judging grammaticality were significantly higher than those that could have occurred by chance, mirroring adults' performance in a previous study using a standard AGL task.
Email: Daisuke Tanaka, tanaka@rstu.jp

(4083)

The Influence of Implicit Learning on the Gazing Bias in a Paired-Associates Task. KENGO TANE and CHIKASHI MICHIMATA, *Sophia University*. — We recorded the eye movements during a paired-associates task, and compared implicit learning condition and explicit learning condition. During the learning phase, participants should learn the association between the color (red or green) and abstract figures. In half of the trials of learning phase, the stimulus pairs were presented with Continuous Flash Suppression paradigm in order to create implicit condition. During the test phase, correct pair and incorrect pair were presented side by side, and participant's eye movements were recorded until they respond by key press. Results showed that, participants showed gaze bias toward choosing stimulus more in the implicit learning condition than in the explicit learning

condition. This result suggests that the gazing bias would be relevant to a process which leads the implicit information to the conscious decision.

Email: Kengo Tane, k-tane@sophia.ac.jp

(4084)

Neural Correlates of Scene Perception Based on Temporal Order and Sequencing of Natural Scenes. SACHIO OTSUKA and JUN SAIKI, *Kyoto University*. — Prior studies have shown that statistical learning promotes performance on subsequent detection of shapes, scenes, or faces. However, it is unclear whether this enhancement is based on temporal regularities or the sequencing of items. To address this issue, we examined the neural correlates of scene perception based on temporal order and sequencing of natural scenes. In the familiarization phase, participants viewed a stream of scenes consisting of structured and random triplets. In the subsequent test phase, participants were required to detect a target scene. The test included the forward order of scenes presented during the familiarization phase and backward order of scenes. Neural activations during both phases were assessed with functional magnetic resonance imaging. Behavioral results showed learning effects of both temporal order in the forward condition and sequencing in the backward condition. Neural responses that engaged with scene perception based on both temporal regularities and sequencing will be reported.

Email: Sachio Otsuka, otsuka.sachio.65w@st.kyoto-u.ac.jp

(4085)

Detection of Probabilistic Change by Rhesus Macaques (Macaca mulatta). LISA A. HEIMBAUER, *The Pennsylvania State University*, TING QIAN and RICHARD N. ASLIN, *University of Rochester*, DANIEL WEISS, *The Pennsylvania State Universitiy*. — To effectively track statistical regularities in the environment, individuals must interpret when variance in observable statistics emanates from a single underlying causal structure or from multiple structures. In three implicit learning experiments, we examined whether nonhuman primates are capable of inferring and retaining new structures to the same extent as human learners (see Qian, Jaeger, & Aslin, in review). Using a serial reaction time joystick task, we asked whether six rhesus macaques (Macaca mulatta) could track shifting regularities without operant reward. Similar to humans, the monkeys were often more successful detecting multiple structures when correlated contextual cues (e.g., background color) were provided. The monkeys sometimes demonstrated retention of underlying statistical information, as the time to relearn familiar regularities was often reduced. We conclude that the ability to track probabilistic statistics in complex, changing environments may have a lengthy evolutionary history.

Email: Lisa Heimbauer, lisa.heimbauer@gmail.com

(4086)

Is Facilitation of Procedural Memory's Influence Upon Reading Comprehension Mediated by Individual Differences in Reaction Time? DALE HIRSCH and CHRISTOPHER WAS, *Kent State University*. — Individual differences in working memory capacity (WMC) account for a substantial portion of variance in complex cognitive processes, such as comprehension. However, recent evidence has suggested that individual differences in the facilitation of procedural memory (FPM) account for unique variance in comprehension, and even fluid intelligence, above that accounted for by WMC. One explanation that has not been explored for the unique variance accounted for in comprehension by the facilitation of procedural memory is that the FPM task has a reaction time component. Three measures of each focal construct (FPM, WMC, reaction time, and comprehension) were administered to 227 participants. Structural equation modeling was used to estimate the relationships among latent constructs. Whereas WMC was not related to simple reaction time FPM was related to simple reaction time. However, although the relationship between FPM and comprehension was attenuated by simple reaction time, reaction time did not fully mediate this relationship.

Email: Dale Hirsch, hirsch_da@yahoo.com

(4087)

Neural Correlates of Sequential Learning Are Related to Personality Type. SONIA SINGH, GRETCHEN N.L. SMITH, JEROME DALTROZZO and CHRISTOPHER CONWAY, *Georgia State University*. — Sequential learning (SL) enables people to perceive and learn statistically-structured patterns in the environment. Currently it is not known to what extent individual variables, such as personality type, influence SL proficiency. We investigated this relationship using event-related potentials (ERPs) with both visual and auditory SL tasks in 16 adults. In both SL tasks, a "predictor" preceded a "target" with varying probability. ERPs were recorded to assess learning of the predictor-target contingencies. Participants' personality was assessed with the Big Five Dimensions of Personality. Results indicated increased amplitude of a P600-like component to higher target probability predictors, demonstrating SL. This ERP effect interacted with 3 personality factors: Extraversion [400-500ms post-predictor onset: $F(4,26)=5.10$, $p=0.008$ & 550-650ms post-predictor onset: $F(2,13)=6.83$, $p=0.009$] and Neuroticism [500-600ms: $F(2,13)=6.46$, $p=0.001$] for the auditory SL task and Openness [400-550ms: $F(2,13)=4.92$, $p=0.025$] for the visual SL task, suggesting that the neural correlates of SL are related to personality dimensions.

Email: Christopher Conway, cconway@gsu.edu

(4088)

How to Measure Memory Formation and Consolidation? Don't Forget the Within-Block Position Effect. DEZSO NEMETH and KAROLINA JANACSEK, *Eotvos Lorand University*. — Memory consolidation is a widely studied phenomenon in cognitive neuroscience. In our study on Mild Cognitive Impairment, we investigated the Within-Block Position Effect which is relatively unknown but critical factor in memory consolidation. Seventeen MCI patients and 17 healthy elderly adults participated in the experiment. We used the Alternating Serial Reaction Time (ASRT) task to measure sequence learning. Individuals with MCI showed weaker learning performance than the healthy elderly group. However, using the reaction times only from the second half of each

learning block, we found intact learning and consolidation in MCI. Based on the assumption that the first part of each learning block is related to reactivation processes, we suggest that these processes are affected in MCI. Our results highlight the importance of the Within-Block Position Effect; memory consolidation studies would benefit from including this effect in experimental protocols.

Email: Dezso Nemeth, nemethd@gmail.com

(4089)

How Much Irregularity Can Learning Withstand in the Hebb Repetition Effect? MARIE-ÈVE ST-LOUIS, FRANCOIS VACHON, MARIE-CHARLOTTE NOIREAU and SEBASTIEN TREMBLAY, *Universite Laval*. — The Hebb repetition effect—the improvement in the recall of repeated sequences—constitutes a laboratory analogue of sequence learning known to be sensitive to noise in the repeated sequence. This study aims to determine the maximal amount of noise under which learning can occur. Participants carried out a verbal serial recall task with sequences of 9 letters. One sequence was repeated every fourth trial. Three groups varied on the probability, at every repetition, of each item to be modified: 0%, 20%, or 40% noise. Groups with 0% or 20% noise learned the repeated sequence at the same pace, while the group with 40% noise failed to learn the repeated sequence. At 20% noise, sequence learning appears to be a robust process that can compensate for changing items, whereas at 40% noise, changing items inhibits learning of the repeated sequence, suggesting the presence of a threshold between 20% and 40% noise.

Email: Marie-Ève St-Louis, marie-eve.st-louis.3@ulaval.ca

(4090)

Retrieval-Induced Forgetting of Motor Sequences in Indirect Memory Tests. HANNA MÜLLER, TATJANA LORAN, IGOR LORAN, CHRISTIAN FRINGS and TOBIAS TEMPEL, *Universitaet Trier*. — Selectively retrieving a subset of newly learned motor sequences causes forgetting of non-retrieved sequences of that set. Retrieval-induced forgetting (RIF) has been demonstrated for several kinds of motor sequences organized into sets according to different principles (e.g. Reppa, Worth, Greville, & Saunders, 2013; Tempel & Frings, 2014). The present investigation examined RIF with indirect memory tests. We found that RIF of motor sequences occurred not only in recall tests, but also in tests requiring the execution of the sequences in response to novel cues not present during learning. This finding suggests that RIF affected motor programs, that is, a representational format closely corresponding to parameters of movement execution. In addition, the results correspond to the inhibitory postulate of cue-independence.

Email: Hanna Müller, s1hhmuel@uni-trier.de

(4091)

Relational Memories are Evident in Eye Movement Behavior Following Subliminal Memory Cues. ALLISON E. NICKEL, *University of Wisconsin, Milwaukee*, KATHARINA HENKE, *University of Bern, Switzerland*, DEBORAH E. HANNULA, *University of Wisconsin, Milwaukee*. — Eye movements

were used to examine whether or not memory for studied relationships can be documented following presentation of subliminal cues. Participants (assigned to experimental or control groups) studied scene-face pairs. Test trials evaluated implicit and explicit memory for these pairs. Each trial began with a subliminal scene cue, followed by three visible studied faces. For experimental group participants, one face was the studied associate of the scene (implicit test); for controls none were a match. Subsequently, the display containing a match was presented to both groups, but was preceded by a visible scene cue (explicit recognition). Eye movements were recorded. Participants in the experimental group looked disproportionately at matching faces on implicit test trials; participants from both groups looked disproportionately at the match on explicit test trials, though viewing effects were slower to emerge among controls. Memory for studied relationships can be expressed in eye movement behavior without awareness.

Email: Deborah Hannula, hannula@uwm.edu

(4092)

Relative Distinctiveness and the Own Age Bias. JOYCE OATES, ZEHRA PEYNIRCIOGLU and SCOTT PARKER, *American University*. — Face recognition biases occur when in-group (people with similar physical characteristics to the perceiver) faces are remembered better than out-group faces (Sporer, 2001). Distinctiveness also affects general face recognition such that atypical faces are remembered better than typical faces (e.g., Valentine, 1991). The contextual fan effect (e.g., Reder et al., 2002) addresses effects of distinctiveness on memory without relying on atypicality but on the number of items that share a given feature. Using facial photographs of young and older people, we tested the own-age bias and the contextual fan effect in the same experiment. Indeed, young participants remembered own-age faces better than older faces, and low-fan faces were remembered better than high-fan faces. However, no interaction was observed, suggesting that the own-age bias operates independently from the contextual fan effect. We frame the findings within Valentine's face-space model.

Email: Joyce Oates, joyceoates@gmail.com

(4093)

Temporal Dynamics of Semantic Similarity in Recognition Memory Decisions. COREY WHITE and RYAN CURL, *Syracuse University* (Sponsored by Michael Kalish). — It is well established that semantic similarity plays a role in recognition memory, whereby lures that are semantically similar to the studied items are more likely to be mistaken as targets. However, relatively little is known about how this similarity information affects the dynamics of the mnemonic decision. To address this, we tested whether semantic similarity information becomes available early or late in the decision process. The degree of semantic similarity for study and test items was manipulated by varying the proportion of categorized words that appeared in the study list, and the response dynamics were assessed by separately analyzing fast and slow responses during the test phase using conditional response functions. The results show that information from

semantic similarity enters the decision process quickly and has most pronounced effects for fast decisions. This suggests that some mnemonic information becomes available very early during the recognition decision and strongly affects the retrieval dynamics that drive the decision process. Implications of these retrieval dynamics are discussed relative to current models of recognition memory and decision making.
Email: Ryan Curl, rcurl@syr.edu

(4094)

Investigating the Relationship Between Implicit and Explicit Memory: Event-Related Potentials (ERPs), Masked Priming and Episodic Recognition. JOANNE PARK and DAVID DONALDSON, *University of Stirling*. — Implicit memory is known to influence explicit memory, but precisely how remains unclear. Here we employed ERPs to measure implicit (masked repetition priming) and explicit (episodic recognition) memory, during a recognition task that included masked repetition priming of test cues. To modulate priming Stimulus Onset Asynchrony (SOA) between prime and target words (398ms vs. 698ms) was manipulated. Regardless of whether test items were old or new, masked repetition elicited typical N400 priming effects, which were longer in duration for the long than for the short SOA. Recognition memory analysis focused on the effect of modulating priming on the ERP old/new effects. With a long SOA, familiarity-related ERP effects (mid-frontal positivity) were evident; with a short SOA early recollection-related ERP effects (left-parietal positivity) were found. Results demonstrate that varying prime-target SOA influenced the duration of implicit processing, leading to changes in the nature of the explicit memory processes engaged.
Email: Joanne Park, joanne.park3@stir.ac.uk

(4095)

Incidental Sequence Learning in a Motion Coherence Discrimination Task: How Response Learning Affects Perception. JOCHEN LAUBROCK, *Universität Potsdam*, ANNETTE KINDER, *Freie Universität Berlin* (Sponsored by Martin Fischer). — The serial reaction time task (SRTT) is a standard task used to investigate incidental sequence learning. Whereas incidental learning of motor sequences is well-established, few and disputed results support learning of perceptual sequences. Here we adapt a motion coherence discrimination task to the sequence learning paradigm. The new task has two advantages, (1) the stimulus is presented at fixation, thereby obviating overt eye movements, and (2) by varying coherence a perceptual threshold measure is available in addition to the performance measure of reaction time. Results from three experiments show that action relevance of the sequence is necessary for sequence learning to occur, that the amount of sequence knowledge varies with the ease of encoding the motor sequence, and that sequence knowledge, once acquired, has the ability to modify perceptual thresholds.
Email: Jochen Laubrock, laubrock@uni-potsdam.de

(4096)

Learning Phonotactic-Like Regularities in Immediate Serial Recall. SIMON FISCHER-BAUM and CHARLI V. HOLLOWAY, *Rice University*. — Speech errors have been used to argue that speaker's implicitly learn about artificial phonotactic constraints (e.g. /k/ never appears as a syllable onset in an experiment). The current research investigates whether errors can reveal similar learning in other cognitive domains. In a series of experiments, participants were presented lists of six written words, organized into two groups of three words, in an immediate serial recall task. In the experimental lists, some words were constrained to appear in specific positions (i.e. in the beginning of a group), while others were unconstrained. As with speech errors, recall errors with constrained words showed sensitivity to the statistical regularities built into the experiment. For example, the 4th word of the list was more likely to be recalled as the 1st word if that word was constrained to appear in the group-beginning position than if it was an unconstrained word. Results were replicated with a variety of different artificial constraints, including probabilistic constraints. Taken together, these results suggest that the mechanism by which errors reveal the learning of artificial constraints is not specific to phonotactics.
Email: Simon Fischer-Baum, sjf2@rice.edu

• MEMORY AND REWARD, MOTIVATION, AND EMOTION •

(4097)

Age-Related Changes in Face Memory: Are Older Adults Less Affected by Emotion? ALISON BURROS and MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, PHILIP A. ALLEN, *University of Akron*. — The present study examined whether negative emotion enhances incidental face memory and whether this enhancement is preserved in older adults. Participants first performed a gender discrimination task on a face expressing an angry or happy emotion. After a 20-minute distraction task, they were given a surprise recognition test, judging whether faces were shown earlier (old vs. new identity). When the exact same emotional face picture was used during the recognition test (Experiment 1), younger adults showed memory facilitation for angry faces over happy faces but older adults did not. When neutral faces were used at test (Experiment 2), no memory facilitation was obtained for both younger and older adults. These findings suggest that negative emotional expressions improve memory only for specific features of that image, not general memory of that person's identity, and this memory enhancement decreases in old age.
Email: Alison Burros, burrosal@onid.oregonstate.edu

(4098)

Effects of Monetary Incentives on Attentional Networks in Younger and Older Adults. JULIA SPANIOL, ANNA LENA BIEL, PETE WEGIER, LEANN K. LAPP, BENJAMIN J. DYSON, RYAN S. WILLIAMS and KATHLEEN M. LYONS, *Ryerson University*. — Despite evidence for age-related

changes in cognition and motivation, little is known about the interaction of aging and motivation on attention. The current study examined how attentional networks (alerting, orienting, and executive control) respond to motivational incentives, and how gain and loss frames may modulate these effects. Young and older adults (N=96) completed a modified version of the Attention Network Task (ANT; Fan et al., 2002). Incentive cues were varied trial-by-trial to induce phasic changes in performance motivation. Additionally, incentive framing (as gain vs. avoided loss) was manipulated between-subjects. To reduce the impact of age differences in speed-accuracy tradeoff, accuracy and reaction time were jointly analyzed with the EZ-diffusion model (Wagenmakers et al., 2007). Results indicate that incentives and incentive framing modulated orienting and executive control, in both age groups. In contrast, alerting was not sensitive to motivational manipulations or to age. No evidence for age-related change in the attentional response to incentives or to gain and loss frames was found.
Email: Julia Spaniol, julia.spaniol@gmail.com

(4099)

Effects of Reward Motivation on Young and Older Adults' Associative and Cued Recognition. JESSICA PARKS, MEAGAN LUTTRELL, ALLISON STEEN, JOANN RESNER and SHARON MUTTER, *Western Kentucky University*. — We presented high or low value reward cues prior to study list word pairs and examined how this affected associative and pair recognition (Exp. 1) or item recognition for words presented with the same (intact pairs) or a different (rearranged pairs) context cue (Exp. 2). Age differences were greater in associative than pair recognition and high reward cues improved both young and older adults' performance on these tests. Preserved context produced better item recognition for young, but not older adults. Reward value had no effect on older adults' item recognition, however, young adults' performance was worse for words associated with high reward cues. High rewards may have motivated participants, and especially young adults, to form higher order associative units, which improved associative and pair recognition. These unitized associative representations did not aid and may have even impaired young adults' cued item recognition.
Email: Sharon Mutter, sharon.mutter@wku.edu

(4100)

The Relationship Between Memory Performance and Approach-Avoidance Temperament. ROSS L. DE FORREST and LISA GERACI, *Texas A&M University*. — We investigated the relationship between approach – avoidance (Elliot & Thrash, 2002; 2010) and memory performance across two studies with older adults. In each study, participants were given a list of categorizable words to study followed by a free recall test and the approach – avoidance questionnaire. Results from both studies showed that older adults with lower levels of avoidance had better memory performance than older adults with higher levels of avoidance, while levels of approach

were unrelated to memory performance. Results suggest that individual differences in approach – avoidance temperament may play a role in memory performance.
Email: Lisa Geraci, lgeraci@tamu.edu

(4101)

Oculomotor Capture by Aversive Stimuli in the Absence of Contingency Knowledge. LAUREN S. HOPKINS, FRED J. HELMSTETTER and DEBORAH HANNULA, *University of Wisconsin, Milwaukee*. — A variant of the irrelevant singleton paradigm was used to investigate whether or not a stimulus previously paired with shock could capture attention when participants failed to report learned contingencies. During training, participants were instructed to fixate a rectangle embedded in a distractor display. One rectangle type (e.g. horizontal) co-terminated with shock 80% of the time (CS80); another (e.g. vertical) co-terminated with shock 20% of the time (CS20). During test, participants were instructed to fixate a uniquely colored circle presented among distractors; a rectangle (horizontal or vertical) was also present in two-thirds of the trials. Awareness was assessed via questionnaire. Despite the absence of explicit contingency knowledge, results indicated that saccades were made more quickly to CS80s than CS20s during training, and were captured more often by CS80s than CS20s during test. In sum, eye movements can be captured by a conditioned stimulus involuntarily and without awareness of learned associations.
Email: Fred J. Helmstetter, fjh@uwm.edu

(4102)

Mortality Salience: Methodological Considerations for Future Research. BRIAN EMMERT, JR., LEELAND ROGERS, ANNA DRUMMEY and IRENE KAN, *Villanova University*. — In a previous study, we reported that thoughts of mortality has a protective effect against episodic memories of emotionally negative pictures. Specifically, whereas subjects who wrote about an unpleasant experience (dental procedure) revealed a negativity effect (accuracy for negative > positive), this effect was eliminated in young adults who wrote about their thoughts and feelings associated with their own death. In a recent study, we found that the mortality group performed equivalently to a neutral baseline group who wrote about pumping gas (both groups: positive = negative). Furthermore, the negativity effect persisted in the dentist group. We reason that the previously observed protective effect may be an artifact that resulted from the specific baseline comparison. Take together, these data suggest the importance of the inclusion of a neutral baseline comparison group (in addition to a dentist group) in future studies employing a mortality salience manipulation, especially considering the manipulation's popularity in psychological research.
Email: Irene Kan, irene.kan@villanova.edu

(4103)

The Relation Between Memory for Recall and Two Types of Emotional Valence and Arousal: Using IAPS as Emotional Stimuli. MIZUKI KATO, *Hosei University* (Sponsored by Tetsuya Fujita). — In this study, ratings of emotional valence and arousal were obtained for pictures selected from IAPS

(International Affective Picture System; Lang, Bradley, & Cuthbert, 1999, 2008). In conventional rating methods, it was unclear whether the ratings reflected participants' emotion aroused by the presentation of stimulus or emotion included in the content of the stimulus. Therefore, we obtained two separate ratings for the two types of emotion for each stimulus, and investigated the relationship between the two types of ratings. Results showed that for both emotional valence and arousal, positive correlations were found in the ratings. In addition, in this study, we measured the memory for recall of the stimuli, and examined the relation between arousal and emotional valence of the stimuli and memory performance. Results indicated that for both the positive and negative stimuli, memory performance was higher for stimuli with higher arousal level. However, it was also shown that the relationship between arousal and memory for recall was different depending on the two types of ratings and the IAPS condition.
Email: Mizuki Kato, mizuki_i7yba84sh@yahoo.co.jp

(4104)

Are Emotionally Aroused Witnesses Better Witnesses? HEATHER KLEIDER and SHANNA HEGERTY, *Georgia State University*. — Stress associated with witnessing a crime promotes memory error, but does event negativity contribute? Police are trained to use open-ended questioning to guard against contaminating witness memory, but do their beliefs about the stress-memory relationship influence their questioning technique? We investigated whether accurate event memory was influenced by arousal and/or the event valence and whether question-type had an impact on retrieval (Study 1), and whether police officers' beliefs about the stress-memory relationship influenced their questioning procedure (Study 2). We found crime-aroused witnesses committed the most overall memory errors, and further, that closed-ended questions produced the most errors regardless of arousal. Emotional witnesses were asked more closed questions by officers who believed stress facilitated memory, while the reverse was true for officers who believed stress was detrimental. Results suggest negativity and heightened emotion which encompass a crime work together to impede memory and questioning should be open-ended regardless of officer beliefs.
Email: Heather Kleider, hkleider@gsu.edu

(4105)

The Pressure From Peer Comparison May Enhance the Testing Effect but It Lasts Shortly. SHIH-KUEN CHENG, *National Central University*. — Testing is accompanied with competitions but it is not clear how the testing effect, i.e., the better memory for repeatedly tested items than studied ones, is affected by the pressure from peer competition. We examined this issue by providing positive (high-ranking), negative (low-ranking), or no feedbacks to participants who learned 60 Swahili-Chinese word pairs. All participants were in similar levels of anxiety initially but the negative group became more anxious after knowing that their performance was poor. In the immediate test, the negative group gave rise to a greater testing effect whereas the positive group yielded a smaller testing effect in comparison to the neutral group. The greater testing effect for the negative group diminished in the one-week delayed test, while the testing effect in the positive group became greater in the delayed test. These results suggest that the pressure from peer comparison enhances the testing effect but it lasts shortly.
Email: Shih-kuen Cheng, skcheng@cc.ncu.edu.tw

(4106)

The Value of Studied Items Enhances Recall and Recollection of Non-Recalled Items. MICHAEL COHEN, JESSE RISSMAN, ALAN CASTEL and BARBARA KNOWLTON, *University of California, Los Angeles.* — In the value-directed-remembering task, subjects study multiple lists of words that are associated with different point values, and then try to maximize their score at recall by selectively recalling high value words. Here, we show that while subjects preferentially recalled high value words at the expense of low value words, there was also a significant effect of value on recognition for words that were not recalled. After performing a value-directed-remembering task, subjects were given a surprise recognition task for all studied words where they performed Remember/Know judgments. Even for items that were not recalled on the value-directed remembering task, high value items were more likely to be recognized than low value items. This effect was most striking for recollection. These results support the idea that subjects engage in elaborative processing of high value items, and may ignore low value items in order to reduce their interference during recall.
Email: Michael Cohen, mcohen1@ucla.edu

(4107)

Chance Based Uncertainty of Reward Improves Long-Term Memory. ALICE MASON, *University of Bristol*, SIMON FARRELL, *University of Western Australia*. — Across three experiments we asked whether uncertainty of reward outcome has an effect on incentivized learning. We used a simple verbal memory task, in which participants could earn monetary incentives for each word they successfully remembered in a delayed recognition memory test. Rewards were either fixed or delivered with equal probability of rewards or no reward. In Experiments 1&2, we tested whether uncertain rewards promote learning to a greater extent than certain rewards. In Experiment 1, we found uncertain reward produced a memory enhancement similar in magnitude to fixed reward. Mixed effects modeling of the data from Experiment 2, in which a defined outcome was delivered after presentation of the word, revealed that uncertainty and prediction error are significant drivers of recognition memory. Results from Experiment 3 indicated superior recognition memory for uncertain rewards, regardless of reward value. These studies are the first to demonstrate an influence of uncertainty of reward on motivated learning, and are consistent with work showing a ramping of striatal dopamine neurons when rewards are uncertain.
Email: Alice Mason, am8302@bristol.ac.uk

(4108)

The Continuity and Discontinuity Between Dream and Waking-Life Social Networks. HYE JOO HAN and RICHARD SCHWEICKERT, *Purdue University*. — An individual's memory of people and their relations forms a semantic network. Person knowledge is expressed in waking life and also in dreams, during which the semantic network is navigated. In a case study, the waking life social network of a single woman was constructed by asking her which pairs of the 120 core people in her life knew each other, and how emotionally close they were. Her dream social network was constructed from 2048 of her dream reports by linking two people who appeared in a dream together. The waking life and dream social networks differ in several ways, for example, in values of network measures. People are mixed more in dreams than in waking life, although not so mixed as to be random. Similarities arise because emotional closeness in waking life is related to coappearance frequency in dreams and because importance of people in waking life is related to importance of people in dreams.
Email: Hye Joo Han, han18@purdue.edu

(4109)

Rapid Value-Based Decisions From Memory. SEBASTIAN HORN, RUI MATA and THORSTEN PACHUR, *Max Planck Institute for Human Development*. — Everyday decisions often involve the rapid evaluation of potential gains and losses of options, and the associated information needs to be retrieved from memory. In this line of research, we focus on age-related differences in memory-based decisions about values from a lifespan perspective. In a training phase, participants first learn the mapping between specific stimulus features and associated outcomes. In a subsequent decision task, participants are presented with objects that include combinations of these features and must decide quickly whether to accept or reject these objects. We apply diffusion modeling to disentangle the components underlying fast gain-loss evaluation. The modeling results for older adults and children highlight the role of reduced processing efficiency—in contrast with findings about age-related differences in many perceptual decision tasks.
Email: Sebastian Horn, sebastian.horn@mpib-berlin.mpg.de

• WORKING MEMORY III •

(4110)

Part-Set Cuing Facilitation for Spatial Information. YURI PARASIUK, MEGAN CROCCO, JENNIFER SALGADO-BENZ and MATTHEW KELLEY, *Lake Forest College*. — Cole, Reysen, and Kelley (2013) reported robust part-set cuing facilitation for spatial information using a snap circuit toy. These results are in contrast to those reported by Watkins, Schwartz, and Lane (1984) who showed no influence of part-set cuing on spatial memory when using chess boards (see also, Drinkwater, Dagnall, & Parker, 2006). One key difference between the two procedures is that snap circuit stimuli typically are connected to one another, whereas chess pieces are not; these connections might encourage stronger interitem associations and ensure that cues are not disruptive at retrieval. In the present study, we manipulated whether the chess pieces were connected (some pieces lay flat so they touched two upright pieces) or unconnected (normal upright configuration), as well as whether the test provided cues or not. Results indicated strong part-set cuing facilitation in the connected condition and no influence of part-set cuing in the unconnected condition.
Email: Matthew Kelley, kelley@lakeforest.edu

(4111)

Know When to Hold Em, Know When to Fold Em: WMC and Spatial Reasoning. ALLISON J. JAEGER, ANDREW F. JAROSZ and JENNIFER WILEY, *University of Illinois, Chicago*. — Previous research has indicated that working memory capacity (WMC) correlates strongly with performance on a range of cognitive tasks even if the surface characteristics differ, including spatial reasoning tasks. It has also been demonstrated that when completing spatial reasoning tasks, people report using a variety of strategies. The purpose of the current research is to investigate the relationships between WMC, strategy use, and performance on spatial reasoning tasks. Initial results revealed that on a paper folding task WMC predicted performance on the problems requiring three folds, but not on problems requiring only one or two folds. Additionally, on a mental rotation task WMC predicted performance on the items where a non-rotation strategy could be used for successful solution. These results suggest that specific subsets of items may be responsible for the strong relationship between WMC and performance on spatial reasoning tasks.
Email: Jennifer Wiley, jwiley@uic.edu

(4112)

Optimal Number of Factors for Choice Experiments in Mining Community Consultation. BRANDI KLEIN, RACHEL STANCIL, REINHOLD SCHNELL, BRITTNEY ABEL, JORDAN VERSLUES, SISI QUE and KWAME AWUAH-OFFEI, *Missouri University of Science and Technology*. — Choice experiments allow researchers to assess preferences regarding community mining projects. This study used choice experiments with different numbers of variables to investigate the optimal number of variables that should be used in choice experiments. Too many variables to consider in choice sets can increase participants' cognitive load to the point that it becomes a burden, and they begin to make choices that are not in line with their actual beliefs. Results indicate that participants exerted more mental effort as the number of variables increased from three to six, and they rated each level as significantly more difficult than the previous level. There is also some evidence that four variables is the optimal number of variables to use in choice experiments. These results suggest that mining companies that use choice experiments should be aware of the demands of cognitive load and limit the number of variables they use to four.
Email: Brandi Klein, kleinb@mst.edu

(4113)

Subjective vs. Objective Sleepiness: Does Just Feeling Sleepy Affect Cognitive Performance? KETHERA FOGLER, *James Madison University*, KARA THORESON, *U.S. Air Force Academy*, JEFF DYCHE, *James Madison University*. — Partial sleep deprivation (PSD) is a common problem that is associated with deficits in cognitive function that may be exacerbated by an individual's perception of their level of sleepiness. The present research sought to investigate the influence of perceived (subjective) sleepiness on cogntive performance when physiological indices were equivalent. A natural PSD model was used to investigate objective and subjective sleepiness in chronically sleep deprived Air Force Academy Cadets, both before and after a weekend of recovery sleep. Objective sleepiness was measured via a series of Multiple Sleep Latency Tests (MSLT) and actigraphy data. Subjective sleepiness questionnaires were used to screen participants into one of two groups: the most sleepy or the least sleepy cadets. Objective sleep data for these two groups was not significantly different; however, measures of working memory, learning and attention were worse for the group who perceived themselves as being more sleepy. Recovery sleep resulted in better cognitive function in most domains for both groups, with those who were subjectively the most sleepy showing a greater benefit overall.
Email: Kethera Fogler, foglerka@jmu.edu

(4114)

Improving Fluid Intelligence With Training on Working Memory: A Meta-Analysis. JACKY AU, ELLEN SHEEHAN, NANCY TSAI and GREG J. DUNCAN, *University of California, Irvine,* MARTIN BUSCHKUEHL, *MIND Research Institute,* SUSANNE JAEGGI, *University of California, Irvine.* — Working Memory (WM), the ability to store and manipulate information for short periods of time, is an important predictor of scholastic aptitude and a critical bottleneck underlying higher-order cognitive processes including controlled attention and reasoning. Recent interventions targeting WM have suggested plasticity of the WM system by demonstrating improvements in both trained and untrained WM tasks. However, evidence on transfer of improved WM into more general cognitive domains such as fluid intelligence (Gf) has been more equivocal. Therefore, we conducted a meta-analysis focusing on one specific training program, n-back. We searched Pubmed and Google Scholar for all n-back training studies with Gf outcome measures, a control group, and healthy participants between 18-50 years of age. In total, we identified 20 studies that met our criteria, and found a small but significant positive effect of n-back training on improving Gf. Several factors that moderate this transfer are identified and discussed.
Email: Jacky Au, jwau@uci.edu

(4115)

The Wonderlic Personnel Test: A Question of Construct Validity. KENNY HICKS, TYLER HARRISON and RANDALL ENGLE, *Georgia Institute of Technology.* — Despite the widespread popularity of the Wonderlic Personnel Test, evidence of its validity as a measure of intelligence and personnel selection is limited. The present study sought to better understand the Wonderlic by investigating its relationship to multiple measures of working memory capacity and fluid intelligence. Our results show that working memory capacity fully mediated the relationship between fluid intelligence and the Wonderlic. Further, we found that the Wonderlic was a significant predictor of working memory capacity for subjects with low fluid intelligence, but failed to discriminate among subjects with high fluid intelligence. These results suggest that the predictive power of the Wonderlic is dependent on the characteristics of the sample it is administered to, whereas the relationship between fluid intelligence and working memory capacity is robust and invariant to the cognitive capabilities of the sample.
Email: Kenny Hicks, khicks6@gatech.edu

(4116)

The Influence of Working Memory Load on Semantic Priming. TOM HEYMAN, BRAM VAN RENSBERGEN and GERT STORMS, *University of Leuven*, KEITH HUTCHISON, *Montana State University*, SIMON DE DEYNE, *University of Leuven.* — It has been argued that semantic priming arises as a result of automatic target activation (ATA) and/or the use of strategies like prospective expectancy generation (EG) and retrospective semantic matching (RSM). This study investigated the extent that these processes rely on cognitive resources by experimentally manipulating working memory load. To disentangle prospective and retrospective processes, prime-target pairs were selected such that they were symmetrically associated (e.g., answer-question; SYM) or asymmetrically associated in either the forward direction (e.g., panda-bear; FA) or the backward direction (e.g., ball-catch; BA). The results showed that priming for FA pairs completely evaporated under a high working memory load, but that it remained stable for BA and SYM pairs. This was taken to mean that prospective processes (i.e., ATA and EG), which are assumed to cause FA priming, require cognitive resources, whereas retrospective processes (i.e., RSM), which lead to BA priming, are relatively effortless.
Email: Tom Heyman, tom.heyman@ppw.kuleuven.be

(4117)

SAT Dynamics in Early Closure Sentences. JORDAN WHITLOCK, *MIT*, DAVID CAPLAN, *MGH*, JULIE A. VAN DYKE, *Haskins Laboratory.* — We investigated the nature of the memory mechanisms utilized in resolution of complex syntactic ambiguities through the use of the Speed Accuracy Tradeoff (SAT) paradigm. 17 healthy young adults were studied for the use of parallel or serial search mechanisms to retrieve constituents needed to understand early closure sentences (After the man shot the deer ran away). The best fitting models included different rate parameters for sentences with different lengths of ambiguous segments, providing evidence for serial search in understanding ambiguous sentences that require complex syntactic reanalysis.
Email: David Caplan, dcaplan@partners.org

(4118)
Comparing Working Memory Capacity for Sensory vs. Abstract Information. KARA BLACKER, ANTONIO VERGARA and SUSAN M. COURTNEY, *Johns Hopkins University*. — Recent work has demonstrated that abstract information, such as spatial relationships between objects, are stored and manipulated in working memory (WM) in a distinct manner than are concrete, sensory items. Using a novel, retro-cue WM paradigm requiring participants to maintain either 1 to 4 Items (i.e., absolute size of a circle) or 1 to 4 Relations (i.e., relative size between two circles), we illustrated that the capacity for Relations was similar to that of Items. Interestingly, performance on the Item, but not the Relation, task significantly correlated with Symmetry Span performance. Conversely, performance on Relation, but not Item, trials significantly correlated with visual n-back performance. While both n-back and complex span tasks are currently conceptualized as WM tasks, these results suggest that there may be two dissociable processes here: one involved in the storage and manipulation of sensory information and one involved in deriving and maintaining abstract information in WM.
Email: Kara Blacker, kara.blacker@jhu.edu

(4119)
A Note on the Relation Between Complex Span and N-Back Tasks. ANA DUARTE and HUNTER BALL, *University of Georgia*, GENE BREWER, *Arizona State University*, NASH UNSWORTH, *University of Oregon*. — The appropriate measurement of working memory capacity (WMC) is an important area of current research. Complex-span and N-back tasks are typically used to assess WMC, but recent research challenges the assumption that these tasks measure the same underlying construct. To further explore this issue we had participants complete multiple complex-span and N-back tasks. N-back load was manipulated (1 versus 3) and we assessed for moderation from a composite complex-span task measure. Complex-span task performance did not moderate N-back performance as load increased. Our findings suggest that N-back tasks may not be a useful measure of individual differences in WMC, and that complex-span tasks and N-back tasks cannot be used interchangeably as measures of WMC.
Email: Margarida Pitães, margaridapitaes27@gmail.com

• COGNITIVE CONTROL III •

(4120)
The Effect of Chunking on Typing Skill Acquisition Using the Alphabet Input Method in the Japanese Language. YUKI ASHITAKA and HIROYUKI SHIMADA, *Kobe University*. — We examined the progress in skill acquisition among unskilled typists using a new keyboard layout with only eight keys that encouraged chunking. The results revealed that chunking played an important role in skill acquisition. The typists who typed a pair of hiragana characters using the alphabet input method (with four keystrokes) had to separate each character into alphabet letters (for each hiragana character within the

word, the first letter referred to the relevant consonant, and the second letter referred to the vowel). The overlapped mapping between the hiragana character and the alphabet letters reflected the ease of chunking within each hiragana character. The overlapped mapping degraded the skill acquisition for typing the vowel letter (as the second and fourth interkeystroke intervals) only during the early period of skill development; however, it did not degrade the skill acquisition for typing the consonant letter throughout the skill development training, suggesting that the typists could use two-keystroke chunks for each character rather than for each word. These results are discussed in terms of the fan effect and the unit of processing as a syllable (mora) in the Japanese language.
Email: Yuki Ashitaka, ashitaka@maritime.kobe-u.ac.jp

(4121)
Massed Versus Spaced Delivery of Short-Form Mindfulness Training. ALEXANDRA MORRISON, MERISSA GOOLSARRAN, ELIOT T. TANG-SMITH, SCOTT L. ROGERS and AMISHI P. JHA, *University of Miami*. — Mindfulness training (MT) benefits mind wandering and working memory. We investigated optimal delivery of short-form 8-hour MT in 3 groups: massed delivery (n=25), spaced delivery (n=20), and test-retest (n=34). Participants completed the Sustained Attention to Response Task (SART), a delayed-recognition task, and the Ospan task at pre-training (T1), post-training (T2), and an 8-week follow-up (T3). ANOVAs revealed a time (T1 vs. T2) by group interaction for SART A' scores, a marginal interaction for delayed-recognition accuracy, and a non-significant interaction for Ospan scores. SART and delayed-recognition showed a linear trend where T1-T2 differences increased proportionally, with the largest gains in the massed group, then spaced group, and no change in the test-retest group. At T3, only SART improvements remained and only in the massed group. Results suggest short-form MT reduces mind wandering and to some extent, benefits working memory when delivered as massed more so than spaced delivery.
Email: Alexandra Morrison, amorrison@psy.miami.edu

(4122)
The Role of Anticipation in the Relation Between Math Anxiety and Math Performance. HYESANG CHANG, KATHRYNE VAN HEDGER, ANDREA HENRY, GREG J. NORMAN and SIAN L. BEILOCK, *University of Chicago* (Sponsored by Erin Maloney). — Math anxiety is known to be associated with poor math performance. Studies have suggested that negative thoughts and worries about doing math temporarily deplete cognitive control resources, resulting in impaired performance on complex math tasks. Here we manipulated the duration of anticipation of a math task to examine whether math-anxiety-related math deficits could be influenced by the anticipatory anxiety about doing math. The longer anticipation (12-minute) of an arithmetic verification task – compared to the shorter anticipation (3-minute) – resulted in domain-specific impairments in math performance in individuals with high math anxiety, while improving low math anxious individuals' math performance. On a reverse word judgment task, both groups

performed similarly regardless of the duration of anticipation. To better understand the role of anticipation in math anxiety, we examined whether differential patterns of physiological responses as a function of temporal proximity to the math task could explain the high math anxious individuals' domain-specific math deficits. Together, our findings suggest that anticipatory anxiety about doing math may enhance the adverse effects of math anxiety.

Email: Hyesang Chang, hsc@uchicago.edu

(4123)

Effects of Alcohol on Inhibitory and Activational Mechanisms of Behavioral Control. CECILE MARCZINSKI and AMY L. STAMATES, *Northern Kentucky University.* — Failures of behavioral control underlie many psychological problems including addictive behaviors. While personal characteristics can contribute to behavioral control, the role of environmental cues has not been closely examined. For example, a person can consume alcohol in a bar (a setting with more activational cues) or at a business dinner with the boss (a setting with more inhibitory cues). This study (n = 40) examined the acute effects of alcohol consumption on a modified behavioral control task, the cued go/no-go task (Marczinski & Fillmore, 2003). Participants were trained on their assigned task (activational/inhibitory) and then attended separate sessions where they received 3 doses of alcohol. The results revealed that participants in the activational condition experienced poorer behavioral control, but self-reported lower perceived impairment, than participants in the inhibitory condition under the highest dose of alcohol. These findings indicate that behavioral control should be studied under the acute effects of alcohol.

Email: Cecile Marczinski, marczinskc1@nku.edu

(4124)

A Tail about Executive-Control Depletion: Mu, not Tau, Gets Tired. KIMBERLY TALBOOM and KIN LAU, *Arizona State University*, HUNTER BALL, *University of Georgia*, GENE BREWER, *Arizona State University* (Sponsored by Chris Blais). — Executive-control was depleted with a sustained attention task, psychomotor vigilance. Response time distributions were compared between depletion and control groups. Ex-Gaussian analyses showed that the mean of the normal, μ, was greater in the depleted group. There was no difference in τ, the mean of the exponential tail. It is long exponential RTs reflected in τ that are thought to reflect executive control. These results suggest that participants in the depletion group exhibited longer response latencies routinely compared to the control group. This generalized increase in response latencies for the depleted group, rather than a more extreme lapse on a smaller proportion of trials, provides evidence against the hypothesis of executive-control depletion. Instead, the results support models of depletion that propose other factors that underlie depletion effects, such as motivation or generalized fatigue.

Email: Kimberly Wingert, kimberly.talboom@gmail.com

(4125)

Attentional Control on Processing Unexpected Primes: Dual Mechanisms. HSUAN-FU CHAO, *Chung Yuan Christian University.* — An unexpected prime sometimes produces a positive priming effect, and sometimes produces a negative priming effect. In the present study, I proposed that an unexpected prime may trigger attentional inhibition in two ways. First, when the prime matches the distractor set, the prime receives attentional inhibition. Second, when the prime is unrelated to the distractor set but highly salient, it receives reactive attentional inhibition. In both cases, the prime stimulus that receives attentional inhibition can produce a negative priming effect. I conducted two experiments to investigate the effects of distractor set and stimulus salience on prime processing. Experiment 1 showed that a prime stimulus that matched the distractor set produced negative priming. In addition, Experiment 2 showed that a prime stimulus irrelevant to the distractor set produced negative priming when its luminance was high. These findings supported the proposal of the present study.

Email: Hsuan-Fu Chao, hfchao@cycu.edu.tw

(4126)

The Functional Locus of Post-Error Slowing in the Eriksen Task: An ERP Study. HARTMUT LEUTHOLD and IAN GRANT MACKENZIE, *University of Tuebingen.* — In choice reaction time (RT) tasks, participants typically respond slower on trials following an error response (post-error) than preceding an error response (pre-error). This post-error slowing (PES) pattern has been attributed to cognitive control influences on information processing. Yet, the specific mechanisms contributing to PES are still debated. For example, PES observed in the Eriksen flanker interference task might reflect disrupted target processing or increased response caution. In the present study, we investigated this issue by analysing electrophysiological correlates of sensory (P1, N1), decision (P300), and motor processing (lateralized readiness potential, LRP) in addition to behavioural measures. RT showed reliable flanker interference and PES effects. Crucially, the analysis of stimulus- and response-locked LRP onsets indicated a longer duration of motoric but not premotoric processing on post-error compared to pre-error trials. By contrast, sensory and decision-related ERP components were mainly modulated in amplitude rather than latency. In conclusion, present results are consistent with the assumption that participants respond more cautiously following an error response.

Email: Hartmut Leuthold, hartmut.leuthold@uni-tuebingen.de

(4127)

Switch Hands! Mapping Temporal Dynamics of Proactive Cognitive Control Via Anticues. JOSEPH ADAM, SELAS JENNINGS, THAMAR BOVENDEERDT, PASCAL VAN GERVEN and PETRA HURKS, *Maastricht University.* — This study used a novel behavioral paradigm—the anticue task—to investigate the temporal dynamics of proactive cognitive control in the manual motor system. We used a four-choice

reaction time task, with left and right anticues preceding the target signal by variable cue-target intervals (100-800 ms). Anticues required participants to prepare the fingers on the hand opposite to the location of the cue (incongruent mapping). Results showed that anticues produced reaction time costs with short cue-target intervals that switched to reaction time benefits with longer cue-target intervals (relative to neutral cues). These findings support the notion that anticues are mediated by an intention-driven proactive control process that balances inhibition and excitation to redirect motor activation from the wrong, ipsilateral hand to the correct, contralateral hand.
Email: Jos Adam, jos.adam@maastrichtuniversity.nl

(4128)
Computational Models of the Attentional Bias Toward Pain. ROBERT DOWMAN, BEN RITZ and KATHLEEN FOWLER, *Clarkson University*. — Computational modeling was used to explore the neural mechanisms underlying the ability of an unexpected painful target stimulus to disengage attention from another stimulus and reorient it towards itself. The model architecture that provided excellent quantitative fits of the reaction time and brain activation data obtained in experimental work suggests that the painful target activates somatic threat detectors in the dorsal posterior insula, which in turn activates medial and lateral prefrontal cortex areas involved in reorienting attention towards decision and/or response processes required for the task. An architecture that provided excellent fits of the reaction time data shows that the faster reaction times for the painful target could be achieved by an increase in arousal. Importantly, the arousal model predicts that an unexpected neutral target presented with the painful target will also show faster reaction times, whereas the somatic threat detection model predicts that only the painful target will show this effect.
Email: Robert Dowman, rdowman@clarkson.edu

(4129)
Increased Trial-to-Trial Spatial Uncertainty Amplifies the Context-Specific Proportion Congruency Effect in a Flanker Paradigm. NATHANIEL DIEDE and JULIE BUGG, *Washington University in St. Louis*. — The context-specific proportion congruency (CSPC) effect is the attenuation of interference for stimuli in a mostly incongruent compared to a mostly congruent context (e.g., location). The effect has been attributed to context-specific episodic retrieval of learned attentional settings. Drawing on the skill learning literature showing variable training (training multiple tasks concurrently) enhances learning relative to fixed training (training a single task), we varied the degree of spatial uncertainty in a CSPC flanker paradigm. A later, but larger, CSPC effect emerged in the high uncertainty (variable location) condition compared to the low uncertainty (fixed location) condition at eccentric locations common to each condition. A CSPC effect was not present for central locations

in the variable condition possibly due to perceptual grouping. Transfer effects to novel locations were similar across conditions, though nominally stronger in the fixed condition. The findings provide preliminary support for the amplified learning of location-specific attentional settings when training includes high spatial uncertainty.
Email: Nathaniel Diede, ndiede@wustl.edu

(4130)
The Time Course of Cognitive Control: Electrophysiological Correlates of Stimulus and Response Incongruency. CLIO JANSSENS, GILLES POURTOIS, CARSTEN N. BOEHLER and TOM VERGUTS, *Ghent University*. — Current theories of cognitive control state that control is implemented by enhancing processing in task-relevant cortical areas and suppressing processing in task-irrelevant areas (Egner & Hirsch, 2005). However the time course of these mechanisms remains largely unknown. We addressed this by measuring EEG while subjects performed a flanker task with bilaterally and unilaterally congruent, stimulus incongruent, or response incongruent flankers. This experiment replicates previous findings (Appelbaum et al., 2011) but crucially allows tighter interpretations due to the addition of the stimulus incongruent condition. Moreover it shows novel effects, namely initial effects of stimulus incongruency (on the N2 component) and later effects of response incongruency (on the LPC). Finally, we report (Granger) connectivity analyses between frontal and posterior areas as time within a trial develops.
Email: Tom Verguts, tom.verguts@ugent.be

(4131)
Executive Attention, Task Set, and Decision Boundary Setting in Aphasia. WILLIAM S. EVANS, *Boston University*, DAVID CAPLAN, *MGH*, JEFFREY STARNS, *University of Massachusetts Amherst*. — Language performance in people with aphasia (PWA) suggest potential executive deficits affecting controlled language use. The current work tested claims regarding the Executive Attention model (Engle and Kane, 2004) in aphasia and its relation to varying task sets in linguistic and nonlinguistic tasks. PWA and matched controls were tested on four tasks measuring executive attention in verbal and nonverbal domains using word-picture interference, semantic and perceptual go/no-go, and spatial stroop designs. Participants were also tested on lexical decision and numerosity judgment tasks with varying speed and accuracy-focused instructions, with performance modeled using the Diffusion Model (Ratcliff, 1978). For PWA, results indicated both executive attention deficits and difficulty in flexibly adjusting decision boundaries to meet task demands across domains, with greater deficits in linguistic compared to nonlinguistic tasks. Implications for accounts of control in aphasia will be discussed.
Email: William Evans, wsevans@bu.edu

• VISUAL SEARCH II •

(4132)

The Dynamic Changes of the Information Processing Characteristics in Cued Detection. CHENG-TA YANG and TING-YUN CHANG, *National Cheng Kung University*, DANIEL R. LITTLE, *The University of Melbourne*. — Recently, we (Yang, Little, & Hsu, in press) demonstrated that the processing architecture of a system varied according to the validity of a location cue in a redundant-target detection task. Strategies shifted from diffuse attention, parallel processing (uninformative cue) to focused attention, serial processing (informative cue). Based on these findings, this study tested whether the strategy alternation can be observed in an associated AND version of cued detection where participants made a positive response until both targets were detected and further tested the dynamic changes in information processing from one cue condition to another. We found exhaustive rules were adopted to detect redundant targets. The cue manipulation affected the processing architecture, which was modulated by the test order of cue conditions. These results ruled out the coactive model assumed in many parametric models of cued detection. Moreover, observations of the dynamic changes in information processing highlight the flexibility and individual differences of a decision mechanism. Email: Cheng-Ta Yang, yangct@mail.ncku.edu.tw

(4133)

Does the Dual-Target Cost in Visual Search Increase When Objects Overlap, and Can it be Reduced by the Presence of Depth Information? HAYWARD J. GODWIN, TAMARYN MENNEER and SIMON LIVERSEDGE, *University of Southampton*, KYLE CAVE, *University of Massachusetts*, NICK S. HOLLIMAN, *University of York*, NICK DONNELLY, *University of Southampton*. — Conducting a visual search for two visual targets results in a dual-target cost to performance. Compared to single-target baselines, dual-target searches exhibit lower response accuracy and higher reaction times. Previous work has focused on search tasks in which objects are presented in isolation with no overlap, which stands in contrast real-world search tasks such as airport X-ray screening where there is a considerable degree of overlap. In the present study, we explored whether the dual-target cost increases when overlap is introduced. Eye movements and behavioural performance showed that the dual-target cost did not, in fact, increase when overlap was increased. We also addressed whether adding three-dimensional depth information reduced the dual-target cost by facilitating object segmentation. We found that depth information decreased the time taken to respond overall, but did not reduce the dual-target cost. The dual-target cost is independent of object segmentation and the complications arising from overlap. Email: Hayward J Godwin, hg102@soton.ac.uk

(4134)

Evidence for Parallel Processing in the Identification of Shape and Color During Visual Search. JOSEPH GLAVAN and JOSEPH HOUPT, *Wright State University*. — In his 1998 review paper, Wolfe failed to find evidence of bimodal distributions in over 2,400 pairs of visual search slopes (the relationship between search time and the number of distractors) and concluded that "any effort to divide tasks into serial and parallel search on the basis of search slope alone will be futile." Additionally, search slope alone confounds the serial/parallel distinction with cognitive workload. Systems Factorial Technology (SFT; Townsend & Nozawa, 1995) is specifically formulated for measuring architecture (serial/parallel) and workload without confusing the two. In this study, participants searched for a target (a red circle) in a field of distractors that differed from the target in shape, color, or both. Search times were evaluated using the Capacity Coefficient and Survivor Interaction Contrast (SIC) from SFT. Results provide strong evidence against serial processing while suggesting either independent parallel or coactive processing of shape and color. Email: Joseph Glavan, j.glavan4@gmail.com

(4135)

Winter Is Coming: How Humans Forage in a Temporally Structured Environment. DARYL FOUGNIE, *Harvard University*, JINXIA ZHANG, *Nanjing University of Science and Technology*, SARAH M. CORMIEA, *Harvard University*, XUE GONG, *Wheaton College*, GEORGE A. ALVAREZ, *Harvard University*, JEREMY WOLFE, *Brigham and Women's Hospital/Harvard Medical School*. — Much is known about visual search for single targets, but relatively little about how participants "forage" for multiple targets. One important question is how long participants will search before moving to a new display. Evidence suggests that observers leave when intake drops below the average rate. However, the real world has temporal structure (e.g. seasons) that could influence behavior. Does it matter if winter is coming and the next trial will be worse than the last? Participants were given displays comprised of targets and distractors. The number of targets per trial was structured–rising and falling systematically. Participants were asked to collect targets as fast as possible, and could quit searching at any time. Foraging behavior was affected by temporal structure—observers searched displays longer when quality was falling compared to rising. These results demonstrate that foraging theories need to consider richer models of observers' representations of the world. Email: Daryl Fougnie, darylfougnie@gmail.com

(4136)

Semantic and Visual Similarity Guide Visual Search for Words and Numbers. MICHAEL HOUT, *New Mexico State University*, HAYWARD J. GODWIN and GEMMA FITZSIMMONS, *University of Southampton*, ARRYN ROBBINS, *New Mexico State University*, TAMARYN MENNEER, *University of Southampton*. — Recently, interest has grown in determining the contribution of semantic information during visual search. It's difficult, however, to directly quantify the role of semantics in search, while simultaneously controlling for lower-level, visual factors. In two experiments, we examined how semantic and visual information guide attention during search. We developed a new approach that uses multidimensional scaling of number and letter stimuli to quantify the visual similarity between

objects. We tracked participants' eye movements as they searched for numbers (Experiment 1) or words (Experiment 2) amongst distractors that varied in their visual and semantic similarity to the target. In both experiments, we found that increases in both types of similarity to the target increased the probability that objects would be examined. Consistent with previous research, the findings demonstrate that semantic information is used to guide search, but, importantly, this effect is shown while also considering the influence of visual similarity.
Email: Michael Hout, mhout@nmsu.edu

(4137)

New Reaction Time Tasks for Assessing Inattention of People in Occupational Therapy. TOSHIO OHYANAGI, KUNIHIRO KANAYA and YASUHITO SENGOKU, *Sapporo Medical University*, MASAKO MIYAZAKI, *University of Alberta*. — Inattention is one of the base causes of accidents and injuries in our daily lives. During the process of rehabilitation, Occupational Therapists (OTs) detect inattention through varied assessments of patients. OTs mostly use neuropsychological tests and reaction time (RT) tasks to judge patients' inattention. However it is often the case that the results of the tests and current RT tasks do not reflect the patients' inattentional behavior. We have been developing new RT tasks for assessing inattention of people. We explained the RT tasks and showed how well the results of our RT tasks reflect subjects' attentional behavior at SCiP2012. In this presentation, we explain the modified version of RT tasks to get more reliable data from subjects and present the results of assessing inattention of elderly people by using the new RT tasks. The results suggest that the new RT tasks are better for assessing attentional function of people.
Email: Toshio Ohyanagi, ohyanagi@sapmed.ac.jp

(4138)

Intentional Control and Metacognition of Attentional Effort during Visual Search. SHIORI SARO, MOTOHIRO ITO and JUN-ICHIRO KAWAHARA, *Chukyo University*. — The present study measured meta-attention during visual search to investigate whether observers can intentionally control attentional effort. Observers indicated the presence or absence of a target ("T") among non-targets ("I"s or "L"s). They were instructed to invest 100% or 50% of their attentional effort in the visual search in separate experimental blocks. Difficulty and set size were manipulated, and efficacy of attentional control was measured with a visual analog scale. We found that observers' meta-attention was not associated with their behavioral performance. Effort did not interact with task difficulty or set size, although observers could control their attentional effort during the visual search tasks in terms of general delays in reaction times. We replicated these results in terms of accuracy measures in Experiment 2. The present study demonstrated that observers erroneously believe that they can control their attentional effort, and that the effort is automatically invested during visual search.
Email: Shiori Saro, s337.0428@gmail.com

(4139)

Effects of Expertise on Domain-General and Domain-Specific Visual Search. LAURA MATZEN, MICHAEL HAASS, AUSTIN SILVA, MICHAEL TRUMBO, SUSAN STEVENS-ADAMS, ANN SPEED and LAURA MCNAMARA, *Sandia National Laboratories*. — Expertise in a domain can change behavioral as well as neuronal responses to visual stimuli (e.g. Biggs & Mitroff, 2013; Tanaka & Curran, 2001). Due to the difficulties of accessing experts, most studies of expertise in visual search have focused on one of two types of experts: aviation security officers or radiologists. To date, no studies have compared the effects of expertise on domain-general and domain-specific visual search tasks across multiple domains of expertise. In this study, we investigate the effects of multiple types of domain expertise on behavioral and eye movement patterns for a battery of domain-general and domain-specific tasks. People with expertise in multiple kinds of visual search domains (including X-ray images, radar images, and data visualizations) completed a mental rotation task, a spatial working memory task, a useful field of view task, and domain-general visual search tasks testing parallel and serial visual search performance and visual inspection performance. They also performed a task within their domain of expertise. We compared participants within and between the groups to investigate the effects of expertise in a specific domain on more general cognitive processes.
Email: Laura Matzen, lematzen@gmail.com

(4140)

Characterizing Representations in Activated Long-Term Memory. CORBIN CUNNINGHAM, HRAG PAILIAN and HOWARD EGETH, *Johns Hopkins University*. — Activated long-term memory (ALTM) has been proposed as a memory system separate from working memory and long-term memory (Cowan, 2001), based on its large capacity for storing information and retrieval/search efficiency (Wolfe, 2012). Here, we characterize ALTM storage and retrieval functions by determining whether information is stored as a fixed set or as individual items that can be flexibly retrieved from the initially encoded set. In our study, observers memorized 16 target objects and completed 400 visual search trials. After the initial block, observers were given either 8 of these objects (old) or 8 new target objects (new) to remember, and completed 400 additional visual search trials. Response times in the old and new conditions did not differ, suggesting that the remainder of previously stored items were not included in the current search set; thus, information in ALTM is stored as representations that can be organized flexibly.
Email: Corbin Cunningham, cunningham@jhu.edu

(4141)

Using a Model of Hypothesis Generation to Predict Eye Movements in a Visual Search Task. DANIEL BUTTACCIO, *University of Maryland*, NICHOLAS D. LANGE and RICK P. THOMAS, *University of Oklahoma*, MICHAEL DOUGHERTY, *University of Maryland*. — In this research, we use a model of hypothesis generation to make predictions regarding the deployment of attention afforded by the cued-recall of target characteristics before the onset of a search array.

On each trial, participants received a memory prompt that was diagnostic regarding the target's color in a subsequently presented search array. We assume that the participants utilized the memory prompts to generate hypotheses (i.e., potential target characteristic) from long-term memory into working memory to guide attentional processes. Given that multiple hypotheses might be generated in response to a prompt, it is unclear how the focal hypothesis (i.e., the hypothesis that exerts the most influence on attention) affects search behavior. We test two plausible models against the empirical data. Results indicate that a model assuming only that the first item generated into working memory guides overt attentional processes is most consistent with the data.
Email: Daniel Buttaccio, buttacciodr@gmail.com

(4142)

Perceptual and Conceptual Set Biases in Multiple-Target Visual Search. ADAM BIGGS, STEPHEN H. ADAMO, EMMA W. DOWD and STEPHEN MITROFF, *Duke University*. — Visual searchers, such as radiologists and airport security officers, are more likely to miss additional targets after locating a first target within the search array. Such errors can be serious (i.e., what if a security officer finds a water bottle, but not a gun?), and previous work has shown that multiple-target search errors have numerous contributing causes. One often espoused, but not empirically supported, hypothesis is that searchers become biased to find subsequent targets similar to the first found target (and are therefore less likely to find dissimilar targets). Utilizing "big data" obtained from the mobile application Airport Scanner, the current study tested this hypothesis. Multiple-target search errors were substantially reduced when two targets were identical, suggesting that the first found target did indeed bias subsequent search. Further analyses revealed both a perceptual set bias (i.e., a bias to find additional targets with similar features to the first target) and a conceptual set bias (i.e., a bias to find additional targets with a conceptual relationship to the first target). These findings are discussed in terms of the relationship between attention and working memory in visual search.
Email: Adam Biggs, adam.biggs@duke.edu

• BILINGUALISM III •

(4143)

Automatic Activation of Translation Equivalents During Bilingual Spoken Comprehension. ANTHONY SHOOK and VIORICA MARIAN, *Northwestern University*. — When listening to spoken language, bilinguals access words and concepts in both of their languages at the same time. In the present study, we examined whether cross-linguistic activation can occur in bilinguals when the input does not overtly cue words in the non-target language, a process known as covert co-activation, using an eye-tracking paradigm. When asked in English to click on an image of a duck, English-Spanish bilinguals looked more to an image of a shovel than to unrelated distractors, because the Spanish translations of the words duck and shovel (pato and pala, respectively) overlap phonologically in the non-target language. Though the input corresponded to only a single language, bilinguals co-activated their unused language. We conclude that during speech comprehension, bilingual listeners experience extensive interaction between their two languages. The finding that language co-activation occurs even in single language contexts provides support for highly interactive theories of language processing.
Email: Anthony Shook, a-shook@northwestern.edu

(4144)

Cross-Language Phonological Activation of Meaning in English-Chinese Bilinguals. WINSTON GOH and JASMINE J. M. SIM, *National University of Singapore*. — Previous research found cross-language phonological activation in language pairs that share similar as well as different language types and orthographic properties. Recently, Friesen and Jared (2012) argued that although such effects are theoretically important, the magnitude was typically quite small. Consequently, they investigated if such activations were actually strong enough to result in a noticeable influence on the activation of the corresponding semantic representations (i.e., meaning) in the non-target language. Their study found cross-language phonological activation of meaning in language pairs that share similar language type and orthographic properties such as English and French. The present study examined if the effect of cross-language phonological activation of meaning can also be found in language pairs that have different language types and orthographic properties such as English and Chinese. Results revealed that despite differences in language types and orthographic properties, cross-language phonological activation of meaning was also evident. The findings were discussed with respect to the Bilingual Interactive Activation (BIA+) Model.
Email: Winston Goh, psygohw@nus.edu.sg

(4145)

How Is Bilinguals' Reading Comprehension Influenced by the Vocal Music Sung by Different Languages? LI-HAO YEH, YA-LUN HSIAO and TING-CHEN CHAN, *Chung Yuan Christian University*. — Do you think reading while listening to songs disturbs your comprehension? The purpose of this study is to examine the impact of vocal music on bilinguals' reading comprehension. 68 ESL students were assigned to silent, background music, Chinese vocal music or English vocal music group. Participants read Chinese and English passages followed by reading comprehension tests and reading span task. The result showed that participants had lower reading comprehension in Chinese only when listening to background music and English vocal music. However, they showed poor English reading comprehension when listening to either English or Chinese vocal music. These findings suggested that when L1 is processed participants are more likely to ignore the disturbance created from the same language. However, when L2 is processed, their reading comprehension was harmed by vocal music from L1 and L2. The discussion focused on the non-selective activation of lexical access.
Email: Li-Hao Yeh, lhyeh@cycu.edu.tw

(4146)

Electrophysiological Correlates of Intra-Sentential Code-Switching in Spanish-English Bilinguals: Comparing Auditory and Visual Processing. CARLA B. FERNANDEZ and KAITLYN A. LITCOFSKY, *Pennsylvania State University*, JANET VAN HELL, *Pennsylvania State University/Radboud University, Nijmegen.* — Code-switching, the interchangeable use of two languages within an utterance, is a hallmark of bilingualism. Even though bilinguals report that code-switching in natural discourse is effortless, behavioral and neurocognitive studies have found there is a processing cost when switching between languages. Although natural code-switching occurs more frequently in spoken than written communication, very few studies have examined code-switching in the auditory modality by having bilinguals listen to spoken sentences. In an Event-Related Potentials (ERP) study, we compared auditory and visual processing of code-switched sentences. Spanish-English bilinguals heard or read code-switched sentences (switching from L1 to L2 and from L2 to L1) or non-switched sentences. When bilinguals read code-switched sentences, there is a cost associated with switching from the dominant (L1) to the weak language (L2), but not vice versa. The auditory data are currently recorded and analyzed. Results will be discussed in terms of modality effects in processing code-switched sentences.
Email: Janet G. Van Hell, jgv3@psu.edu

(4147)

Impact of Bilingualism on Executive Processing — An Individual Differences Approach. CLAUDIA VON BASTIAN, ALESSANDRA S. SOUZA and MIRIAM GADE, *University of Zurich.* — Inconsistent findings concerning generalized bilingual advantages have been discussed to be caused by methodological issues such as measuring cognitive abilities with single indicators or treating bilingualism as a categorical instead of a continuous variable. Therefore, we investigated the effect of bilingualism on 21 tasks measuring shifting, updating, inhibition, monitoring, working memory capacity, and reasoning in 118 participants. The degree of bilingualism was assessed on three dimensions: age of second language acquisition, proficiency, and daily language confrontation (i.e., active bilingualism). Unique contributions as well as interactions of these three continuous indicators were evaluated with linear mixed-effects models accounting for individual differences. Positive effects – depending on differing indicators or combinations thereof – were found for shifting switching and mixing costs, updating (although only marginally significant), and monitoring. The overall pattern of effects suggests that proficiency and language confrontation contribute differently to bilingual advantages, thereby providing a potential explanation for inconsistencies in previous research.
Email: Claudia von Bastian, c.vonbastian@psychologie.uzh.ch

(4148)

Retention and Retrieval in the Bilingual Memory. EVELYNE LAGROU and MARC BRYSBAERT, *Ghent University.* — Little research has tested whether plain retention of information learned from texts or discourse is better in

L1 or L2. These studies report surprisingly limited evidence for an L2 disadvantage in word list recall, although this does seem to depend on factors such as the semantic organization of the list (Nott & Lambert, 1969). In the present study we investigated free recall of word lists in L1 and L2. The first goal of this study was to test whether memory performance is influenced by the type of semantic organization of the lists. As expected, recall scores were better when the items of the list were part of different semantic categories, both in L1 and L2, even if these categories were only implicitly present. The second goal of this study was to compare the forgetting curves in L1 and L2. Therefore we retested our participants on three different time moments: 1 day, 1 week, or 1 month later. We observed a traditional forgetting curve with a steep decline in memory performance after one week, both in L1 and in L2. Importantly although memory performance was initially comparable between L1 and L2, the slope of the forgetting curve in L2 was significantly steeper than in L1.
Email: Evelyne Lagrou, evelyne.lagrou@ugent.be

(4149)

Interlocutor Identity Affects Proficient Bilinguals' Language Activation. MONIKA MOLNAR, CLARA MARTIN and MANUEL CARREIRAS, *Basque Center on Cognition, Brain and Language.* — We investigated whether proficient bilinguals' language activation is biased by non-linguistic information, such as interlocutor identity. First, using an audio-visual task, highly proficient Basque-Spanish bilingual participants were implicitly familiarized with Spanish and Basque monolingual and bilingual interlocutors. Then, participants completed an audio-visual lexical decision task, in which the familiarized interlocutors produced test items in Spanish or Basque. Participants' response latencies decreased when the language that the interlocutors spoke during familiarization matched the language they spoke at test, suggesting that bilinguals benefit from an interlocutor-language association. Additionally, we assessed whether bilinguals are able to predict the context-appropriate language based on visual interlocutor-identity cues alone. Event-related potentials recorded prior to the onset of the audio stimuli revealed that bilinguals exhibit different brain responses depending on whether the trial is presented by monolingual or bilingual interlocutors. Therefore, bilinguals are able to activate a language for speech comprehension relying on interlocutor identity.
Email: Monika Molnar, m.molnar@bcbl.eu

(4150)

Semantic Clustering in Recall as a Function of Bilingual Language Proficiency. WENDY S. FRANCIS, RANDOLPH S. TAYLOR, RENEE M. PENALVER and MARY K. LIANO, *University of Texas at El Paso.* — A recall experiment was conducted to find out whether proficient bilinguals make differential use of pre-existing semantic associations in their more and less proficient languages. Spanish-English bilingual participants (N = 128) and English-speaking non-bilingual participants (N = 128) attempted to learn and recall lists that contained semantically related pairs of words. Bilinguals learned two lists in each language, one in which the related

pairs of words were consecutive and one in which the words in each pair were separated by several items. Contrasting predictions about clustering in recall output were made based on the context maintenance and retrieval model of clustering and based on the weaker-links hypothesis of bilingual lexical processing. The degree of clustering was estimated using a multinomial processing tree approach, the pair-clustering model. Recall performance and clustering were compared across languages, language groups, and list types.
Email: Wendy S. Francis, wfrancis@utep.edu

(4151)

Korean-English Bilinguals Fail to Access Korean Animacy Constraints. AMY LEBKUECHER and BARBARA MALT, *Lehigh University*. — Bilinguals may display an influence of their second language (L2) syntax in their first language (L1) use. We found previously that Korean-English bilinguals show an L2 English influence on use of L1 Korean animacy constraints in sentence acceptability judgments. Does this L2 influence reflect a permanent change to underlying L1 grammatical knowledge or a change in the ability to access underlying L1 grammatical knowledge? In the current studies, participants completed either a forced choice sentence preference task or text proofreading task. In forced choice, bilinguals demonstrated knowledge of L1 word order but not animacy constraints. In proofreading, they detected and corrected significantly fewer animacy errors in Korean than monolinguals. These results suggest that Korean-English bilinguals cannot access their knowledge of Korean animacy constraints even when provided with the fewest task demands possible (forced choice) or when the grammatical violations are presented in a more natural language context (text proofreading).
Email: Amy Lebkuecher, all412@lehigh.edu

(4152)

The Effects of Task Demands and Word-Frequency on Language Source Encoding. ELVA STROBACH, WENDY S. FRANCIS and MARIA P. RANSOM, *University of Texas at El Paso*. — Five bilingual experiments investigated the extent to which language source information is retained in long-term memory and available for later episodic retrieval. In all experiments, mixed-language word lists were presented, in which half of the words appeared in English and half appeared in Spanish. Half of the words were of high lexical frequency and half were of low frequency. At study, words were read in isolation (Experiment 1), read in a sentence context (Experiment 2), presented auditorially (Experiment 3), produced in response to a picture (Experiment 4), or translated (Experiment 5). At test, participants were given picture cues and performed a forced-choice recognition task to indicate whether the corresponding words were originally studied in English or Spanish. Results were analyzed using a signal detection approach. The results of these experiments have implications for models of source memory as well as models of bilingual lexical processing.
Email: Elva Strobach, enstrobach@miners.utep.edu

(4153)

Advance Word Planning Increases Non-Dominant Language Availability. DANIEL KLEINMAN, TAMAR GOLLAN and VICTOR S. FERREIRA, *University of California, San Diego*. — Bilinguals frequently switch languages while speaking to other bilinguals. Previous research, often studying bare noun production, has shown that language switching incurs processing costs. Why, then, do bilinguals choose to switch mid-conversation? One possibility is that words planned in advance - including those in connected speech - have more time to accrue activation prior to selection than in bare noun production. This additional time could especially benefit otherwise less accessible words, such as those in the non-dominant or non-target language. A dual-task experiment tested this. On each trial, English-dominant Spanish-English bilinguals first categorized a tone (low/medium/high) and then named a picture in whichever language they chose. The tone was presented 1500 ms or 100 ms before the picture. In the 100 ms condition, increased task overlap meant bilinguals had more time to select a picture name. As predicted, bilinguals produced non-dominant (Spanish) names significantly more often with greater task overlap. This suggests that planning speech in advance reduces differences in accessibility between words, thereby making it easier for bilinguals to select le mot juste regardless of language.
Email: Daniel Kleinman, dkleinman@ucsd.edu

(4154)

Inter-Lexical Activation in Different-Script Bilinguals: Evidence From Korean-English Bilinguals. KICHUN NAM, YEONJI BAIK, HEEJO YOU, JAE HEE RYU, DAHEE KIM and JANG HO PARK, *Korea University*. — Event-related potentials (ERPs) were used to investigate whether phonological representations from both the first (L1) and second (L2) language of different-script bilinguals are activated during covert language production of L1 and L2 words. Korean-English bilinguals were divided into three different groups according to their L2 proficiencies: unbalanced non-proficient, balanced low-proficient, and balanced high-proficient. Participants performed a phoneme monitoring task, and behavioral results showed a greater L1 interference effect in non-proficient bilinguals while no significant group difference was observed for L2 interference effect. A reduction in N400 amplitude was found in response to L1 interference phonemes in comparison to unrelated phonemes for balanced bilingual groups only, suggesting facilitation of L1 Korean when performing in English. Greater P300 effect was found for balanced high-proficient bilinguals in both language tasks, indicating a greater sensitivity over stimulus evaluation during lexical access. These findings provide further support for non-selective access of L1 and L2 words for different-script bilinguals, and the size of interference effect differed according to L2 proficiencies.
Email: Kichun Nam, kichun@korea.ac.kr

(4155)

Semantic Integration During Code-Blend Comprehension in Bimodal Bilinguals. MARCEL GIEZEN and KAREN EMMOREY, *Laboratory for Language and Cognitive*

Neuroscience. — Hearing signers speak and sign simultaneously in conversation, which is called 'code-blending'. The present study investigated whether previously reported facilitation effects during code-blend comprehension reflect form-level or semantic integration of signs and words. Proficient native (N=16) and non-native ASL-English bilinguals (N=15) completed a lexical decision task and a semantic decision task with ASL signs, English words, and ASL-English code-blends. Code-blends facilitated lexical decisions for both groups compared to ASL alone (their non-dominant language), but not compared to English alone (their dominant language). However, semantic decisions yielded code-blend facilitation for native signers compared to either language alone, but for non-native signers only compared to ASL alone. For non-native signers, code-blend facilitation may arise simply from early recognition of the dominant language, while for native signers, facilitation arises from integration of both languages. The difference between tasks indicates that integration occurs at a semantic, rather than at a form level of representation.
Email: Marcel Giezen, giezenmr@gmail.com

(4156)

Frequency Effects in Bilingual Natural Reading. USCHI COP and EMMANUEL KEULEERS, *Ghent University*, DENIS DRIEGHE, *University of Southampton*, WOUTER DUYCK, *Ghent University*. — Bilingual eye movements in first (L1) and second (L2) language natural reading of a book were used to investigate whether language and L2 proficiency modulate the frequency effect (FE). Word isolated comprehension tasks, like the lexical decision task, show a larger FE for bilinguals in L2 compared to L1 and monolinguals, because of a lower exposure to the lexical items in the bilingual lexicon. Whitford and Titone (2011) find the same for sentence embedded target words in a paragraph reading task. Also they find that L2 proficiency modulates the FE's. Our study is the largest assessment of bilingual reading (29 000 content words) and the first one that includes L1 proficiency in the analyses. As a baseline we tested English monolinguals. We find a larger FE in L2 than in L1 for bilinguals. Both when reading in L1 and L2 the FE is smaller when L1 proficiency is lower. The modulation by L2 proficiency is opposite to other findings. We show that by not taking into account L1 proficiency, a distorted L2 proficiency effect is seen. Our results show that the bilingual disadvantage is indeed caused by a differential frequency distribution.
Email: Uschi Cop, uschi.cop@ugent.be

(4157)

Do Non-Native Speakers Use Context Speech Rate in Word Segmentation? MELISSA BAESE-BERK, *University of Oregon*, TUULI MORRILL, *George Mason University*, LAURA DILLEY, *Michigan State University*. — Native English speakers use multiple cues to segment a continuous speech stream into words. Dilley & Pitt (2010) demonstrated that alterations in context speech rate influences the number of words perceived in an ambiguous stretch of speech. This effect has been framed in terms of expectation. Listeners create expectations for the amount of speech material as a function of the speech rate of

the preceding material. While native listeners use speech rate to make predictions and facilitate lexical access in upcoming speech, it is not clear that non-native listeners do the same. We presented non-native listeners with the stimuli from Dilley & Pitt, which contain acoustically ambiguous regions. We ask whether non-native listeners are capable of using speech rate to form similar predictions as native listeners, indicating that speech rate is a universal property used in word segmentation. Alternately, speech rate may be less informative for less proficient non-native listeners.
Email: Melissa Baese-Berk, mbaesebe@uoregon.edu

• PSYCHOLINGUISTICS III •

(4158)

Discrimination and Identification Training for Mandarin and Korean Speech Perception. ERICA MICHAEL, *University of Maryland*, GREGORY COLFLESH, *University of Maryland Center for Advanced Study of Language*, VALERIE KARUZIS, MICHAEL KEY and SVETLANA COOK, *University of Maryland*, NOAH SILBERT, *University of Cincinnati*, CHRISTOPHER GREEN, EVELYN BROWNE, C. ANTON RYTTING, ERIC PELZL and MICHAEL BUNTING *University of Maryland*. — Accurately perceiving unfamiliar speech sounds is challenging for foreign-language learners, and is critical for acquiring higher-level linguistic structures. We created three training tasks to improve native English speakers' perception of Mandarin tones or Korean stop consonants. Participants completed a pre-test before training, a mid-test after one week of training, and a post-test after a second week of training. All tests used an AXB discrimination paradigm. For some participants, training involved only an identification task; other participants received one week of discrimination training and one week of identification training. A control group completed the tests without receiving training. For Mandarin tones, perception improved significantly after the first week of training but did not improve further at post-test. For Korean stop consonants, perception did not improve significantly after the first week, but improved from mid-test to post-test. We will also discuss generalization to untrained words or speakers and correlations with cognitive assessments.
Email: Gregory Colflesh, gcolflesh@casl.umd.edu

(4159)

Processing of Acoustic and Phonological Information of Lexical Tones in Mandarin Chinese Revealed by Mismatch Negativity. RUIMING WANG, *South China Normal University*, PING LI, *Pennsylvania State University*, KEKE YU and LI LI, *South China Normal University*. — The accurate perception of lexical tones in tonal languages involves the processing of both acoustic information and phonological information carried by the tonal signal. In this study we evaluated the relative role of the two types of information in native Chinese speaker's processing of tones at a preattentive stage with ERP, particularly the MNN. Specifically, we

distinguished the acoustic from the phonological information by manipulating phonological category and acoustic interval of the stimulus materials. We found that a significant main effect of phonological category for the peak latency of MMN, but a main effect of both phonological category and acoustic interval for the mean amplitude of MMN. The results indicated that the two types of information play different roles in the processing of Chinese lexical tones: acoustic information only impacts the extend of tone processing, while phonological information affects both the extend and the time course of tonal processing.
Email: Ruiming Wang, psywrm@gmail.com

(4160)
Use of Gender-Marked Context in Noun Recognition: Abstract Cues or Multiword Sequences Storage? ELSA SPINELLI, JEAN PIERRE CHEVROT and CINDY BELLANGER, *Grenoble University*. — French nouns are either feminine or masculine and are preceded by feminine or masculine determiners in the singular. Plural articles however are unmarked for gender. Numbers of studies have shown effects of gender-marked contexts on word recognition. However, it is unclear how gender is used during the recognition of the following word. It could be that abstract gender information is retrieved and influences the process of lexical access. Or, gender effect could be due to the retrieval of stored determiner-noun sequences. Some nouns occur more frequently in the plural (peanuts), others more often in the singular (rainbow). We examined the recognition of plural and singular oriented nouns preceded by singular and plural articles. Singular-oriented nouns were recognized faster after singular (gender marked) articles than after plural (gender unmarked) ones. However, plural-oriented nouns were recognized faster after plural (gender unmarked) articles, suggesting that article-noun sequences outweigh abstract gender cue.
Email: Elsa Spinelli, elsa.spinelli@upmf-grenoble.fr

(4161)
Explicit Attention to Pitch Direction Enhances Mandarin Tone Learning. KIRSTEN SMAYDA, GAYATRI RAO, HAN-GYOL YI, BHARATH CHANDRASEKARAN and W. TODD MADDOX, *University of Texas at Austin*. — Learning novel speech categories is a challenging task in adulthood. Previous research suggests one reason for this difficulty is cross-language differences in weighting cues that differentiate speech categories. Previous research suggests that successful Mandarin tone learning requires attention to pitch height and pitch direction (multidimensional strategies) as opposed to just one dimension (uni-dimensional strategies). To encourage multidimensional strategy use we recruited native English speakers who never learned a tone language and trained them to categorize Mandarin tones under one of four conditions that cued them to attend to: pitch height; pitch direction; pitch height and direction; or direction but not height. Since pitch direction is not a linguistically-relevant dimension in English, we predicted that hints that encouraged attention to pitch direction would enhance multidimensional strategies.

We found support for this hypothesis suggesting that training paradigms could benefit from increasing awareness to the pitch direction dimension.
Email: Kirsten Smayda, ksmayda@utexas.edu

(4162)
Universal Phonological Preferences Are Not Sensorimotor. XU ZHAO and IRIS BERENT, *Northeastern University* (Sponsored by Nancy Kim). — Across languages, certain syllables are systematically preferred (e.g., blif≻bnif≻bdif≻lbif). Such preferences have been observed in the behavior of speakers of different languages, even when none of these structures exists in their language. But whether this convergence reflects universal grammatical constraints or nonlinguistic (i.e., auditory and/or articulatory) pressures remains unclear. Our past analyses challenged the auditory account by replicating this effect with printed materials. However, the syllable preference might be informed by covert articulation of these stimuli. To address this possibility, we reassessed participants' syllable preferences while articulation was mechanically suppressed. Auditory stimuli yielded strong effects of syllables structure irrespective of suppression—the worse-formed the syllable, the more likely its misidentification. Results with printed stimuli were more complex, likely due to the conjunction of phonological and graphemic strategies. Together, these findings indicate that speakers possess broad linguistic preferences that are irreducible to sensorimotor factors.
Email: Xu Zhao, zhao.xu@husky.neu.edu

(4163)
A Response Time Model on the Role of Spectral and Duration Cues in Vowel Perception. GABRIEL TILLMAN, DON VAN RAVENZWAAIJ and SCOTT BROWN, *University of Newcastle*, TITIA BENDERS, *University of Amsterdam* (Sponsored by Ami Eidels). — An integral part of language comprehension is the problem of phoneme categorization: in particular vowel contrasts. When Dutch listeners categorize vowels as the long and open /a:/ versus the short and closed /A/, behavioral categorization data suggests that spectral quality is weighed more heavily than duration when classifying these phonemes. But unlike spectral information, duration information is only completely available at the offset of the stimulus. Therefore, listeners' processing of duration may be underestimated in behavioral categorization data. To disentangle the contributions of spectral quality and duration in vowel categorization, we use reaction time data from a vowel categorization task. We then model this data with a Bayesian hierarchical Linear Ballistic Accumulator model. The results of our analysis demonstrate the role of non-decision time (i.e. perceptual encoding time) and speed of processing in accounting for differences in the use of spectral and duration information in phoneme categorization.
Email: Gabriel Tillman, gabriel.tillman@newcastle.edu.au

(4164)
Evidence for Experience-Based Changes in Inter-Lexical Inhibition. EFFIE KAPNOULA and BOB MCMURRAY, *University of Iowa*. — Changes in inhibition are linked to a

variety of cognitive impairments, but it is unknown whether inhibition is amenable to learning. We examined this in spoken word recognition (Luce & Pisoni, 1998; McClelland & Elman, 1986). While studies have examined the conditions under which inhibitory links are formed for newly learned words (Gaskell & Dumay, 2003), we asked whether inhibition between known words can be strengthened. Participants were exposed to a set of words over 4 tasks for 40 minutes. Half received High-Competition (HC) and half received Low-Competition (LC) training. Both groups heard the same words the same number of times, however, tasks were manipulated to require either more or less inter-lexical competition. For example, in a 2AFC word recognition task responses were minimal pairs (neck/net) for HC training, and unrelated (neck/cat) for LC. After training, we tested timing of inter-lexical inhibition using the visual world task of Dahan et al. (2001). The HC group resolved competition faster than the LC group, demonstrating that inter-lexical inhibition can be shaped by experience.
Email: Effie Kapnoula, kapnoula@gmail.com

(4165)
Morphological Processing of Fully Opaque and Pseudo-Compounds: Similarity and Difference in Inter-Letter Typing Speed. THOMAS SPALDING, CHRISTINA GAGNE, JUANA R. PARK and KELLY A. NISBET, *University of Alberta*. — We used inter-letter typing speed to investigate the extent to which morphological structure contributes to the processing of compound and pseudo-compound words. Of particular interest are fully opaque compound words (hogwash) and pseudo-compound words (carpet), which differ primarily with respect to morphological structure, but are similar in the degree to which the (pseudo)constituents contribute to the meaning of the word. We found indications of morphological processing for pseudo-compounds: There were significantly elevated inter-letter typing times around the (pseudo)constituent boundary. However, pseudo-compounds and fully opaque compounds also differed. First, the inter-letter typing time elevation was much smaller for pseudo-compounds than for fully opaque compounds. In addition, the typing time elevation was spread across the letters before and after the (pseudo)constituent boundary for pseudo-compounds, but concentrated only on the letter after the constituent boundary for the fully opaque compounds. Third, we presented compound and pseudo-compound words with the order of their constituents reversed, and found that reversal had relatively little effect for the compounds, but a large effect for the pseudo-compounds.
Email: Thomas Spalding, spalding@ualberta.ca

(4166)
Here's Looking at You: Visual Similarity Enhances the Moses Illusion for Semantically-Related Celebrities. DANIELLE DAVIS and LISE ABRAMS, *University of Florida*. — When people read questions like How many animals of each kind did Moses take on the ark?, many answer two despite knowing that Noah, not Moses, sailed the ark. This Moses illusion typically occurs when names share semantic features. This experiment examined whether sharing visual concepts

(facial features) enhances Moses illusions for celebrity names. Questions contained either an unrelated distractor name or a semantic distractor name. Semantic distractors were either visually similar or dissimilar to the correct target name. Moses illusions occurred when questions contained either semantic distractor relative to an unrelated distractor, with the most illusions for questions containing a visually-similar semantic distractor. Furthermore, presenting a picture of the target before the question reduced the number of illusions, irrespective of distractor type. Results demonstrate the importance of visual information in proper name processing even in written form, and challenge traditional explanations for illusions as resulting from shallow semantic processing.
Email: Danielle Davis, dstahldavis@ufl.edu

(4167)
Adding New Words to the Mental Lexicon and Identifying the Next New Words. LANCE WILLIAM HAHN, TAYLOR SANDBERG BLAETZ and WILLIAM ALLEN WALTERS, *Western Kentucky University*. — Even native speakers encounter and acquire new words. By understanding how new words are incorporated into the mental lexicon, we gain insight into processes underlying language acquisition. We hypothesized that new slang words found in informal communication have been integrated into the existing mental lexicon. We used a lexical decision task to probe links between conventional prime words and slang target words. Targets were recognized faster following a related prime than an unrelated prime, t(46) = 4.97, p < .001, d = .725. Thus, conventional words can prime slang target words.To track the integration of new words into the mental lexicon, it is necessary to identify new words early in the word's adoption. We developed a method to identify new slang words within a geographic region by contrasting a corpus produced by users of slang and a corpus produced by users who avoid slang. The two corpora were created by gathering messages from Twitter accounts that either used or avoided known slang words. From over 25,000 unique slang corpus unigrams, 641 potential new slang words were identified. The combination of identifying new words early and probing their semantic links provides a novel window into language acquisition.
Email: Lance Hahn, lance.hahn@wku.edu

(4168)
Likelihood and Possibility Both Guide Verb-Based Anticipatory Processing. TESSA WARREN, EVELYN MILBURN and MICHAEL WALSH DICKEY, *University of Pittsburgh*. — Listeners anticipate likely upcoming verbal arguments (Altmann & Kamide, 1999; Kamide, et al., 2003), consistent with models wherein verbs activate event-related memory representations and activation spreads to likely event participants (e.g., Ferretti, et al., 2001). However, some studies report that listeners also anticipate unlikely but possible verbal arguments (Boland, 2005; Borovsky, et al., 2012). This suggests that coarse-grained verb-based semantic constraints may also guide anticipatory processing (Kuperberg, 2013). Our experiments investigated how the possibility versus likelihood of upcoming arguments guides predictions, when they are dependent on the verb (Experiment 1) vs. an

agent+verb combination (Experiment 2). Likelihood rapidly guided the anticipation of upcoming arguments, but listeners also looked at unlikely arguments compatible with the verb's coarse-grained requirements (see also Kamide, et al., 2003, Borovsky, et al., 2012; Kukona, et al., 2011). Verb-based possibility contributes to anticipatory processing, even when it is incompatible with likelihood established by verbs or verb-agent combinations.
Email: Tessa Warren, tessa@pitt.edu

(4169)

LAB: Linguistic Annotated Bibliography—A Searchable Portal for Normed Database Information. ERIN BUCHANAN, KATHRENE D. VALENTINE, MARILEE L. TEASLEY, KAYLA N. JORDAN and MARSHALL T. BEAUCHAMP, *Missouri State University*. — Psycholinguistic research is flourishing with numerous publications advancing our knowledge of word characteristics and ways to study them. This presentation showcases the Linguistic Annotated Bibliography (LAB) as a searchable web portal to quickly and easily access reliable database norms, related programs, and variable calculations. Over 600 publications were coded by language, number of stimuli, stimuli type (i.e. words, pictures, symbols), keywords (i.e. frequency, semantics, valence), and other useful information. This tool not only allows researchers to search for the specific type of stimuli needed for experiments, but also permits the exploration of publication trends across 100 years of research. Details about the portal creation and use are outlined, as well as various analyses of change in publication rates and keywords. In general, advances in computation power have allowed for the increase in dataset size in the recent decades, in addition to an increase in the number of linguistic variables provided.
Email: Erin Buchanan, ErinBuchanan@MissouriState.edu

(4170)

Using Eye Movements to Examine Reading in Autism Spectrum Conditions. PHILIPPA HOWARD, VALERIE BENSON and SIMON LIVERSEDGE, *University of Southampton*. — This study aimed to test the hypothesis that there is a deficit in the online access to and use of higher order world knowledge during reading in Autism Spectrum Conditions (ASC; Minshew & Goldstein, 1998). Adults with and without an ASC read sentences containing plausible, implausible or anomalous thematic relations as their eye movements were recorded. Predictions of delays in the detection of anomalies and implausibilities in the ASC group were not supported, with both groups detecting anomalies in first fixations, and implausibilities in go past times at the critical word. However, ASC participants spent longer re-reading all sentences. The ASC readers were as efficient as controls in their on-line use of higher order knowledge during reading, but sentential comprehension appeared to be more effortful for this group. Possible explanations for this will be discussed in relation to current theories of cognitive processing in ASC.
Email: Philippa Howard, PLH1G11@soton.ac.uk

(4171)

Semantic Knowledge Influences Adaptation to Accented Speech. STANISLAV SAJIN and CYNTHIA CONNINE, *Binghamton University, SUNY*. — In the following study it was examined if semantic richness, defined as the number of features (NOF) associated with a concept, plays a role in adaptation to accented speech. During the learning phase, participants were exposed to accented words that either were rich in meaning (i.e., high NOF) or impoverished in meaning. During the test phase, participants that were exposed to high NOF word in the learning phase showed faster recognition for a new set of accented productions compared to participants who were exposed to low NOF words in the learning phase. These results indicate that semantic information helps listeners adapt quicker to accented speech.
Email: Stanislav Sajin, ssajin1@binghamton.edu

(4172)

Language Understanding and Common Sense Reasoning. JOSHUA HARTSHORNE, TOBIAS GERSTENBERG, TIMOTHY J. O'DONNELL and JOSHUA TENENBAUM, *Massachusetts Institute of Technology*. — Pronoun understanding frequently requires common sense reasoning. Interpreting he in (1-2) depends on the final word:1. Al beat Bart at tug-of-war because he was strong/weak/motivated/lazy.2. Al frightened Bart although he is reckless/timid. We suggest that listeners infer the intended meaning using Bayesian inference over an intuitive theory of how speakers choose messages to convey and how speakers then choose utterances to convey that message. Because the speaker is more likely to try to convey a message that is true, this model incorporates the listener's beliefs about what is true of the world. We derived those beliefs through surveys (Exp. 1) or from computational models of specific domains (tug-of-war matches and billiard ball collisions; Exp. 2). Across experiments, we compared model and human pronoun interpretations in sentences involving a variety of events and connectives (because/although/etc.). The model fit human interpretations very well (rs>.8). Previous theories were at chance.
Email: Joshua Hartshorne, jkhartshorne@gmail.com

(4173)

A "Big Data" Study of Concreteness and Psychological Distance in Naturalistic Language Use. BRYOR SNEFJELLA, *McMaster University* (Sponsored by Victor Kuperman). — Trope and Liberman (2010) put forward the construal theory of psychological distance, which states that with increasing distance from the self goes increasing abstraction. Proximal objects are described with rich contextual detail (low-level construal) and distal objects are described by essential characteristics (high-level construal). We complement previous experimental research into construal by offering a new corpus-based method for operationalizing construal level, as a mean of concreteness ratings (Brysbaert et al., 2014) of words found in the linguistic contexts for a word/phrase of interest. Our analyses of a geo-tagged corpus of Twitter messages and the USENET corpus validated the construal level theory across millions of observations in naturalistic

language use. Lower concreteness (higher-level construal) characterized tweets sent from a longer distance from the geographic location of reference, and contexts of phrases denoting more distant past and future events, and more distant social relationships. New dimensions of psychological distance were also discovered.

Email: Bryor Snefjella, snefjebn@mcmaster.ca

(4174)

The Role of Executive Function Components in Predicting Eye-Movements During Reading. REGINA HENRY and VICTOR KUPERMAN, *McMaster University*, JULIE A. VAN DYKE, *Haskins Laboratory* (Sponsored by Debra Jared). — Studies of children with dyslexia and ADHD have identified a link between deficiencies in executive function (EF) and reading, including comprehension (e.g., Altemeier, Abbott & Berninger, 2008). However, it is unclear how specific components of EF predict reading ability in a non-clinical population. Our study compared individual performance on a representative battery of EF tests against the eye-movement records of 40 young adults obtained during reading text passages for comprehension. We employed principal components analysis and correlational analyses to demonstrate that EF components affect different stages of the time-course of reading-for-comprehension, gauged via eye-movement measures, and accuracy of responses to comprehension questions. Participants who were slower at updating were disadvantaged at all stages, showing longer and more fixations and lower comprehension scores. Individual performance in inhibition tasks only affected early eye-movement measures, associated with lower-level oculomotor control, while shifting had no effect whatsoever. Implications for reading theories are discussed.

Email: Regina Henry, henryr@mcmaster.ca

• LETTER AND WORD PROCESSING III •

(4175)

On the Time-Frame and Nature of the Syllabification Process in Reading. OLESSIA JOURAVLEV and STEPHEN LUPKER, *University of Western Ontario*. — The goal of this research was to identify when information about the syllabic length of words (monosyllables vs. disyllables) becomes available to the processing system. Specifically, we examined how the consistency between the number of vowel letters in a word and the number of syllables in a word (consistent (birch – 1Syllable-1Vowel; druid – 2Syllables-2Vowels) vs. inconsistent (fruit – 1Syllable-2Vowels; onion – 2Syllables-3Vowels)) impacts the speed and ease of determining the number of syllables the word contains. A go/no-go task (instructions to either go for one syllable or go for two syllables) was used, while ERPs were recorded. Monosyllables with one vowel and disyllables with two vowels enjoyed a processing advantage over the other two word types in both the behavioral and the

ERP data. Time-wise, these differences emerged as early as 200 ms post stimulus presentation, suggesting that readers are aware of the syllabic length of words very early in processing.

Email: Olessia Jouravlev, Ozhuravl@uwo.ca

(4176)

Time Course of CV Pattern Effects in Visual Word Processing. FABIENNE CHETAIL, *Université Libre de Bruxelles-LCLD*, ALAIN CONTENT, *Université Libre de Bruxelles*. — We showed in the last years that the sequential organization of letters as consonants and vowels (i.e., the CV pattern) constrains the perceptual structure of letter strings, with each vowel or vowel cluster determining one perceptual unit. We assumed that the impact of the CV pattern occurs early, although no direct evidence has been provided. This hypothesis was tested in the present study through event related potential (ERP) recording. Participants performed a lexical decision task on letter strings matched on number of letters and syllables, but with a different number of vowel clusters (e.g., REUNION, EVASION: hiatus and control words respectively). A difference between the two conditions was found in time windows around 170 ms, 250 ms, and 400 ms, and the effects were stronger for pseudowords than words. The findings support the claim that the CV pattern exerts its effect at an early stage of processing.

Email: Fabienne Chetail, fchetail@ulb.ac.be

(4177)

The Impact of Hyperlinks on Reading on the Web. GEMMA FITZSIMMONS, MARK J. WEAL and DENIS DRIEGHE, *University of Southampton*. — Text on the Web features marked differences to text typically presented in reading experiments. A significant difference is the presence of hyperlinks, which are words in a different colour linking to other Webpages. Although previous research examined how highlighting or modifying words within sentences influences reading behaviour, to date, relatively little work has examined how people read on the Web using eye-tracking methodology. With that in mind, we recorded participants' eye movement behaviour as they read edited articles from Wikipedia. We manipulated the frequency of target words, as well as whether they were presented as hyperlinks or not. The key result was that participants did not demonstrate any difficulty when reading hyperlinked text, however re-reading did increase when a target word was hyperlinked and low-frequency. We suggest that hyperlinks indicate additional information concerning the target word and coupled with lexical difficulty promoted re-analysis of previous text sections.

Email: Gemma Fitzsimmons, gem.fitzsimmons@gmail.com

(4178)

Using Eye Movements to Understand Cognitive Processing During Copying From the Board. ABBY LAISHLEY, *Bournemouth University*, SIMON LIVERSEDGE, *University of Southampton*, JULIE KIRKBY, *Bournemouth University*. — Copying text may seem trivial, but the task itself is psychologically complex. It involves a series of sequential visual and cognitive processes which must be co-ordinated; these include visual encoding, mental representation, then

written production. To investigate the time-course of word-processing during copying, we recorded eye-movements of adults and children as they hand-copied isolated words presented on a classroom board. Longer and lower frequency words extended adults' encoding durations, suggesting whole word encoding. Only children's short word encoding was extended by low frequency. Though children spent more time encoding long words compared to short words, gaze durations for long words were extended similarly for high and low frequency words. This suggested that children used partial-word representations and encoded multiple sublexical units rather than single whole words. Piecemeal word representation seems to underpin copying behaviour in children, though reliance on partial word representations may decrease due to progression in reading development.
Email: Julie Kirkby, jkirkby@bournemouth.ac.uk

(4179)

Inhibitory Effects of Transposed Letter Neighbours During Silent Sentence Reading. ASCENSION PAGAN and HAZEL BLYTHE, *University of Southampton*, KEVIN PATERSON, *University of Leicester*, SIMON LIVERSEDGE, *University of Southampton*. — Several computational models (e.g., McClelland & Rumelhart, 1981) assume that lexical selection is made by a lateral inhibition mechanism due to the pre-activation of similar words, as they are defined by Coltheart et al. (1977). Although previous studies have shown an inhibitory effect using transposed letter neighbours (TLN) (e.g., Andrews, 1996), the role of TLN during silent sentence reading is still not clear. This experiment explored whether the identification of a TLN that appeared earlier in a sentence resulted in a greater interference, compared to a control word, on the identification of a target-word which appeared downstream. Eye movement measures showed that reading times for the target-word were longer when a TLN, relative to a control word, appeared earlier in the sentence. This suggests that transposed-letters pairs behave as orthographic neighbours during reading, and supports the assumption of a lateral inhibitory mechanism during lexical retrieval.
Email: Ascension Pagan, a.p.pagan-camacho@soton.ac.uk

(4180)

Young Deaf Readers' Word Processing Efficiency. NATHALIE BÉLANGER, ELIZABETH SCHOTTER and KEITH RAYNER, *University of California, San Diego*. — Recent evidence shows that skilled adult deaf readers have a wider perceptual span, make fewer regressions back in the text and skip words less often relative to skilled hearing readers, suggesting that they are very efficient at processing foveal and parafoveal visual and word-based information. In a moving-window experiment, we show that young deaf readers, matched on reading-level to young hearing readers, read significantly faster, make fewer fixations within a sentence, make longer forward saccades and fewer regressions than their hearing peers (with equal comprehension levels), suggesting that they can pick up word-level information extremely rapidly and efficiently in the fovea and parafovea with no cost to comprehension.
Email: Nathalie Bélanger, nbelanger@ucsd.edu

(4181)

Accent Familiarity Affects Specificity of Word Learning. CONOR FRYE and SARAH CREEL, *University of California, San Diego*. — When acquiring words, learners must detect commonalities across multiple nonidentical tokens. We ask whether familiarity with the subtle phonetic detail of to-be-learned words (accent) increases the accuracy of learning those words. Three listener groups— English monolinguals, Spanish-English bilinguals, and Mandarin-English bilinguals—learned novel words in an English or Spanish accent and were tested on those words as labels for unfamiliar shapes in both accents. ME bilinguals were significantly less accurate when the training accent mismatched the test accent. SE bilinguals and English monolinguals generalized to the untrained accent better when trained in their native accents. This pattern may indicate that accent unfamiliarity generates weaker or overly-specific representations (e.g. Lively et al., 1993), yielding worse recognition when phonetic cues change. Conversely, prolonged accent experience yields generalizable representations of newly-learned words. Thus, vocabulary acquisition in one's own accent may be more effective than acquisition in unfamiliar accents, which has implications for L2 instruction.
Email: Conor Frye, cifrye@ucsd.edu

(4182)

Cascaded vs. Stage-Like Semantic Access in Spoken and Written Word Recognition: Insights From Lexical Decision. BLAIR ARMSTRONG, *Basque Center on Cognition, Brain and Language*, ELMA ABAD, *Universitad del Pais Vasco*, ARTHUR SAMUEL, *Stony Brook University and the Basque Center on Cognition, Brain, and Language*. — Does the temporal nature of auditory word recognition allow for more cascaded semantic access than visual word recognition, for which the characters in a word can be processed in parallel? We investigated whether a semantic variable, imageability, was a stronger predictor of performance in auditory versus visual lexical decision. Using a within-participant design, native Spanish speakers were presented with alternating blocks of auditory and visual stimuli. Results were analyzed with linear mixed-effect models and showed an interaction between presentation modality and imageability. Separate analyses of each presentation modality further showed that imageability was a non-significant predictor in the visual modality, but was a significant predictor in the auditory modality. These findings suggest that semantic representations are more strongly activated at the moment the decision is made in the auditory domain, consistent with more cascaded processing in auditory word recognition. Implications for connectionist models of word recognition are discussed.
Email: Blair Armstrong, blair.c.armstrong@gmail.com

(4183)

Simulating the Effects of Phonotactics in Oral Reading. ANASTASIA ULICHEVA, BRENDAN WEEKES, *University of Hong Kong*, and MAX COLTHEART, *Macquarie University*. — The present study investigates how phonotactic rules constrain oral reading in the Russian language. Notably, the pronunciation of letters in Russian is regular and

consistent, but it is subject to substantial phonotactic changes. Critically, the position of the phoneme and its context within the word may alter its pronunciation. Data from an oral word reading task with monosyllables showed an effect of phonotactic dependencies on skilled human reading. In addition, the results of simulations from the Russian dual-route cascaded (DRC) and the Russian connectionist dual-process model (CDP++) are presented. The main outcome of the simulations with respect to phonotactic dependency is that the CDP++ cycle times show limited sensitivity to phonotactic dependency, whereas DRC shows the same effects of phonotactic dependency as human readers. Potential reasons for these differences, as well as the theoretical implications of phonotactics to theories of reading. Email: Anastasia Ulicheva, ulicheva@hku.hk

(4184)

Reading Sentences in Lowercase vs. Uppercase. EVA-MARÍA ROSA-MARTÍNEZ, *Universidad Católica de Valencia, San Vicente Mártir*, BEATRIZ DÍAZ and MANUEL PEREA, *Universitat de València*. — While uppercase letters may be more legible than lowercase letters (Arditi & Cho, 2007), words are more usually presented in lowercase than in uppercase. When words are presented in isolation, lowercase words are identified more rapidly than uppercase words, and this lowercase advantage is generally greater for infrequent words. Here were examined how a perceptual factor such as letter case (lowercase vs. UPPERCASE) influences eye movement control during sentence reading. Unlike the early study of Tinker and Paterson (1929), we employed a fixed-width font (Courier New). Each sentence contained a target word that could be high/low in word-frequency. Results showed faster reading speed (fewer/shorter fixations) in lowercase than uppercase sentences, and a greater lowercase advantage for low-frequency words than for high-frequency words in gaze durations. This pattern poses problems for those accounts that assume that a word's letters are converted into abstract letter codes early during lexical processing. Email: Eva-María Rosa-Martínez, eva.rosa@ucv.es

(4185)

Sequence Processing in a Covert Speech Repetition Network. FENG RONG, ANNA LISETTE ISENBERG, ERICA SUN and GREGORY HICKOK, *University of California, Irvine*. — Generating words, phrases, and sentences requires grouping syllables into a correct order. In this fMRI study, we first indentified 11 cortical and sub-cortical ROIs by an independent set of tasks including covert rehearsal and passive listening, then investigated the network's involvement in syllable sequencing comparing tightly matched sequence and non-sequence conditions, in which the subjects heard and repeated the same set of syllables in each activation block with the only difference being whether they were repeating a sequence (RS) or individually (RU). Within the ROIs, one group of regions (IFG, SMA, BG) responded stronger in both rehearsal and RS conditions comparing to controls, suggesting a particular role for these traditional motor-speech areas in syllable sequencing. Furthermore, although not all ROIs in the network were identified as activating differentially to the

RS and RU conditions, functional connectivity between nodes in the network were correlated with sequencing error rates as measured behaviorally outside the scanner, indicating that speech sequencing involves a complex sensorimotor network composed of interacting cortical and sub-cortical regions. Email: Feng Rong, frong@uci.edu

(4186)

Individual Differences in Working Memory and Conceptual Priming Influence Spelling Ability. CHRISTOPHER WAS, *Kent State University*, ANGELA C. JONES, *John Carroll University*, RACHAEL TODARO, *Kent State University*. — Despite extensive research examining the influence of general working memory capacity and activation of relevant background knowledge on reading comprehension, the influence of these constructs on spelling skill has received little to no attention in the cognitive literature. Because models of spelling include domain-specific activation of knowledge and working memory, we expect that more domain-general measures may correlate with spelling ability. As such, we investigated the contributions of individual differences in working memory and conceptual priming on spelling ability. We administered two working memory measures, a semantic priming measure, a simple reaction time measure, and a spelling-to-dictation test. We found that both working memory and conceptual priming were related to spelling accuracy whereas reaction time was not. Thus, both the ability to maintain and update information in working memory and the implicit activation of word knowledge contribute skilled spelling. Email: Christopher Was, cwas@kent.edu

(4187)

Detecting Mindless Reading From Eye Movements. TOMASZ LOBODA, *University of Pittsburgh*, ERIK REICHLE, *University of Southampton*. — Mindless reading occurs when a reader's eyes continue to move across a printed page in a reading-like manner, but there is little or no comprehension of the text that is being read. Prior research on mindless reading has relied upon subjective reports of mindlessness to examine how such lapses of attention affect both on-line (e.g., eye movements) and off-line (e.g., comprehension) measures of the text being "read" (e.g., Reichle, Reineberg, & Schooler, 2010). Here, we report the results of a new large-scale eye-movement study and our attempts to develop statistical classifiers to automatically detect instances of mindless reading using only properties of the text (e.g., word lengths) and participants' eye movements. Our results suggest that it is possible to detect mindless reading without relying upon subjective reports, thus providing a method to study mindless reading in a more unobtrusive and ecologically valid manner (e.g., without requiring participants to self-monitor mindfulness). Email: Tomasz Loboda, tol7@pitt.edu

(4188)

Using E-Z Reader to Model Distributions of Fixation Durations. HEATHER SHERIDAN, *University of Southampton*, ERIK REICHLE, *University of Pittsburgh*, EYAL

REINGOLD, *University of Toronto*. — Recent work has used distributional analyses to show that lexical variables can have a rapid effect on fixation durations during reading, and that this rapid lexical processing is supported by a substantial amount of parafoveal preview (Reingold, Reichle, Glaholt, & Sheridan, 2012). To explore whether these findings could be accommodated by a model that assumes that words are processed in a strictly serial manner, we used the E-Z Reader model of eye-movement control (Reichle, Pollatsek, & Rayner, 2012) to simulate a manipulation of the availability of parafoveal preview (valid vs. invalid preview) and a manipulation of lexical processing speed (fast vs. slow). Consistent with empirical findings, these simulations indicated that rapid lexical effects are enabled by both the availability of parafoveal preview, and by a fast lexical processing rate. We argue that future models of eye-movement control should account for empirical effects on distributions in addition to mean effects.
Email: Heather Sheridan, h.sheridan@soton.ac.uk

• DECISION MAKING II •

(4189)
Risk Literacy and Transparent Risk Communication. ROCIO GARCIA-RETAMERO, *University of Granada*, EDWARD COKELY, *Michigan Technological University*. — Over the past years, numerical skills have become increasingly necessary for navigating the modern health care environment. Unfortunately, many people struggle to grasp numerical concepts that are essential for understanding health-relevant information. In short, the general public lacks basic numeracy, which limits their risk literacy¾the ability to accurately interpret and make good decisions based on information about risk (see www.RiskLiteracy.org). In this poster, we will present a collection of studies investigating (1) how helpful numbers are when communicating risks, and whether (2) appropriately designed visual aids can be highly effective, transparent, and ethically desirable tools for improving risk communication, limiting the influence of different levels of numeracy. Theoretical mechanisms and open questions of our research will also be discussed.
Email: Rocio Garcia-Retamero, rretamer@ugr.es

(4190)
Discounting of Delayed Losses: Evidence for an Anomalous Group of Debt-Averse Individuals. LEONARD GREEN, ANA BAUMANN and JOEL MYERSON, *Washington University in St. Louis*. — Participants recruited using MTurk chose between immediate payments and larger, but delayed payments. As expected, the overall likelihood of choosing the larger payment increased as the delay to when that payment had to be made increased. Interestingly, however, there was a group of participants who became less, rather than more, likely to choose to pay later when the delay was longer. These people may be characterized as debt averse, in that owing money for a shorter period appears to be preferable to a longer period of debt. These results suggest that although people differ only quantitatively in their discounting of delayed gains,

people differ qualitatively as well as quantitatively in their discounting of delayed losses, as evidenced by the existence of an anomalous group of debt-averse individuals.
Email: Ana Baumann, baumann.ana@gmail.com

(4191)
Information Foraging for Perceptual Decisions. CASIMIR LUDWIG and DAVID R. EVENS, *University of Bristol*. — How do we sample noisy information from multiple sources in order to make decisions? We address this general problem in the perceptual domain. Subjects make a comparative direction discrimination judgement of two random dot motion patterns that are activated only when directly fixated. The viewing time is limited and subjects have to adapt their time allocation to the quality of the two patterns. A simple foraging model assumes a pattern is sampled until until the change in the precision of the direction estimate for that pattern drops below a threshold. At that point the subject switches to the other pattern and accrues information from that source. We test two predictions of the model: (i) the timing of the first switch should depend on the online accrual of information; (ii) the representation of previously sampled information decays. Our experiments confirm the first prediction, but show that decay is surprisingly small.
Email: Casimir Ludwig, c.ludwig@bristol.ac.uk

(4192)
Sampling Bias in an Olfactory Preference Task and a Haptic Preference Task. TAKASHI MITSUDA, *Ritsumeikan University*. — When people are presented with a pair of images and asked to identify which one is more attractive, their gaze gradually shifts toward the image that they eventually choose. Many researchers have examined the relationship between the gaze and decision processes, but few have investigated the relationship between the sampling behavior and decision processes in other sensory preference tasks. This study examined sampling behavior in an olfactory preference task and a haptic preference task. In accordance with the gaze bias, subjects tended to sample the item they were about to choose just before making their decision when they were instructed to identy the item they liked more, but not when they were instructed to identify the item they disliked more. This result shows that the sampling bias is not peculiar to visual preference tasks.
Email: Takashi Mitsuda, mitsuda@ci.ritsumei.ac.jp

(4193)
Comparative Decision Making: Age Differences in Stopping Rule Selection. TESSA JOHNSON, MARIO FIFIC, KYLE ZIMMER and KRYSTA RYDECKI, *Grand Valley State University*. — The purpose of this study is to assess whether adolescents, ages ranging from 8-17, adhere to Stopping Rule Selection Theory (SRS), which hypothsizes that a decision maker is able to use multiple stopping rules for a variety of decision tasks. We compared decision making strategies among children and adults via a computerized, deferred decision making task. The object was to make a decision to buy or not to buy a product based on recommendations consulted. The first goal is to investigate how source reliability

affects the number of recommendations consulted and the accuracy of the decision. The second goal is to observe how dynamics of stopping rule selection changes among age groups, and whether the decision making departs from optimality. Results showed striking differences in the number of reviews consulted and in accuracy with respect to changes in source reliability and subject age.
Email: Tessa Johnson, johnsote@mail.gvsu.edu

(4194)
Mouse Tracking Emispatial Neglect. LAURA BARCA, *ISTC-CNR*, LISA S. ARDUINO, *LUMSA University and ISTC-CNR Rome*, GIOVANNI PEZZULO, *ISTC-CNR*, LAURA VERONELLI, *Casa Cura Policlinico, Milan*. — A typical feature of Unilateral Spatial Neglect (USN) is impaired processing of stimuli placed in the left side of space. Here, USN patients categorized as artifact/natural two pictures of objects (target and distractor) displayed in the upper corners of the screen, selecting their response with the mouse cursor. Tracking the mouse movements during response selection revealed: first, poor accuracy in responding to left targets (neglected space), and second, that distractors rightward located (non-neglected space) strongly attracted the patients' mouse trajectories, even when patients correctly responded to the left. We interpreted these results in terms of dynamical models of perceptual choice, in which the response alternatives compete based on continuous accumulation of evidence from sensory stimuli (target and distractor). Patients' bias in response selection and mouse trajectories can be explained assuming that stimuli in the neglected space have much greater uncertainty.
Email: Laura Barca, laurabarcapst@gmail.com

(4195)
Effects of Emotional Faces on Reward Prediction Errors in Reinforcement Learning: Evidence From the Feedback-Related Negativity of ERPs. HONG-HSIANG LIU, CHIA-TZU LI, YUNG-FONG HSU and WEN-SUNG LAI, *National Taiwan University*. — Emotional experiences have pervasive impacts on choice behaviors, but the underlying mechanism remains unclear. In this study we investigate how emotional faces regulate reward-based choices using behavioral and event-related potentials (ERP) data. Sixty-six subjects were randomly assigned to the Neutral-Neutral (NN), Angry-Neutral (AN), and Happy-Neutral (HN) groups. Subjects in each group were randomly exposed to half trials of the pre-determined emotional faces and another half of the neutral faces before choosing between two cards drawn from decks with assigned reward probabilities. Trial-by-trial data were fit with a standard reinforcement learning model using the Bayesian estimation approach. Our analysis revealed that the NN group gained more rewards than the other two groups. ERP analysis showed that compared to the NN group, subjects in the AN and HN groups had a smaller feedback-related negativity (FRN) expectancy effect, indicating an interruption in predicting rewards. Further, both AN and HN groups appeared to be more sensitive to negative outcomes.

Collectively, our study suggests that emotional faces negatively regulate reward-based choices, probably through overweighting with negative feedbacks.
Email: Yung-Fong Hsu, yfhsu@ntu.edu.tw

(4196)
Helping Drivers Make Better Decisions: A Conceptual Model of Calibration. MARY LESCH and WILLIAM HORREY, *Liberty Mutual Research Institute for Safety*. — Calibration refers to the accuracy of a measurement instrument by determination of its deviation from a standard. There is mounting evidence that drivers' perceptions are not well-calibrated with performance measures. This failure in calibration can have dire consequences, for example, when a driver decides, without regard to the driving environment, to engage in secondary activities because s/he believes they have no impact on their driving performance. Recent findings in the area of driver distraction are presented in the context of a conceptual model of calibration which highlights the critical nature of the cues used by the driver, as well as researchers, in assessing performance. This model provides a framework for understanding the impact of various factors on judgments and performance estimates and suggests methods to help bring drivers' perceptions into alignment with performance measures. Thus, calibration research should help drivers make better decisions regarding engagement in secondary tasks.
Email: Mary Lesch, mary.lesch@libertymutual.com

(4197)
Sequential Modulation of Preference Judgments. SEAH CHANG, YANG SEOK CHO and CHAI-YOUN KIM, *Korea University* (Sponsored by Jacqueline Shin). — Preference judgments of an object can be made not only based on the features of the object itself but based on other factors including context (Leder et al., 2010). It has been suggested that brief contextual priming influences subsequent preference ratings (Wong & Root, 2003). The present study set out to test the possibility that the preceding preference judgment behaves like a contextual prime and influences the subsequent preference judgment. In the present study, two experiments were conducted to explore whether the preference ratings of artworks (Experiment 1) and faces (Experiment 2) are modulated by the preference judgment of the preceding stimulus. A paired sequence design was used in which a neutral stimulus is presented twice, once after a preferred stimulus and again after a non-preferred stimulus in separate blocks. The results from the two experiments showed that preference rating on a neutral stimulus was higher following a preferred stimulus than following a non-preferred stimulus, implying the sequential modulation of preference judgments.
Email: Seah Chang, seahchpsyc@gmail.com

(4198)
Two's a Crowd: Testing Dual-Systems Theories of Moral Judgment With Response-Time Measures. DEREK POWELL, *University of California, Los Angeles* (Sponsored by Patricia Cheng). — A number of researchers (e.g., Greene et al., 2004) have argued that moral judgments are produced by two cognitive systems: a fast intuitive system that applies

simple moral rules, and a slower deliberative system that weighs the utilities of outcomes. This study examined participants' reaction times during moral judgments and judgments about preferred outcomes in moral dilemmas. Whereas moral judgments may sometimes be driven by moral rules, judgments about preferences necessarily depend on the perceived utilities of outcomes. According to the dual-systems theory, people should often be slower to make judgments about the utilities of outcomes than to make moral judgments where simple rules might be applied. Surprisingly, the results of this study disconfirmed this and several other predictions of the dual-systems theory. In light of these results, it seems unnecessary to posit separate systems governing the application of moral rules and considerations of utility.
Email: Derek Powell, derekpowell@ucla.edu

(4199)

The Contrast Linear Ballistic Accumulator: A New Model for Multi-Alternative Forced Choice Tasks. DON VAN RAVENZWAAIJ, SCOTT BROWN and ANDREW HEATHCOTE, *University of Newcastle.* — Over the last few decades, cognitive psychology has seen an advent of sequential accumulator models that aim to fit response time data from forced choice tasks. When the number of response options is higher than two, these models tend to posit one accumulator per response option: evidence accumulation is conceptualised as absolute evidence for one response option. Here, we propose a new model for sequential evidence accumulation in which evidence is collected relative to other response options: the contrast linear ballistic accumulator. In the first part of this talk, we present three kinds of model architectures that differ in terms of the conditions that have to be met for a response to be chosen. We demonstrate in model simulations that one of these architectures naturally produces Hick's Law (Hick, 1952). In the second part, we present fits of this model version to an empirical Hick's Law dataset.
Email: Don van Ravenzwaaij, don.vanravenzwaaij@newcastle.edu.au

(4200)

Diagnostics or Bayesian Statistics? A Contemporary Model of Forensic Testimony Based on Non-Analytic Cognition in Human Fingerprint Matching. MATTHEW THOMPSON and JASON TANGEN, *University of Queensland.* — Experts in many domains rely rapid and unconscious recognition of previously encountered instances—non-analytic cognition. We will present evidence for non-analytic cognition in human fingerprint matching, such that experts can discriminate fingerprints in noise, spaced in time, and when briefly flashed on screen. Based on these and other findings—and in contrast to the unsupportable claims of individualisation currently made by forensic examiners—we propose a diagnostic framework for the interpretation and expression of forensic comparisons in the courtroom. The framework is based on the medical diagnostic model which offers information about similar situations in order to help decision-makers reason about the present case. A juror can use this "statistical base rate" to deduce the particular from the general, and then use claims made about the present case ("causal base rates") to temper these judgments.
Email: Matthew Thompson, mbthompson@gmail.com

POSTER SESSION V
Saturday Evening
Grand Ballroom, Long Beach Convention Center
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• MUSIC COGNITION •

(5001)

Perceiving Modulations in South Indian Classical (Carnatic) Melodies by Indian and Western Musicians and Nonmusicians. RACHNA RAMAN and W. J. DOWLING, *University of Texas at Dallas*. — We examined differences between musicians' and nonmusicians' perception of modulations as they unfolded in time in Carnatic music using Toiviainen and Krumhansl's (2003) concurrent probe-tone technique. Previous investigations showed that with culturally familiar music listeners use culture-specific and psychophysical cues, whereas with music from another culture they rely more on psychophysical cues and schematic knowledge imported from their own culture. We compared baseline profiles of four ragams (modes) with profiles of modulating excerpts containing the same ragams. Indian musicians' tonal hierarchy profiles tracked the modulations in and out of the new ragam. Western musicians' profiles tended to match those of Indian musicians, indicating their employment of psychophysical cues as well as western schematic cues. Indian and western nonmusicians' profiles did not reflect the modulations. Indian nonmusicians' inability to identify modulations in melodies from their own culture suggests that musical training, irrespective of culture, facilitated performance on the continuous probe-tone task.
Email: Rachna Raman, rachnaraman@hotmail.com

(5002)

Long-Term Musical Training Associated with Enhanced Auditory and Visual Perception Under Degraded Conditions. ESPERANZA ANAYA, *Midwestern University*, DAVID B. PISONI, *Indiana University*, WILLIAM G. KRONENBERGER, *Indiana University School of Medicine*. — Previous research has reported that musicians exhibit enhanced speech perception in noise and argued that long-term musical training leads to modality-specific enhancements in auditory information processing. We examined the effects of long-term musical experience on auditory and visual perception under degraded conditions. Musicians and nonmusicians were compared on auditory and visual perception in noise measures. Subjects completed two speech-in-noise tests (SIN) and an environmental sounds in noise test. Visual perception tasks were a Fragmented Sentences Task (FST) and an Object Recognition Task. Subjects also completed vocabulary and nonverbal reasoning measures. Musicians outperformed nonmusicians on the SIN and FST measures. Correlations were found between these measures for both musicians and nonmusicians. Musicians also displayed better vocabulary knowledge and nonverbal reasoning skills in comparison to nonmusicians. Results showed that musicians not only have enhanced speech perception in noise skills but they also showed enhanced visual perception of degraded text when compared to nonmusicians. These findings suggest that long-term musical experience leads to modality-general improvements in perceptual abilities.
Email: Esperanza Anaya, eanaya@midwestern.edu

(5003)

Examining Musical Timbre and Emotion. MEAGHAN VICTORIA MAUER and XIAOWEI ZHAO, *Emmanuel College*. — In the present study, we investigated the influence of musical timbre on emotional arousal and perception. We hypothesized that timbre that is similar to the human voice (e.g., from cello) would cause a stronger emotional response than timbre that is dissimilar to the human voice (e.g., from marimba). Thirty-three participants were randomly assigned to three groups that listened to a piece of music played through cello, marimba, or piano timbre for two minutes. Physiological responses were recorded while the music was playing, and participants completed an emotional word rating task and a self-report measure of their emotional response following the listening period. No significant effects were found between groups on physiological responses and emotional word rating task, but analysis of the self-report data showed a significant effect of timbre on participants' ratings of the degrees to which the musical selection conveyed happiness and sadness.
Email: Xiaowei Zhao, zhaox@emmanuel.edu

(5004)

Does Vocal Anger Prime or Adapt the Perception of Instrumental Fear? CASADY BOWMAN and TAKASHI YAMAUCHI, *Texas A&M University*. — Language and music express emotion and comparing these domains enables us to answer questions about the link between emotion, music and speech. Previous research demonstrated aftereffects for emotionally expressive faces and for emotionally expressive vocalizations, indicating that aftereffects can cross perceptual domains and re-calibrate auditory representations of affective voices. Will this adaptation also exist for instrumental sounds? In three experiments we showed that adaptation to instrumental sounds causes aftereffects for vocal sounds. Adaptation to angry vocalizations caused instrumental sounds drawn from an anger–fear continuum to be perceived as less angry and more fearful, while adaptation to fearful vocalizations elicited the opposite aftereffects; however, these results were not found when participants were adapted to instrument sounds and tested on vocal sounds. Based on these results, we argue that the brain mechanisms used for processing emotion in music are also used and evolved for the representation and evaluation of vocal sounds.
Email: Casady Bowman, casadyb@tamu.edu

(5005)
Effect of Repetition on Affect and Recognition Judgments in Nontonal Tunes. MELISA AKAN, *Boğaziçi University*, MUSTAFA TAHA BILGE, *Vanderbilt University*, ESRA MUNGAN, *Boğaziçi University*. — Previous studies demonstrated mere exposure effects (MEE) with both tonal and atonal music (e.g., Peretz et al., 1998; Wilson, 1979). Our goal was to investigate the effects of repeated exposures and different levels-of-processing on liking and recognition confidence ratings for fully random and semi-random tunes. Tunes were presented either 1, 6 or 12 times and were encoded either with a deep or a shallow orienting task. We observed MEE only for random melodies and only after 6 and 12 exposures. In contrast, recognition confidence scores linearly increased with the number of previous exposures both for fully random and semi-random tunes. Levels-of-processing did not have an effect on liking and recognition confidence judgments. We discuss the observed dissociation between liking and recognition confidence ratings for random and semi-random tunes with reference to the two-factor model (Stang, 1974), the fluency misattribution model (Bornstein & D'Agostino, 1992) and implicit memory.
Email: Esra Mungan, mungan@boun.edu.tr

(5006)
Memory for Tones Drawn From the Major Scale and Rast Makam: A Cross-Cultural Study of North American and Turkish Listeners. TIMOTHY JUSTUS and CHARLES YATES, *Pitzer College*, NART BEDIN ATALAY, *TOBB University of Economics and Technology*, MEAGAN E. CURTIS, *Purchase College*. — Listeners familiar with a musical system are thought to internalize tonal regularities via implicit learning and draw upon such knowledge when generating musical expectations. We examined whether implicit knowledge would bias tonal memory in a culture-specific manner (Curtis & Bharucha, 2009). North American and Turkish participants listened to 48 melodies based on either the major scale or rast makam. Melodies always included the five shared tones (C, D, F, G, and A) and one non-shared tone (E-natural, E-half-flat, B-natural, or B-half-flat). Following each melody, participants were asked whether one of twelve possible probe tones had been presented. Preliminary results are suggestive of cross-cultural differences; compared to probe tones never present in the melodies (E-flat and B-flat), North American participants were more likely to accept the missing major scale tone following a major context, but not the missing rast tone following a rast context. Turkish participants, however, did so for both.
Email: Timothy Justus, timothy_justus@pitzer.edu

(5007)
The Perception of Simple and Complex Meters: A Cross-Cultural Study of North American and Turkish Listeners. CHARLES YATES and TIMOTHY JUSTUS, *Pitzer College*, NART BEDIN ATALAY, *TOBB University of Economics and Technology*, SANDRA E. TREHUB, *University of Toronto*. — Prior work has suggested that the perception of metrical structure is influenced by the listener's musical enculturation history. Here, we adapt an experiment of Kalender, Trehub, and Schellenberg (2013), conducted with mono- and bi-musical North American listeners, to a true cross-cultural design comparing North American and Turkish listeners. Participants heard four melodies, half based in a simple, isochronous meter (2/4) and the other half in a complex, non-isochronous meter (5/4). Each melody was followed by four target phrases: identical, structure-preserving, structure-violating, and obvious change. Participants rated the similarity of each target phrase to the corresponding melody. We predicted that the North American group would be sensitive to the difference between structure-preserving and structure-violating changes for simple but not complex meters, whereas the Turkish group would be sensitive to this distinction for both. Preliminary results suggest that, for musically trained listeners, both groups were sensitive to simple and complex metrical structures.
Email: Charles Yates, cyates@students.pitzer.edu

(5008)
Where's the Key? Recognition Memory for Diatonic and Nondiatonic Melodies. ABIGAIL L. KLEINSMITH and W. TRAMMELL NEILL, *SUNY-Albany*. — In previous research, Kleinsmith et al. (Psychonomics, 2013) familiarized subjects with a melody presented in two different keys (C and D). Subsequent recognition memory was better for the melody in a physically closer key (C#) than for a more distant, but harmonically more related, key (G). Training in more widely separated keys (F# and C) yielded better recognition in keys physically closer to the studied exemplars (G and C#) than for an "average" key (D#). The results indicated separate key-specific (or pitch-specific) memory traces, to which instances in new keys are compared. In the present experiments, the studied melodies were altered by shifting notes up or down by quarter tones, or by substituting all whole-tone intervals. According to Western music theory, no key can be determined for these melodies. Quarter-tone altered melodies were recognized as well as diatonic (major key) melodies, while whole-tone melodies were recognized somewhat more poorly. For both types, however, physically closer transpositions were recognized better than more distant transpositions, as found for the diatonic melodies. The results question the common assumption that key abstraction is crucial to memory for melodies.
Email: W. Trammell Neill, neill@albany.edu

(5009)
Separate Mechanisms Underlie Pitch Expectations in Music. MATTHEW ROSENTHAL, *University of Nevada, Las Vegas*. — Perceptual sensitivity to musical pitch structure proceeds from an inital ability to discriminate pitches based on pitch co-occurrence (i.e. set membership) to a later emerging ability to discriminate pitches based on their syntactic function within a set. However, few studies have directly investigated the mechanisms that underlie the acquisition and formation of these two types of pitch expectations. In this presentation, I will provide evidence that music listeners rely on two separate mechanisms for expectations based on set membership and expectations based on syntactic function within a set. The main difference between the two mechanisms is the type of

statistical information to which each is sensitive. Based on exisiting neuroimaging studies and my own studies using the monaural listening paradigm, I will argue that these two mechanisms dissociate accros the right and left cerebral hemispheres. These findings shed light on the mechanisms that may underlie acquisition of pitch knowledge and support recent proposals of neurocognitive overlap between the speech and music domains.
Email: Matthew Rosenthal, rosent17@unlv.nevada.edu

(5010)
The Use of Amabile's American Haiku Task to Examine Musical Associations in Semantic Memory. CYNTHIA SIFONIS, WILLIAM C. FUSS, JONATHAN SAULTER, ALEX LEKANDER and BRITTANY VENTLINE, *Oakland University*. — The present studies explore using Amabile's American Haiku task to examine the presence of musical associations in semantic memory. Participants were randomly assigned to listen to familiar or unfamiliar music before or after writing a haiku. The haikus were then examined for the inclusion of the concepts associated with the music theme. Analyses demonstrated that concepts associated with the music were more likely to be incorporated into the haikus when unfamiliar music was listened to prior to writing the haiku. Comparisons of participants' performance in the haiku task to the more traditional story-writing task reveal the usefulness of using the haiku task for examining musical associations in memory. Compared to a story-writing task, in which story schemas are activated along with the concepts associated with the music theme, the haiku task reflects more closely the actual concepts activated by listening to the music theme.
Email: Cynthia Sifonis, sifonis@oakland.edu

(5011)
Common Learning Mechanisms for Language and Music Grammar Acquisition. ERICA KNOWLES and ERIN INGVALSON, *Northwestern University*, PATRICK WONG, *Chinese University of Hong Kong*. — Language and music are both syntactic systems that require the acquisition of the structural rules that govern the construction of complex strings from basic units. Given the similar demands of acquisition across these two auditory domains, it is plausible that language and music may rely on common domain- general cognitive resources. The present study extends previous findings of a role of declarative and procedural memory in language acquisition to music in order to investigate the common reliance on these domain-general memory systems during structural rule acquisition. Participants learned an artificial language grammar and an artificial music grammar as well as completing a battery of cognitive tests measuring declarative memory, procedural memory, working memory, and overall IQ. The results indicate that declarative memory and procedural memory support the acquisition of both

language and music structural rules. These findings suggest that domain-general learning mechanisms subserve both language and music acquisition.
Email: Erin Ingvalson, ingvalson@northwestern.edu

• NUMERICAL COGNITION •

(5012)
While Waiting for the Dots: The Influence of Short-Term Memory in Tasks Indexing the Approximate Number System. MARCUS LINDSKOG, ANDERS WINMAN and LEO POOM, *Uppsala University*. — Approximate Number System (ANS) acuity is commonly indexed by tasks where participants discriminate between two arrays of visually presented dots. The tasks come in different flavors. Sometimes both arrays are presented simultaneously. Sometimes they are separated by a short interstimulus interval (ISI). It has been hypothesized that the latter version might introduce short-term memory (STM) demands into the task. The present study tests this possibility by using a task, within-subjects, where the two arrays are separated by four levels of ISI (0ms, 50ms, 300ms, 2000ms) and by measuring STM capacity. In line with previous research we find that performance improves when an ISI is introduced. The length of the ISI does not, however, influence performance. Further, controlling for STM for numbers eliminates the effect of an ISI. The results indicate that performance in tasks indexing ANS acuity will be influenced by STM capacity when arrays are separated by an ISI.
Email: Marcus Lindskog, marcus.lindskog@psyk.uu.se

(5013)
Contextual Repetition Effects on the Perceived Duration of Numbers: How Time Is Biased by Symbolic Magnitude. DOUG ALARDS-TOMALIN, ALEXA KRAVETZ, JASON LEBOE-MCGOWAN and LAUNA LEBOE-MCGOWAN, *University of Manitoba*. — Large digits (8, 9) tend to be perceived as presented for a longer duration than small digits (1, 2) (Oliveri et al. 2008; Vicario et al., 2008). The current study examined the role of stimulus context on this bias. In Experiment 1, infrequently occurring and frequently occurring magnitude digits were perceived to have equivalent durations. In Experiment 2, large digits, preceded by repetitive large digit context sequences, were judged as shorter in duration than those preceded by repetitive small digit sequences (a contrast effect). In Experiment 3, dot-patterns were substituted for digits in the context sequence, and led participants to rate targets following large sequences as lasting for longer durations. In Experiment 4, digits were again used; however, participants judged the color the numbers were presented in prior to judging the duration of a target digit. The contrast effect was again found, but only when participants alternated their responses between red/black keys versus making repetitive responses. We suggest that repetition

suppression, namely exposure to similar magnitude digits in the context sequence, may play a role in our observation of contrast effects on the perceived duration of digits.
Email: Jason Leboe-McGowan,
Jason.Leboe-McGowan@umanitoba.ca

(5014)

The Respective Influence of Visual and Numerical Information in Numerosity Estimation. CHARLOTTE MUSCARELLA, *Vrije Universiteit Brussel*, DELPHINE SASANGUIE, *KU Leuven*, EVA VAN DEN BUSSCHE, *Vrije Universiteit Brussel*, BERT REYNVOET, *KU Leuven Kulak*, MARC BRYSBAERT, *Ghent University*. — Several approaches have been proposed to explain our non-symbolic number processes. The aim of this study was to investigate to what extent humans rely on visual versus numerical information when estimating numerosities. Moreover, we investigated whether developmental differences play a role in the reliance on visual and/or numerical information. To this end, we conducted two numerosity estimation experiments in adults (Experiment 1) and in children (Experiment 2). Our results show that adults and children mostly rely on numerical information to estimate numerosity. Nevertheless, they also seem to be biased by different visual cues present in the stimuli. Finally, compared to younger children, older children are influenced to a greater extent by the numerical information and the visual information, when estimating numerosity. Overall, we can conclude that humans rely on visuo-numerical information in order to make a numerosity estimation and that developmental differences are present in this reliance.
Email: Charlotte Muscarella, Charlotte.Muscarella@vub.ac.be

(5015)

Obstacles to Algebraic Understanding. MARTA MIELICKI and JENNIFER WILEY, *University of Illinois at Chicago* (Sponsored by Susan Goldman). — Algebra is considered a gatekeeper subject in mathematics education because it is a prerequisite for higher level mathematics and essential for success in science. Despite this, however, cognitive factors that contribute to algebraic problem solving performance are still not well understood. One key difficulty for algebraic understanding is learning to use symbols to express mathematical quantities. To explore individual differences in symbolic problem solving skills, this study examined performance on a novel Symbol Math Task, where students were required to compute functions and operations from symbolic expressions. Relations between bilingualism, executive functions, basic math skills, and symbolic problem solving skills were explored. An advantage was found for bilinguals in performance on the novel Symbol Math Task.
Email: Marta Mielicki, mmieli2@uic.edu

(5016)

Subitizing and Counting Abilities in Children With Hemiplegia. SANDRINE MASSON and NOLWENN GUEDIN, *Université de Genève*, MICHEL FAYOL, *University of Clermont, CNRS*, CATHERINE THEVENOT, *Université de Genève*. — In this study, we assessed counting and subitizing abilities in children with hemiplegia. This population was chosen because those children have difficulties in finger counting, which is currently viewed as a grounding activity for the development of more abstract numerical skills. Once measures of processing speed were entered as covariate, we showed that children with hemiplegia were still slower than control children. Even more interestingly, hemiplegic children managed to subitize canonical configurations but reversed to counting when non-canonical configurations of small numerosities up to 4 were presented. This suggests that such competencies are related to number manipulation and practice and might question theoretical framework considering subitizing as an innate capacity.
Email: Sandrine Masson, masson.mail@gmail.com

(5017)

The Role of Coding Strategies on the Modulation of Spatial-Numerical Associations by Working Memory Load. OLIVER LINDEMANN, *University of Potsdam*. — If participants are instructed to memorize a random sequence of numbers, the spatial-numerical associations (SNA) in a number classification task depend on the ordinal position of the numbers in the memorized sequence (van Dijk & Fias, 2011; Lindemann, Abolafia, Pratt & Bekkering, 2008). To current study investigates the underlying mechanisms of the impact of working memory representations on SNAs by manipulating the spatial characteristics and coding requirements of the memory task. Two experiments demonstrate that the ordinality information itself is not directly associated with spatial codes and can therefor not account for the effects on SNAs. Instead, the results suggest that the modulation of SNAs is driven by the participants' strategy to represent the sequences spatially and the tendency to transform ordinality information into spatial arrangements in visual working memory.
Email: Oliver Lindemann, oliver.lindemann@uni-potsdam.de

(5018)

The Relation Between Symbolic Number Processing and Math Achievement: Opening the Black Box. DELPHINE SASANGUIE, BERT DE SMEDT and BERT REYNVOET, *KU Leuven*. — It has repeatedly been demonstrated that symbolic number processing (comparing Arabic digits) correlates with and predicts arithmetic performance. To date, however, it remains a black box which process within symbolic processing causes this relationship. To examine this, we let adult participants perform an arithmetic test, together with four symbolic number tasks: 1) digit identification, 2) digit-number word audiovisual matching, 3) digit order judgment and 4) digit comparison. Additionally, they performed two reading test (word and non-word reading) in combination with the letter variants of the numerical tasks. This way, we could reveal whether our observations were number specific or could be generalized to other symbols, like letters. Regression analyses revealed that only the performance on the digit- and the letter order judgment task contributed to the

variance of the arithmetic and reading tests respectively. This suggests a common general underlying capacity (e.g. working memory) for both arithmetic and reading.

Email: Delphine Sasanguie, delphine.sasanguie@kuleuven-kulak.be

(5019)

Individual Differences in Mental Arithmetic: Calculation Strategy Depends on Central Executive and Spatial Working Memory Resources. STESON LO and SALLY ANDREWS, *University of Sydney*. — The ability to mentally verify sums is a highly advantageous skill in our modern monetary society. However for complex problems like 25+48, the correct solution can be derived from multiple techniques, even though most school curriculums only teach one. We presented a masked prime of a potential interim solution to investigate whether participants adopted a decomposition strategy of separately adding the unit and decade digits together [e.g., (5+8)+(20+40)], or a complement strategy of rounding one of the numbers and subsequently removing the excess [e.g., (25+50)-2]. Across participants, results showed that those with poorer central executive resources to update their interim solutions benefited most from primes derived from a complement strategy, while those with poorer spatial working memory benefited most from primes derived from a decomposition strategy. Results also indicated that multiple strategies were used within individual participants, suggesting that people are highly flexible in the way that they solve arithmetic problems.

Email: Steson Lo, stlo2597@uni.sydney.edu.au

(5020)

Body Posture, Working Memory, Anxiety, Gender, and Math Performance. AMANDA KOWALSKY and MICHAEL KASCHAK, *Florida State University*. — Several studies have demonstrated that body posture can influence behavior and cognition. Here, we investigated whether body posture affected performance on a math test. Participants were asked to sit in a powerful, expansive posture or a narrow, constricted posture, prior to taking a math test assessing a range of concepts. We also collected measures of the participants' working memory (WM), and test anxiety. In addition to main effects of gender (males outperformed females) and problem difficulty, the study showed a complex set of interactions between the measured variables. Among the stronger effects was an interaction between test anxiety and working memory (no effect of WM among participants high in test anxiety; positive effect of WM among participants low in test anxiety). There was also an interaction between gender and working memory (no gender difference for participants high in WM; males outperformed females for participants low in WM).

Email: Amanda Kowalsky, kowalsky@psy.fsu.edu

(5021)

Generalization Effect in Simple Arithmetic Across Chinese and Canadian Adults. YALIN CHEN and JAMIE CAMPBELL, *University of Saskatchewan*. — Several recent studies suggested that skilled adults use automatic counting procedures to solve small simple addition problems (e.g., 2 +

3 = 5) rather than fact retrieval from long term memory. A behavioural signature of procedure use is generalization from practice of one set of problems to a different set of problems. Thirty-six Canadian and 36 Chinese adults were tested in an addition generalization paradigm. The results showed a generalization effect in response time (RT) for the rule-based 0 + N problems (e.g., practicing 0 + 4 facilitated subsequent performance of 0 + 8) for both the Chinese and Canadian groups. There was no such effect for 1 + N problems, ties (e.g., 2 + 2), small non-tie (sum < 10) or larger non-tie simple additions for either group. The results did not support the hypothesis that Chinese and Canadian adults engage counting algorithms for small simple addition problems.

Email: Yalin Chen, yac617@mail.usask.ca

(5022)

Domain-General and Domain-Specific Training to Improve Children's Numerical Knowledge. SUSANNE JAEGGI, *University of California, Irvine*, EMILY DAUBERT, *University of Maryland at College Park*, MARTIN BUSCHKUEHL, *MIND Research Institute,* GEETHA RAMANI, *University of Maryland at College Park*. — The numerical knowledge of children from low-income backgrounds trails behind their peers from middle-income backgrounds. This gap is present before children enter elementary school, and it progressively widens over the course of schooling. Therefore, improving the numerical knowledge of low-income children early in elementary school is of critical importance and will likely produce lasting benefits. In this study, we targeted mathematical achievement of kindergarteners from low-income backgrounds using two approaches: Based on Geary and Hoard's model (2005), one group of children completed an intervention targeting their conceptual knowledge, specifically, their understanding of numerical magnitudes. Another group of children completed an intervention targeting their underlying cognitive system, specifically, their working memory. Both interventions involved playing game-like activities on tablet computers over the course of several sessions. Our results indicate that both interventions improved numerical knowledge as compared to a control group, suggesting that both, domain-specific and domain-general interventions facilitate math learning.

Email: Susanne Jaeggi, smjaeggi@uci.edu

(5023)

Two Models of Learning the Concept of Whole Numbers. PATRICIA BAGGETT, *New Mexico State University*, ANDRZEJ EHRENFEUCHT, *University of Colorado*. — We present two theoretical models of how the concept of whole numbers is acquired. One, which is used as the justification for current techniques of teaching arithmetic in early grades, is based on these assumptions: Arithmetic operations are based on operations on sets. The first arithmetic process that students must learn is counting, and all other arithmetic operations are derived from it. The second model, suggested by John Leslie (The Philosophy of Arithmetic, 1817), assumes that arithmetic operations are based on operations on binary representation of numbers, and that the basic process is dividing by two, with a remainder. These models make

different testable predictions, and we will show some results of teaching arithmetic, to both children and adults, using techniques based on the second model. A tool replacing the need for counting and a number line, is a counting board based on the work of John Napier (Rabdology, 1617).
Email: Patricia Baggett, baggett@nmsu.edu

(5024)
Mathematics Anxiety Affects Attentional Control. ALEX M. MOORE and MARK ASHCRAFT, *University of Nevada, Las Vegas.* — Mathematics anxiety is thought to reduce cognitive functioning by impairing the efficient use of working memory resources. The conventional theory describes a processing disadvantage associated with high levels of math anxiety that increasingly impairs performance as working memory demands also increase. By contrast, recent reports demonstrate that the negative effects of math anxiety can be measured in tasks that are relatively free of working memory assistance (number comparison and enumeration). The experiments reported examined these effects in college adults in a dual task paradigm. The results of the study largely replicated math anxiety effects reported in the literature; however, the dual task settings provide key insight into their interpretation. The results obtained are explained in the context of attentional control. Finally, implications drawn from this extension are used to explore the interaction between math anxiety and achievement for future research.
Email: Mark Ashcraft, mark.ashcraft@unlv.edu

(5025)
Effects of Training on Simple Arithmetic: Retrieval From Long-Term Memory? KIM UITTENHOVE, CATHERINE THEVENOT, and PIERRE BARROUILLET, *Université de Genève.* — The aim of the present study was to investigate training effects on simple addition and multiplication problems in adults. Traditionally (Logan & Klapp, 1991), it is believed that training facilitates retrieval of the answers from long-term memory. However, more recent research challenges this assumption (Barrouillet & Thevenot, 2013). In the present study, we further investigated this issue by contrasting two learning methods and investigating transfer to untrained problems. We tested adults in a month-long daily training paradigm on either addition or multiplication problems. Half of the participants were trained with the rote memorization technique, which we expected to target problem-answer associations, thus benefiting retrieval on trained problems. The other participants were trained with the production technique, which targets procedures as well as retrieval, and could even benefit untrained problems. Both methods had different effects that varied with problem type. We discuss implications for adults' simple multiplication and addition solving.
Email: Kim Uittenhove, kim.uittenhove@unige.ch

(5026)
Ten-Year-Old Children Strategies in Mental Addition: A Counting Model Account. CATHERINE THEVENOT, PIERRE BARROUILLET and CAROLINE CASTEL, *Université de Genève.* — Forty-four ten-year-old children were

asked to solve very simple additions involving operands from 1 to 4. Such problems are generally thought as being solved by retrieval of the answer from memory. However, chronometric data revealed a monotonic linear increase in RTs depending on the magnitude of both operands. This pattern of results is difficult to reconcile with the retrieval-based account of the problem-size effect and challenges the dominant view that small additions are mainly solved through retrieval from the age of ten.
Email: Catherine Thevenot, catherine.thevenot@unige.ch

(5027)
The Transition From Visual Sets of Items to Number and Consequences for Number Sense Acuity. BERT REYNVOET, *KU Leuven Kulak.* — In daily life discrete number and continuous visual information (density and surface) are confounded: 10 apples are not only more numerous but also occupy more surface than 5 apples. This confound is considered problematic and researchers have put great effort in creating different methodologies to account for it in order to study number processing. This has led to many studies investigating the acuity of the approximate number system (ANS) and its developmental pattern showing that ANS acuity improves with increasing age and found to be related to mathematical abilities. In this presentation I will show the results of a study in which we contrasted two methods that have been described in literature to control for effects of continuous visual cues on deriving discrete number. Both methods resulted in different acuity measures (w) and most importantly, the acuity measures obtained with both methods were not related. These results suggest that the transition from visual sets to number is dependent on how the stimuli are created and has important consequences on theories of cognitive development of ANS acuity.
Email: Bert Reynvoet, bert.reynvoet@kuleuven-kulak.be

(5028)
The 3-D Tally Code: A New Alternative to the Number Line for Comprehending Large Numbers. ARTHUR CHARLESWORTH, *University of Richmond.* — Although 97% of adults competently use a number line for numbers through one-thousand (Siegler & Opfer, Psychological Science 2003), a number line for numbers through one-billion has severe mental-visualization shortcomings. For example, on average a 30,000 percent error was made by a third of adults marking one-million on a line from one-thousand to one-billion (Landy, Silbert, Goldin, Cognitive Science 2013); also see (Landy, Charlesworth, Ottmar, CogSci 2014). The 3-D tally code facilitates envisioning (mentally-visualizing) any number from 1 to 10^{15} by leveraging three-dimensional cognitive resources, in alignment with the short-scale's thousand, million, billion, etc. Using the 3-D tally code, one envisions a thousand tallies |||... left-to-right, then counts front-to-back a thousand such rows to envision a million tallies, then counts bottom-to-top a thousand such

layers, thereby envisioning a billion-cube. One envisions a trillion as a row of a thousand billion-cubes left-to-right and a quadrillion, 10^15, as a thousand such rows front-to-back.
Email: Arthur Charlesworth, ArthurCharlesworth@gmail.com

• EMBODIED COGNITION II •

(5029)

No Time in My Hands. Different Spatial Coordinates Support Temporal and Numerical Concepts in Blind and Sighted Individuals. ROBERTO BOTTINI, *University of Milan-Bicocca*, DANIEL CASASANTO, *University of Chicago*, VIRGINIE CROLLEN, *UCL - Louvain*, OLIVIER COLLIGNON, *CIMeC-Trento*, DAVIDE CREPALDI, *University of Milano Bicocca*. — Dozens of studies suggest that numerical and temporal concepts are spatially represented in the human mind by means of mental lines. Do the Mental Number Line (MNL) and the Mental Time Line (MTL) share a common spatial basis? Sighted and blind individuals participated in our experiment to test whether different spatial frames of reference (SFoR) support the representation of the MNL and the MTL, and to investigate the role of vision in shaping the spatial basis of abstract concepts. Both a hand-based and an external SFoR contributed to the representation of the MNL, with the former being more salient in blind individuals. Conversely, only an external SFoR was used to represent temporal relationship, both in sighted and blind individuals. These results suggest that the MTL and the MNL are based, in part, on different spatial coordinates, and contribute to clarify the role of vision in the development of abstract representations.
Email: Roberto Bottini, bottini.r@gmail.com

(5030)

Form Follows Function: The Time Course of Hand Action Representations Evoked by Handled Objects. RAGAV KUMAR, MICHAEL E.J. MASSON and DANIEL N. BUB, *University of Victoria* (Sponsored by A. A. J. Marley).— To investigate the role of action representations in the identification of upright and rotated objects, we examined the time course of their evocation. Subjects made vertically or horizontally oriented reach and grasp actions primed by images of handled objects that were depicted in upright or rotated orientations, at one of three possible SOAs: -250 ms (action cue preceded the prime), 0 ms, and +250 ms. Congruency effects between action and object orientation were driven by the object's canonical (upright) orientation at the 0 ms SOA, but by its depicted orientation at the +250 ms SOA. Alignment effects between response hand and the object's handle appeared only at the +250 ms SOA, and were driven by the depicted orientation. We conclude that subjects initially evoke a conceptually-driven motor representation of the object, and that only after some time can the depicted form influence the elicited action representation.
Email: Ragav Kumar, ragavk@uvic.ca

(5031)

Embodied Cognition? Effects of Hand- and Foot-Related Action Words on Hand and Foot Responses in a Stroop Task. JEFF MILLER, *University of Otago*, BARBARA KAUP, *University of Tübingen*. — Theories of embodied cognition suggest that the recognition of action-related words activates motor-related brain areas involved in carrying out the named actions, and recent fMRI studies support these theories by showing increased activation of the particular motor areas associated with the perception of specific action-related words. We looked for evidence of such word-based motor activation within a Stroop task in which participants made hand and foot responses based on the colors of stimulus words, while withholding responses to colored nonwords. Hand responses were substantially faster to hand- than foot-related action words, and the reverse was true for foot responses, consistent with the idea that motor areas are activated during word recognition. To see whether these strong RT effects reflected specifically motor processes, we examined the lateralized readiness potential and the limb selection potential—two event-related motor EEG potentials specifically associated with hand and foot responses.
Email: Jeff Miller, miller@psy.otago.ac.nz

(5032)

The Body's Influence on the Mind: Motor Response Characteristics Alter Causal Judgments. CLINTON DUDLEY, *Montclair State University*, MENGQI GUO, ANNA CERRATI, VANJA M. VLAJNIC, MARIA C. DEL CID and KELLY GOEDERT, *Seton Hall University*. — Past evidence indicates that irrelevant perceptual and motor task demands affect cognitive performance across domains (Lakens et al., 2011; Landy & Goldstone, 2007). We investigated perceptual and motor influences on causal judgment from contingency in a causal discounting paradigm. Over a series of trials, right-handed subjects learned about two potential causes of a common outcome. We varied the left/right location of a target cause, the top/bottom location of the button for predicting "yes" the cause would produce the outcome, and the responding hand (left/right). Subjects judged the target as most causal when it and the responding hand were on the right. Furthermore, they demonstrated reduced discounting under these conditions when using the top vs. bottom response button to make a "yes" prediction. These results suggest that spatial perception and action may be tied to metaphorical concepts, which produce more or less fluent responding conditions that influence causal processing and judgment.
Email: Clinton Dudley, dudleyc1@mail.montclair.edu

(5033)

Reduced Object-Based Grouping Near the Hands. JIHYUN SUH and RICHARD ABRAMS, *Washington University in St. Louis*. — The present study examined the effects of hand proximity on object-based grouping. In several experiments, participants viewed stimuli that were either near to or far from their hands. The target stimulus appeared in one of two rectangles: Either at a location that had been previously cued, at the uncued end of a cued rectangle, or in the uncued rectangle. We found a significantly reduced same-object

advantage in both reaction time and sensitivity for stimuli near the hands. This is consistent with previous findings revealing altered visual processing in the near-hand space.
Email: Jihyun Suh, juhn38@gmail.com

(5034)

Perceiving Disgust Affects Cortico-Bulbar Excitability. A TMS Study. CARMELO M. VICARIO and ROBERT D. RAFAL, *Bangor University*, ALESSIO AVENANTI, *University of Bologna*. — Evidence exists about the involvement of common neural basis for the processing of sensorial and emotional disgust. Motivated by the evidence of a direct link between somatosensory intra-oral muscles and midbrain regions involved in the processing of reward and avversion we investigated whether tongue (TNG) muscle excitability is a somatic marker sensitive to disgust outcomes conveyed through visual pictures. We used Transcranial Magnetic Stimulation (TMS) to study Motor Evocated Potentials (MEPs) of the tongue (TNG), and of a control muscle (Extensor Carpi Radialis -ECR) during the exposure to pictures of disgusting vs. attractive foods, disgusting vs. attractive insects and faces expressing disgust and happiness. Disgusting outcomes selectively affect TNG MEP amplitudes. We found that TNG MEPs were significantly reduced while looking at disgusting foods and faces expressing disgust compared with their respective counterparts. On the other hand, TNG MEPs were significantly enhanced while looking at disgusting insects. These results suggest that cortico-bulbar excitability might embody the neural marker linking reward/punishing processing with motor outputs
Email: Carmelo M. Vicario, lo.vi.ca@tiscali.it

(5035)

Time Course of Evoked Action Representations. CARRIE KOBELSKY, DANIEL BUB and MICHAEL MASSON, *University of Victoria*. — Action representations are thought to contribute directly to our conceptual knowledge of manipulable objects. Hand grasps for manipulable objects are either functional (applied when using an object) or volumetric (applied when merely lifting an object). Participants made a reach and grasp response in the context of a pictured object. In contrast to the pattern of action priming effects previously obtained using object names as context, these results show a tight coupling in the temporal dynamics of functional and volumetric action representations elicited by object form. This result suggests that different input modalities (language and visual form) have a different impact on the evocation of actions associated with the shape of an object and those associated its function.
Email: Carrie Courchene, carrie.courchene@gmail.com

(5036)

Iconicity Effects in Language. JOHN MATTHEW JONES and GABRIELLA VIGLIOCCO, *University College of London*. — Although wordforms are usually only arbitrarily linked to their meaning, iconicity (resemblance between form and meaning) is also present. This is especially visible in the lexica of non- Indo-European languages and signed languages.

Iconicity has been argued to play a role in grounding linguistic form to real-world experience, rendering language more learnable (Perniss, Thompson, & Vigliocco, 2010). Here we examine sound-shape iconicity, the 'kiki-bouba' effect, i.e. the tendency to associate bouba-like labels with round shapes, and kiki-like labels with spiky shapes (Ramachandran & Hubbard, 2001). In a series of experiments using different paradigms such as iterated learning and cross-situational learning we found that iconicity contributes to make a language learnable and it biases label learning. Moreover we also found that while the effect is reliable and robust across paradigms for the association "bouba" – round shape, this is not the case for "kiki" – spiky shape. These findings have Implications for theories of language learning and processing as well as theories of multisensory integration.
Email: John Matthew Jones, john.jones.09@ucl.ac.uk

(5037)

Storing Information in-the-World: Investigating Cognitive Offloading in a Short-Term Memory Task. EVAN RISKO, TIM L. DUNN and SRDAN MEDIMOREC, *University of Waterloo*. — An important part of understanding the embodied nature of cognition involves uncovering the factors that influence individuals' decisions to offload cognitive demands onto their physical environment. In the present investigation we explore these factors in the context of a memory task that allows individuals the freedom to store to-be-remembered information in-the-world or in-their-head. In particular, we investigate the influence of memory load and individual differences in short-term memory capacity on the tendency to write down items (when free to do so) in a short-term memory task. Results demonstrate that the tendency to offload memory demands is driven by both factors and, interestingly, that individuals offload well before their short-term memory capacity would suggest they needed to. Implications of these results for our understanding of cognitive offloading will be discussed.
Email: Evan F. Risko, efrisko@uwaterloo.ca

(5038)

Enhancing Creative Thinking Through a Brief, Beginner's-Level Yoga Practice. SHELBY JAYNE MARTIN and CHRISTOPHER DAVOLI, *Central Michigan University*. — Recent studies suggest that engaging in contemplative practices (e.g., yoga, meditation) may be beneficial for physical health and well-being. However, it remains unclear how or in what ways these practices might also benefit cognition. Our purpose in this study was to test the hypothesis that yoga can produce observable benefits in cognitive functioning, with a specific focus on creative thinking. To measure creative thinking ability, we had participants solve two sets of remote associate problems (e.g., generating honey as the word that dew, comb, and bee all have in common). Relative to control conditions, participants who completed a beginner's-level yoga practice in between sets exhibited a boost in performance on the second set, particularly for problems high in difficulty. These findings support emerging literature on the ameliorative effects of yoga

and suggest that a brief yoga intervention could serve as a safe, efficient, cost-effective, and accessible pathway to cognitive enhancement.
Email: Christopher C. Davoli, chris.davoli@gmail.com

• COGNITIVE SKILL ACQUISITION •

(5039)
Relating Individual Differences in Working Memory to Interruption Recovery During Multitasking. HAO BAI, WINSTON JONES, JARROD MOSS and STEPHANIE DOANE, *Mississippi State University*. — This study examined the role of cognitive abilities, including working memory, in interruption recovery during multitasking. After completing a set of individual differences tasks measuring working memory capacity among other abilities, selected participants performed a multitasking task. The task required sorting objects by sequentially querying object features and maintaining feature information in working memory. To examine how the amount of information maintained in working memory affects interruption recovery, interruptions were manipulated to occur after zero, one, or two features were queried. Interruption recovery and multitasking performance measures included sorting speed, number of sorting errors, and strategy consistency. Individual differences in working memory and cognitive abilities were related to interruption recovery. Individuals with lower working memory capacity were more disrupted by interruptions in terms of making more errors especially as the number of features being maintained increased. Further interruption recovery results including sorting speed and strategy consistency will also be discussed.
Email: Hao Bai, hao.bai@skill-lab.org

(5040)
An Alternative Explanation for Working Memory Training Effects. JEFFREY CHRABASZCZ, DONALD BOLGER, REGINA CALLOWAY, NICHOLAS BROWN, CHELSEA WETTROTH and MICHAEL R. DOUGHERTY, *University of Maryland, College Park*.— Many positive working memory training results have been negatively criticized on methodological grounds. These criticisms aim to undermine the evidence for working memory training by attributing training results to inappropriate designs or analyses. We ran an experiment that allowed us to gain support for a specific alternative explanation for training effects: that repeated exposures to specific stimuli allow for apparent working memory training by improving long-term memory encoding of those stimuli rather than improving the working memory system directly. We assessed participants on three forms of operation span characterized by letters, words, or symbols as memoranda and then randomly assigned them to an active control or a training condition. Our results provide preliminary evidence that stimulus-specific effects may account for some supposed support for the effect of working memory training.
Email: Jeffrey Chrabaszcz, jchrszcz@umd.edu

(5041)
Training Specificity in Time and Distance Estimation: Effects of Secondary Task Presence. VIVIAN SCHNEIDER, ALICE HEALY and LINDSAY ANDERSON TACK, *University of Colorado*, IMMANUEL BARSHI, *NASA Ames Research Center*. — Learning is often specific to the conditions of training, making it important to identify which aspects of the testing environment are crucial to be matched in the training environment. The present study examined training specificity in time and distance estimation tasks that differed only in the focus of attention. External distance cues (fixed-rate growing lines on a computer display) were provided for the distance estimation task and for the time estimation task in one condition but not in another. The presence of a concurrent alphabet secondary task was manipulated during both training and testing phases in all estimation conditions. For distance as well as for time estimation in both conditions, training the primary estimation task was found to be specific to the presence of the alphabet secondary task. Errors in estimation were greater during testing when the secondary task occurred in only one phase than when the secondary task occurred during neither or both phases. These results imply that for a training program to be effective it needs to anticipate the secondary task requirements that will occur during eventual testing.
Email: Vivian Schneider, vickis@psych.colorado.edu

(5042)
Identifying General Cognitive Abilities Involved in Argument Evaluation. DYLAN BLAUM and MARY ANNE BRITT, *Northern Illinois University*, KRISTOPHER KOPP, *University of Notre Dame*, AMANDA DURIK, *Northern Illinois University*, PETER HASTINGS, *DePaul University* (Sponsored by Nicolas Vibert). — Individuals who lack the necessary skills for accurate argument evaluation (e.g., distinguishing warranted from unwarranted arguments) will be at a significant disadvantage throughout their life. Research has shown that simple tutorials are not effective for many students (about 30%). The current research examines how general abilities (e.g., vocabulary knowledge, reading comprehension, and analytical reasoning) predict learning to evaluate arguments. Study 1 showed that, although all three cognitive abilities predicted some aspects of these skills, vocabulary knowledge positively predicted both baseline argumentation skills and learning gains from a tutorial. Study 2 replicated the relationship between vocabulary knowledge and argumentation skills and found that this relationship is partially mediated by general vocabulary ability and cannot be accounted for by knowledge of the meaning of the specific predicates used in the argument task. The results suggest that targeting general vocabulary knowledge may help students who do not learn from a simple tutorial.
Email: Dylan Blaum, dylblaum@gmail.com

(5043)
We Are the Champions: Interviewing Contestants at the 17th USA Memory Championships. SHARLENE D. WALBAUM, *Quinnipiac University*. — Cognitive Psychology students attended the 17th USA Memory Championship and

interviewed 21 contestants and 2 previous champions who were trainers. They asked questions about basic demographics, preparation, and techniques. Preparation questions concerned the amount of time spent per day, days per week, and overall time spent in preparation. Technique questions included whether the contestant was self-taught or trained. They also asked whether other aspects of life had been affected by this effort and what separates having a good memory from being a memory expert. Finally, these responses were compared to final placement in the competition. Ages of contestants ranged from 13 to 44 and most were male. Most younger contestants attended as part of a high school team with a trainer; older contestants tended to be self-taught. Among the five who were interviewed and were in the top 10, hours spent per day ranged from .5 to 5, number of days from 3 to 7, and time spent overall from 3 weeks to 12 months. Reported techniques were primarily memory palace and PAO (Person-Action-Object). The champion, Nelson Delis, also spent the most time preparing.
Email: Sharlene D. Walbaum, sharlene.walbaum@quinnipiac.edu

(5044)

Personality Traits and Unmanned Aerial System Pilot Selection. KATIE FELTMAN, F. RICHARD FERRARO, KYLE BERNHARDT and HANNAH HILL, *University of North Dakota*. — This study examined how personality traits may relate to performance on piloting tasks, in order to determine what traits may assist in pilot selection for unmanned aerial systems (UAS). As scores on the WAIS increased the ability to maintain target tracking as close to the center point decreased. When conscientiousness increased less deviation from the desired tank levels was seen. When scores on neuroticism increased, reaction times to the systems monitoring task were found to increase as well. This demonstrates that certain personality traits may be beneficial to selecting individuals to train to operate UAS. These results also highlight the impact of vigilance and high workload.
Email: F. Richard Ferraro, f.richard.ferraro@email.und.edu

(5045)

Individual Differences in Talker Identification: Do Musical Experience and Linguistic Background Matter? XIN XIE and EMILY MYERS, *University of Connecticut* (Sponsored by Carol A. Fowler). — Individuals exhibit large variability in their ability to perceive talker identity. We hypothesized that long-term experience of pitch use promotes pitch expertise; and further, individual differences in pitch perception contribute to variability in the perception of talker identity. Two experiments tested our hypotheses in native versus non-native language contexts. Experiment 1 explored behavioral advantages in talker identification in two groups of individuals with potential advantages for pitch processing: tone language speakers and musicians. Experiment 2 tested the contribution of pitch abilities to talker identification. Cumulatively, results suggested that both musicianship and experience with tone languages predicted enhanced ability to accurately identify talkers in unfamiliar languages. Moreover, individual pitch processing ability mediated the impact of

musical and linguistic influence on talker identification. Our results support a shared-resource hypothesis, suggesting that pitch skills obtained via domain-specific training (e.g. via musical training or native language) transfer to processing of talker identity in speech.
Email: Xin Xie, isabelx.xie@gmail.com

(5046)

Average Intelligence in the Brazilian Provinces and Their Correlates. JOSE APARECIDO DA SILVA, *Universidade de São Paulo, Brazil*, GERHARD MEISENBERG, *Ross University School of Medicine, Dominica*. — Differences in intelligence between provinces have been described for several large countries. In this study we use the results of scholastic achievement tests to estimate average intelligence in the 24 states, 2 territories and the Federal District of Brazil. We observe a steep North-South gradient, with intelligence generally higher in the southern states. IQ estimates based on results of PISA 2006 and PISA 2009 range from 72 in Maranhão to 89.7 in the Federal District (Brasilia). Correlations of intelligence with indicators of socio-economic development are about as strong at the level of the Brazilian provinces as they are at the level of independent countries.
Email: José Aparecido Da Silva, jadsilva@ffclrp.usp.br

• EMOTION AND COGNITION III •

(5047)

The Effect of Emotional State on Encoding of Memory for Recognition Human Faces With Different Facial Expressions. SHUICHI HASHIGUCHI and MOTOYASU HONMA, *National Center of Neurology and Psychiatry, Showa University*, YOSHIYA MORIGUCHI and KENICHI KURIYAMA, *National Center of Neurology and Psychiatry*, TAKASHI TSUZUKI, *Rikkyo University*. — Previous study has shown that facial expressions of emotions (e.g., happiness or fear) enhance our memory. In addition, it has been found that the psychological states of participants at the time of encoding influence their memory of faces. In this study, we employed a fear-conditioning paradigm using the electric shock and investigated the relationship between fear-state at encoding and facial recognition memory. We found that recognition of faces decreased in the learned fear state as compared to the neutral state condition. We did not find any difference in the recognition performance of the fear and neutral facial expression condition. Therefore, we concluded that face recognition depends on an internal factor (emotional state) and not on an external factor (facial expression). We need to carry out further investigations to determine which stages of memory processing are related to the memory faces in the fear state.
Email: Shuichi Hashiguchi, shashiguchi.fpd@gmail.com

(5048)

The Influence of Internal and External Arousal on Memory. NUTTIDA RUNGRATSAMEETAWEEMANA and JASON ARNDT, *Middlebury College*. — Numerous studies have

documented that memory is better for emotional experiences than for non-emotional ones. Amongst the three predominant theories that seek to explain emotion-enhanced memory, the attention-narrowing hypothesis and priority-binding theory suggest that emotion attracts attention, and thus enhances encoding of emotion-inducing items. In contrast, arousal-biased competition theory posits that emotion influences memory through both encoding and consolidation processes. The present study examined the effects of externally-arousing events (sounds) on memory for to-be-remembered pictures that were inherently emotional or neutral. Further, emotion's effects on encoding and consolidation processes was examined by presenting sounds either before or after the to-be-remembered pictures. Picture recall was tested after a 2-day retention interval. The results showed that arousing sounds influenced memory for neutral pictures only through encoding processes, while arousing sounds affected memory for arousing pictures only through consolidation processes. This dissociation presents a challenge for existing theories of emotion's effects on memory.
Email: Jason Arndt, jarndt@middlebury.edu

(5049)
The Relation Between Mood and False Memory Creation of Negative Stimuli. DIANA M. STEAKLEY-FREEMAN and DAWN MCBRIDE, *Illinois State University*. — The current study investigated mood as one of the individual differences that contributes to false memory creation. While previous literature suggests that negative mood decreases false memory creation (Storbeck & Clore, 2005), the connection between negative mood and false memory for negative stimuli is unclear. The current study investigated the connection between false memories for both negative and neutral stimuli and depression. Cognitive attribution style was also measured among study participants. Data suggest a small but significant positive correlation between depression and false negative memory creation. Further factor analyses reveled specific components of depression that were most strongly related to negative false memory creation (i.e. feelings of worthlessness, self-criticism, crying, indecisiveness, self-dislike, sadness, and guilt). These data suggest that there are influential individual differences that contribute to the creation of false memories.
Email: Dawn McBride, dmcbride@ilstu.edu

(5050)
Physiological Responses to Emotional Stimuli as a Function of Violent Game Exposure and Individual Differences in Trait Motivational Activation. SATOKO KURITA, *Osaka University of Economics*, HIROKATA FUKUSHIMA, *Kansai University*, HARUMITSU MUROHASHI, *Hokkaido University*, ANNIE LANG, *Indiana University, Bloomington*. — This study attempts to expand our understanding of cognitive and emotional processing of emotional stimuli as a function of prior exposure to violent games and individuals' trait level of motivational activation. Recent research has focused on desensitization to violent events caused by repeated exposure to violent games. In this study ERP was measured while participants were looking at IAPS pictures and heart rate was measured while watching video clips which included

violent content. ERP results showed the predicted smaller LPP (late positive potential: emotional evaluation phase) from violent game players compared to non-violent game players. In addition, larger EPN (early posterior negativity: early attentional phase) was found among violent game players. Effects of prior violent game exposure appear to remain after controlling the effects of individual's motivational activation. The results indicate that chronic violent game exposure might desensitize emotional responses but sensitize attentional processes. Additional insights were provided from heart rate data while watching video clips on the above results.
Email: Satoko Kurita, satokokrt@gmail.com

(5051)
What Environmental Features Causally Impact Subjective Well-Being. JIAYING ZHAO, *University of British Columbia*. — In this study, we examine which environmental features determine subjective well-being. In Experiment 1, participants were randomly assigned to one of four locations over a 300m block on UBC campus, with one end containing grass, trees, and a water fountain, and the other end containing buildings. In each location, participants rated their happiness, affect, and the pleasantness of the environment. The pleasantness ratings reliably predicted happiness ($B=0.03$, $p<.05$), positive affect ($B=0.23$, $p<.01$), and negative affect ($B=-0.15$, $p<.01$), while controlling for weather. This suggests that the environment can causally determine well-being over geographically proximate locations. Experiment 2 replicated the results with 208 pedestrians surveyed at the same four locations. Experiment 3 used the UK Annual Population Survey to obtain data on well-being, the number of public green spaces, and the presence of water in 3360 districts in England. We found that both green space ($B=0.05$, $p<.001$) and water ($B=0.15$, $p<.001$) reliably predicted well-being, while controlling for income and population. Taken together, these results suggest that environmental features such as green space and water can determine subjective well-being.
Email: Jiaying Zhao, jalincarter@gmail.com

(5052)
The Relationship in Biology and Experience Between Positive and Negative Affect: A Multiple-Source View. BEHZAD MANSOURI, ASGHAR IRAN-NEJAD and FAREED BORDBAR, *The University of Alabama*. — The present investigation is about the biofunctional nature of the experience of affect. We show how biology in general and the nervous system in particular are essential but neglected in the recent hotly debated affective revolution. Interdisciplinary theories of the multiple-source, multiple-modality nature of learning imply that the origin of the relationship between the two types of affect is a multiple-front undertaking rooted in the functioning of the nervous system. We contend that affective experience is an evolving body-mind process that unlike what structural theories of emotion preach cannot be explained along a single bipolar dimension represented at discrete points in time or at purely experiential or phenomenological levels. Rather, based on the findings of biofunctional theory, we conclude that different kinds of affect are best represented

by two uni-polar dimensions related to each other in a non-linear fashion created by the ongoing simultaneous activity of the functional neural system.

Email: Asghar Iran-Nejad, airannej@bamaed.ua.edu

(5053)

Neural and Psychophysiological Representation of Affect Derived From Videos. JONGWAN KIM, SVETLANA V. SHINKAREVA and DOUGLAS WEDELL, *University of South Carolina.* — Separate studies tested if neural and psychophysiological representations of affective states derived from video stimuli are consistent with the circumplex model. Study 1 measured galvanic skin response, heart rate, electromyography of zygomaticus major and corrugator supercilii muscle while participants viewed and rated short video clips. Study 2 monitored brain activity using fMRI while participants viewed the same video clips. Videos varied in terms of arousal (high or low) and valence (positive or negative). In Study 1, individual difference multidimensional scaling (INDSCAL) based on similarities of physiological patterns of responding revealed three dimensions, general valence, arousal differences for positive clips, and arousal differences for negative clips. In Study 2, INDSCAL based on similarities of patterns of responding from the 400 most stable voxels indicated a two dimensional solution (valence and arousal) once three participants who neither separated arousal nor valence were dropped.

Email: Jongwan Kim, kim253@email.sc.edu

(5054)

Adaptation and Flexibility: The Integration of Emotion and Cognitive Control. BRANDY TIERNAN, NICOLE CHAMBERS and BERENICE ANAYA, *Western Kentucky University.* — The way in which emotional manipulations distinctly affect cognitive control (i.e., conflict monitoring and goal maintenance) has yet to be determined. Prior work suggests positive affect enhances flexibility and boosts proactive control, while negative affect reduces focus and leads to the use of reactive control and an increased susceptibility to interference. We used event-related brain potentials (ERPs) to examine the influence of emotion on the neural mechanisms of cognitive control related to performance adjustment (frontal slow wave) and conflict adaptation (conflict SP). Participants performed a variation of the Stroop task where a positive, negative, or neutral word was presented before the stimulus. Behaviorally, the Stroop effect was eliminated on trials preceded by a positive word. Physiologically, affect influenced the level of conflict adaptation for the conflict SP, whereas the frontal slow wave was not sensitive to affect. Results suggest that positive emotion facilitates sensitivity to task demands and control adaptation.

Email: Brandy Tiernan, brandy.tiernan@wku.edu

(5055)

Math Anxiety in Community College Women: A Missed STEM Pipeline. LISA SPRUTE and SIAN LEAH BEILOCK, *University of Chicago.* — Recent measures of job and college preparedness indicate only 1/4 of twelfth graders can process numbers like fractions, which support learning college algebra.

Consequentially, millions of unprepared community college students each year require learning pre-college mathematics. Unfortunately, remediation programs are failing: Less than 1/3 of students pass pre-college math courses with even fewer graduating. Women in particular tend to need more pre-college math than men. We show for students taking pre-college math (N = 451), pre-term math anxiety negatively predicts course grades in women but not men, $F(1,342) = 10.4$, $p < .001$, $\eta2 = .030$ (even after accounting for test and chronic anxiety). Moreover for women, knowledge of fractional quantities, and not whole numbers, explains the relationship between math anxiety and course grades (bootstrapping CI -.158 to -.012). Taken together, focusing both on fraction skills and math attitudes may not only improve college preparedness, but may also fulfill job training needs in science, technology, engineering, and math (STEM) fields.

Email: Lisa Sprute, lsprute@uchicago.edu

(5056)

The Effects of Thermal Comfort and Arousal Level on the Mere Exposure Effect. KEN MATSUDA, SHUNSUKE NAKAMOTO, HIROKI MORIOKA and KYOSUKE HIYAMA, *Yamaguchi University*, TOMONOBU GOTO, *Tohoku University*, MAKOTO KOGANEI, *Yamaguchi University*, TAKASHI KUSUMI, *Kyoto University.* — We focused on the influence of indoor thermal comfort on the mere exposure effect while manipulating Predicted Mean Vote (PMV). We used neutral random shapes as stimuli and controlled exposure frequency (0, 1, 5, 10, and 15 times) and PMV (+2 = hot, +1 = warm, 0 = normal, -1 = cool, -2 = cold). After the acclimation phase, participants were exposed to each stimulus, and 5 minutes later, were asked to rate preference, familiarity, novelty, and thermal comfort using a 7-point scale, as well as recognition of old and new items. The mere exposure effect definitely occurred only in a slightly warmer environment. In the PMV+1 condition, Energetic Arousal associated with intellectual activity was high, whereas Tense Arousal associated with emotional state was low. These results suggest the importance of controlling the thermal environment as one would, external noise, for ensuring the accuracy of results.

Email: Ken Matsuda, matsuken@yamaguchi-u.ac.jp

(5057)

Emotions Affect Reasoning Via System 2. SERGE CAPAROS and ISABELLE BLANCHETTE, *Université du Québec à Trois-Rivières.* — Deductive reasoning involves two systems: System 1 (based on the use of heuristics) which is fast but error-prone, and System 2 (based on the use of algorithms) which is accurate but slow. Factors such as intelligence and motivation have been shown to impact mainly System 2. Although some theories postulate that emotions affect reasoning via System 1, this has not been tested empirically. Here we tested how emotional life experiences and emotional content, as well as fluid intelligence, affect Systems 1 and 2. Participants judged the logicality of deductive-reasoning problems (with emotional or neutral contents). For each problem, they first gave a quick and intuitive response (System 1), and then a second slow and thoughtful response (Systems 1 and 2).

While logicality for the intuitive response was little affected by participants' fluid intelligence, emotional experience, or by emotional content, logicality for the second response was decreased by emotional content and emotional experience, and increased by fluid intelligence. Thus, like intelligence, emotions affect mechanisms linked to high-level System 2.
Email: Serge Caparos, serge.caparos@uqtr.ca

(5058)
Spatial Attention is Modulated by Both Arousal and Valence When Image Content is Task Relevant. SIMONA BUETTI and MARIA M. ROBINSON, *University of Illinois at Urbana-Champaign*. — It has been shown that the spatial allocation of attention is modulated by arousal and not by valence. In those studies, the content of the emotional images was incidental to the cueing task. However, it is known that valence is an evaluative dimension of emotion. Here we hypothesized that a certain amount of processing of the emotional content is necessary to uncover effects of valence. We used a modified cueing task where emotional images are presented in the background throughout the trial. We compared two groups: a Memory group who was told that they would be tested on the images at the end of the experiment and a No-Memory group who received no special instructions about the images. Supporting previous results from the literature, in the No-Memory group the results showed an effect of arousal but not of valence on spatial attention: attention disengagement was slower for arousing than neutral images, but there was no difference between positive and negative images. Importantly, in the Memory group, we replicated the typical effect of arousal but also found an effect of valence. This effect of valence did not impact the disengagement of attention, but the voluntary re-orienting of attention towards the uncued location.
Email: Simona Buetti, sbuetti@gmail.com

• FALSE MEMORY II •

(5059)
Effects of Valence, Arousal, and Presentation Modality on True and False Memory. TAMMY MARCHE and VALERIE ELLIOT, *University of Saskatchewan*. — A common paradigm for studying false recall is the Deese-Roediger-McDermott (DRM) paradigm (Roediger & McDermott, 1995). Participants study lists of words that revolve around familiar themes and report studying a critical nonpresented item that is a semantic associate of the presented items. When the semantic associates are negative versus positive words, or when the associates are presented auditorily versus visually, false memory increases. We used the Cornell/Cortland Emotion Lists (CEL; Brainerd et al., 2008) within the DRM paradigm to examine the combined effects of valence, arousal, and presentation modality on true and false recall for sixty adults. False memory increased with negative words, especially when they were high in arousal, whereas true memory increased for positive words and high arousal words independently. Presentation modality had little

effect on true or false memory. Further research is needed that examines the different effects that emotion has on true and false memory.
Email: Tammy Marche, tmarche@stmcollege.ca

(5060)
False Memory Susceptibility Following Mindfulness Meditation. BRENT M. WILSON, *University of California, San Diego*, LAURA MICKES, *Royal Holloway, University of London*, MATTHEW EVRARD, STEPHANIE STOLARZ-FANTINO and EDMUND FANTINO, *University of California, San Diego*. — We examined the effect of mindfulness meditation on false memory susceptibility using the Deese-Roediger-McDermott (DRM) paradigm. Because mindfulness meditation encourages judgment-free thoughts and feelings, we predicted that those participants in the mindfulness condition would freely recall more critical lures. Participants were randomly assigned to either a 15-minute mindfulness induction that instructed them to focus attention on their breath or a 15-minute mind-wandering induction that instructed them to think about whatever came to mind. Overall proportion of words correctly recalled did not differ between conditions. However, participants in the mindfulness condition were significantly more likely to falsely recall the critical lure than participants in the control condition.
Email: Edmund Fantino, efantino@ucsd.edu

(5061)
False Memory for Previously Tested Items: Investigating Test-Induced Associative and Repetition Priming. MATTHEW CRUMP and MICHAEL BLECHER, *Brooklyn College, CUNY*, RANDALL JAMIESON, *University of Manitoba*. — Studying thematically related words produces false memories for non-studied theme words (i.e., DRM effect). Test-induced priming (TIP) is known to increase false-recognition rates when source monitoring is impaired. Our experiments establish the reliability of associative and repetition TIP effects for non-studied lists, which have been inconsistently shown in the literature. In several online experiments, participants encoded words never presented at test. At test, thematically related new words were presented as lures before or after critical category lures. Participants showed reliable false memories for critical lures (E1). TIP effects remained when encoding time increased (E2), when warnings were given (E3 & E4), and when old words from the study phase were included in the test (E6). False-recognition rates were higher for lures primed by repetition rather than association during test (E5 & E6). The role of source-monitoring processes during retrieval in mediating false-recognition from TIP is discussed.
Email: Matthew Crump, crumpmj@gmail.com

(5062)
Do Memory Illusions in the DRM Paradigm Depend on Test Format? JUSTYNA OLSZEWSKA, *Institute of Applied Psychology*, JOANNA ULATOWSKA, *Academy of Special Education*. — The Deese-Roediger-McDermott (DRM) paradigm is a widely used procedure that provides a reliable

method of inducing associative memory distortions. In two experiments, we compared a standard yes/no recognition test with a two-alternatives forced-choice test (2FC). In Experiment 1, participants produced false recognition to critical lures, but the rate of false alarms depended on the way the 2FC test was created. Pairing a theme word with a word from the first position made participants more accurate than pairing a theme word with a word from the tenth position. In Experiment 2, using a within-subjects manipulation, we directly compared memory performance in a 2FC and a yes/no recognition test. It was demonstrated that item-specific memory did not differ across two tests, whereas susceptibility to gist was reliably higher in the yes/no test. The results suggest that associative false memory is a function of both encoding and retrieval factors.

Email: Justyna Olszewska, justynaolszewska1@gmail.com

(5063)

Misinformation Effects are Unrelated to DRM Effects With and Without a DRM Warning. DUSTIN CALVILLO, JOCELYN A. PARONG and NICOLE V. MILLS, *California State University San Marcos*. — The misinformation effect and Deese-Roediger-McDermott (DRM) effect are two forms of false memories. Despite the abundance of research on these two phenomena, few studies have examined the relationship between them. In the present study, 160 participants completed a misinformation task and two DRM tasks, receiving a warning about the effect before the second DRM task. Participants demonstrated misinformation and DRM effects (with and without the warning), but susceptibility to these forms of false memory were not significantly related across individuals. The DRM warning reduced the DRM effect, and signal detection analysis revealed that the DRM warning reduced a liberal response bias in this task. Sensitivity and response biases in both DRM tasks were not significantly related to these measures in the misinformation task. These findings suggest that these two forms of false memories are not interchangeable and they appear to be the result of different cognitive processes.

Email: Dustin Calvillo, dcalvill@csusm.edu

(5064)

Misleading Suggestions of Invisibility Can Lead People to Not Report Previously Witnessed Event Details. TANJEEM AZAD and D. STEPHEN LINDSAY, *University of Victoria* (Sponsored by James Tanaka). — Five experiments examined the effect of suggested invisibility on memory for a witnessed event. Subjects watched a video and 2 days later read simulated witness testimonies. Each free-recall testimony (a) stated that two event details were not visible in the video (though they in fact were clearly displayed) and (b) mentioned two other details only in broad generic terms. Subjects were significantly less likely to report witnessed details when they had been erroneously suggested to not have been visible compared to control details. However, many subjects expressed disbelief in the testimony. To enhance testimony plausibility, subsequent experiments embedded reports of suggested invisibility in responses to cued-recall questions or presented subjects with a transcript of an interview between a witness and an

experimenter. Findings replicated the suggested invisibility effect. Although suggestions of invisibility reduced reports of event details, subjects rarely experienced illusory memories of not having seen those details.

Email: Tanjeem Azad, tazad@uvic.ca

(5065)

Retrieval-Enhanced Suggestibility Is Eliminated When the Misinformation Phase Includes Fewer Contextual Details. JESSICA LAPAGLIA, *Morningside College*, JASON CHAN, *Iowa State University*. — Following a crime, a witness is likely to describe the event prior to misinformation exposure. Recently, LaPaglia and Chan (2013) discovered that when misinformation was presented in a lengthy narrative, initial recall enhanced suggestibility relative to not taking an initial test (retrieval-enhanced suggestibility or RES). However, when misinformation was embedded in questions, initial testing reduced suggestibility. In the current study, we examined whether contextual detail present during misinformation exposure alters the relationship between testing and suggestibility. Participants watched a video of a robbery and some received a memory test immediately afterwards. Later, participants were exposed to misinformation in a narrative (Experiment 1) or in questions (Experiment 2). The misleading sentences/questions were embedded in rich contextual detail (integrated condition) or additional contextual details were removed (isolated condition). We found that an RES effect was present only in the integrated condition, regardless of whether misinformation was presented in questions or a narrative. In the isolated condition, there was a testing benefit—initial recall reduced suggestibility.

Email: Jessica LaPaglia, lapagliaj@morningside.edu

(5066)

The Meaning Is Clear After a Delay: The Effects of Delay and Blocking on False Memory for Lexically Ambiguous Critical Items. MARK HUFF, *Washington University in St. Louis*, JAIME MCNABB and KEITH HUTCHISON, *Montana State University*. — Two experiments examined veridical and false memory for lists of associates from two meanings (e.g., stumble, trip, harvest, pumpkin, etc.) that converged upon a single lexically ambiguous critical item (e.g., fall). Study items were either blocked by meaning or alternated meanings and were followed by a free recall test either immediately or following a 2.5 minute delay. Veridical recall was greater for blocked lists across retention intervals. Critical item false recall was also greater following blocked lists on immediate tests; however, following a delay, false recall increased more for alternated lists than blocked lists, eliminating the blocking effect. Clustering analyses mimicked false recall such that on immediate tests, participants grouped recall by meaning only for blocked lists, but that clustering increased only for alternated lists following a delay. These results suggest that gist-based processing does play an important role in producing false memories, especially following a delay.

Email: Mark Huff, mhuff@wustl.edu

(5067)

Reducing the Misinformation Effect: Extending the Protective Effects of Initial Testing. MARK J. HUFF, *Washington University in St. Louis*, CAMILLE C. WEINSHEIMER and GLEN E. BODNER, *University of Calgary*. — Huff, Davis, and Meade (2013) reported that taking an initial test can render memory more resilient to misleading suggestions. We explored whether this protective effect of initial testing is affected by taking two initial tests, and by the introduction of a delay before the final memory tests. After studying six household scenes, groups recalled the objects in each scene either 0, 1, or 2 times. Nonpresented objects were then suggested via recall tests ostensibly completed by other participants. Memory for the original scenes was then tested immediately or after a 2-day delay. Initial testing reduced the misinformation effect on a source test regardless of delay, whereas initial testing reduced the misinformation effect on a recall test only after a delay. Overall, the protective effects of initial testing on the misinformation effect were enhanced by a delay, but they were not further enhanced by taking more than one initial test.
Email: Glen Bodner, bodner@ucalgary.ca

(5068)

What We See, Read or Hear May Be Distorted Differently. The Effect of Encoding Format on Recognition Performance. JOANNA ULATOWSKA, *Academy of Special Education*, JUSTYNA OLSZEWSKA, *Institute of Applied Psychology*. — Most studies on misinformation have utilized the visual presentation of a to-be-remembered event that was later tested verbally or visually. These studies, however, examined the susceptibility to misinformation when a few different encoding formats were utilized. In the first study either video, slides, written narrative or auditory narrative, describing street mugging were applied. The results demonstrated higher susceptibility to written post-event information (PEI) after encoding video or slides rather than written or audio narrative. Encoding specificity - the availability of similar cues at encoding and retrieval - may serve as the explanation of this effect. To confirm this hypothesis and to examine the effect of format of PEI and test on memory performance, a follow up study was conducted utilizing a fully crossed design applying two separate formats: pictorial and auditory at all three stages of the misinformation procedure. The data imply that congruity between encoding and test can reduce false memories.
Email: Joanna Ulatowska, julatowska@aps.edu.pl

(5069)

Transfer Appropriate Fluency: The Impact of Encoding Task on Fluency-Based False Recognition. MEREDITH LANSKA and DEANNE WESTERMAN, *Binghamton University, SUNY*. — Past research has found that pseudohomophones (e.g, phrawgs) are more likely to be falsely recognized than other types of nonwords and words. This finding has been attributed to the surprising level of phonological fluency that accompanies a stimulus that is orthographically unfamiliar. In this experiment, pseudohomophones, nonwords, and words were studied with encoding tasks designed to either emphasize or block phonological processing. The results showed that false recognition of pseudohomophones was positively related to the amount of phonological processing that was carried out during study. This finding shows a transfer appropriate processing effect in false recognition, as the type of information emphasized during encoding impacted the degree to which phonological fluency led to false recognition.
Email: Deanne Westerman, wester@binghamton.edu

(5070)

An Examination of False Memories Using Artificial Semantic Networks. JOHN POWELL TAYLOR, SHANNA'LE ASHWORTH, MATTHEW FISCHER, KADIE SKOU and ALMYRA PERRY, *Southern Oregon University*. — Semantic networks are a long-standing feature of memory theories and are hypothesized to be important in common memory phenomenon, such as false memories. The problem in memory research is that direct access to any of the networks and network properties for study of the effects of those association networks is difficult. We devised a paradigm to train participants on an associative network of our own design. We created a highly structured semantic network where all of the items were connected to others such that each item was interconnected to varying degrees, from having one neighbor to four. Studied items were drawn from either an inteconnected cluster of the network or from equally spaced positions throughout the network. Test items were drawn from studied, non-studied but trained, and non-studied, non-trained items. We predicted that the number of associates activated at study would influence correct and false recognition at test. We also predicted discriminability of hits and false alarms would increase when studied items were drawn from one side of the network and nonpresented items from the other side, compared to intermixed network selection. Results verify network properties can be manipulated to influence recognition.
Email: John Powell Taylor, taylorj3@sou.edu

(5071)

Source Monitoring Abilities Mediate the Relationship Between Working Memory and False Memories Via Recollection Rejection Strategies. HUNTER BALL, *University of Georgia*, GENE BREWER, *Arizona State University* (Sponsored by Arthur Glenberg). — Relatively little research has investigated whether the quality of monitoring processes account for the mediating role of source monitoring (SM) on the working memory (WM) and false remembering relation. In the current study, participants performed multiple false memory, WM, and SM tasks. Consistent with previous research, SM abilities mediated the relationship between WM and false memories regardless of whether or not participants were warned about the ease of committing false memories at encoding. False alarms to critical lures were more often attributed to a feeling of familiarity for low SM individuals, whereas high SM individuals were better able to recall contextual information from study to correctly reject critical lures. These results suggest that those low and high in SM abilities rely on qualitatively different monitoring processes

to reduce memory errors, and that diagnostic monitoring strategies may account for previous relationships found between WM and false memories.
Email: Hunter Ball, HunterB1005@gmail.com

(5072)

Showups vs. Lineups: Are Showups More Suggestive? JEFFREY NEUSCHATZ, *University of Alabama*, STACY A. WETMORE, *University of Oklahoma*, KYLIE KEY and DANIELLA CASH, *University of Alabama Huntsville*, SCOTT D. GRONLUND, *University of Oklahoma*, CHARLIE GOODSELL, *Canisius College*. — The U.S. Supreme Court, state courts, and social science researchers have stated that showup identifications (one-person identifications) are less reliable than lineup identifications. Moreover, 74% of eyewitness experts endorsed false identifications as more likely from showups than lineups (Kassin, Tubb, Hosch & Memon, 2001). Examination of the extant literature and ROC analyses of over 7,500 participants confirm that showups are indeed an inferior procedure to lineups. This conclusion held true even in situations where showups should have a memorial advantage (i.e., at a short retention interval, a clothing match between encoding and test). The data also reveal that confidence is better calibrated to accuracy for lineups than for showups. The signal-detection based diagnostic feature model (Wixted & Mickes, 2014) provides a theoretical explanation for why showups produce inferior eyewitness performance.
Email: Jeffrey Neuschatz, neuschaj@uah.edu

(5073)

When Correct Rejections Lead to Long-Term Memory Failures. MATTHEW SABIA and ALMUT HUPBACH, *Lehigh University*. — Visual recognition memory can be both incredibly accurate and faulty. Unless test conditions require attention to visual detail, people easily commit gist-based false recognitions by accepting items that are related to studied targets (e.g., Guerin et al., 2012). This study assessed the long-term consequences of conditions that foster false recognitions. Subjects learned a series of images. In an immediate recognition test, we replicated excellent detail memory when targets and related items were presented simultaneously, and increased false recognitions when related items were presented without corresponding targets. Forty-eight hours later, we again assessed target memory by presenting targets alongside new foils. We found that presenting related items without corresponding targets at Test 1 reduced target memory at Test 2. Surprisingly, this effect was accentuated when participants had correctly rejected the related items in Test 1. This finding is discussed in relation to response biases, source memory difficulties and item strength differences.
Email: Matthew Sabia, sabiam3@gmail.com

(5074)

The Effect of Source Monitoring on Reconsolidation. MARISA CRISOSTOMO and DANIEL KIMBALL, *University of Oklahoma*. — Previous research on memory reconsolidation has suggested that reconsolidation is the underlying mechanism for the misinformation effect; however, research has also shown that this misinformation effect disappears when source memory decisions are made. In the present study, participants learned a list of words, were reminded of that learning event (or not) before learning a second list two days later, and were tested for memory of both lists via a recognition task or a source memory task. The source memory task involved specifying List 1, List 2, both lists, or neither list as the word's source(s). Based on previous research, we expected false alarms to List 2 items on the List 1 recognition test to increase with reminding. Competing hypotheses predicted that source misidentifications for List 2 items would decrease, disappear, or remain unaffected with reminding. Results are discussed in terms of the theoretical bases for these hypotheses.
Email: Marisa Crisostomo, mcrisostomo@ou.edu

(5075)

Adaptation to Changing Task Requirements Causes a Familiarity Bias. ANDRE AßFALG, DEVON CURRIE and DANIEL BERNSTEIN, *Kwantlen Polytechnic University*. — After solving an intervening task (e.g., 145 + 223 = ?) participants often claim that an unrelated stimulus is familiar. Past studies have failed to identify moderators for this familiarity bias. However, in Experiment 1, we found that task demands moderate the familiarity bias. When the intervening task required participants to repeatedly type sequences of one or more keys, the familiarity bias did not occur after monotonous repetitions of one key, but did occur after random sequences of multiple keys. Conversely, Experiment 2 included a new set of keys in each trial of the intervening task, thus preventing participants from planning ahead. Under these conditions, we found a familiarity bias irrespective of the number of keys involved. We conclude that task-induced familiarity biases do not result from intervening tasks per se, but instead result from planning processes required by changing task requirements.
Email: Andre Assfalg, andre.asfalg@gmail.com

• WORKING MEMORY IV •

(5076)

ERP Signature of Interference Resolution Predicts Individual Difference in Working Memory. LI ZHOU, *Miami University of Ohio*, LINDSAY MEREDITH and ROBIN THOMAS, *Miami University*. — Large body of research has investigated maintenance function of working memory (WM) and their ERP correlates, however not much has been done on the interference resolution. The interference resolution is as much important as maintenance in the service of the function of WM. In the current study, we adopted the "recent-probe" paradigm and studied proactive interference with electrophysiological measures with memory set size was 2 and 4. Interference resolution was reflected by the difference between recent negative and non-recent negative probes in terms of response time and ERP Late positive component (LPC). LPC was identified as the ERP signature related to interference resolution at frontal, central, and parietal lobe electrodes. Individual's WM capacity was negatively correlated

with interference resolution both in response time and LPC. High WM capacity individuals had less interference. The LPC topographic distribution suggested that the left hemisphere played a critical role in the interference resolution.
Email: Li Zhou, zhoul4@miamioh.edu

(5077)

Differentiation of Receiver Operating Characteristics Based on Corpus Callosum Volume in a Visual-Short Term Memory Paradigm. SHUO QIN, CHANDRAMALIKA BASAK and NITHYA RAMAKRISHNAN, *University of Texas at Dallas*. — The current experiment utilized Receiver Operating Characteristics (ROCs) curves to investigate visual-short term memory in a divided hemi-field paradigm. It has been proposed that object-based integration is processed concurrently and independently by the two hemifields (see Corballis, 1995, for review). If so, corpus collosum (CC) volumes may be predictors of illusory conjunctions across hemifields. Participants were asked to judge if a probe belonged to one of four objects presented previously to both visual fields. There are three possible lures: no match (NM), same hemifield conjunction (SH), and opposite hemifield conjunction (OH). The latter two were conjunctions drawn from either within- or across- visual fields. All participants also underwent MRI brain-imaging to acquire brain volume information. Posterior CC volume was more predictive of OH accuracy and confidence ratings. Group analysis of ROC curves based on CC volume showed that lower CC individuals have higher intercepts in zROCs, which estimates accuracy. Low CC volume therefore predicts better performance.
Email: Shuo Qin, sxq130330@utdallas.edu

(5078)

Varying Attentional Refreshing via Strategies and Cognitive Load Moderates the Benefit of Semantic Retrieval Cues for Working Memory Recall. VANESSA LOAIZA and VALERIE CAMOS, *Universite de Fribourg*. — Converging research has suggested that articulatory rehearsal promotes the phonological representations of memoranda in working memory (WM), but little is known about the representations that attentional refreshing may promote. The following two experiments presented a cue word that was either semantically related or rhymed with a target during the recall phase of a WM task. In Experiment 1, participants were instructed to either use rehearsal-based or refreshing-based maintenance strategies. In Experiment 2, participants engaged in the WM task under low, medium, or high cognitive load conditions in order to vary attentional refreshing. The advantage of semantic over phonological cues was stronger when using the refreshing instead of the rehearsal strategy (Experiment 1) and when cognitive load was low instead of medium or high (Experiment 2). This extends current research showing that rehearsal and refreshing are distinguishable maintenance mechanisms, particularly in that they promote different characteristics of memoranda in WM.
Email: Vanessa Loaiza, vanessa.loaiza-kois@unifr.ch

(5079)

Working Memory Capacity and Expertise Effect of Simultaneous Interpreter. SOPHIA WEN and MICHAEL YIP, *The Hong Kong Institute of Education*. — The present study investigates the relationship between expertise effect of simultaneous interpreter and the working memory capacity. In the present study, a standard reading span test was employed to measure the working memory capacity among three different groups of participants (university students without training in simultaneous interpreting; university students with basic training in simultaneous interpreting and professional interpreters). The recall performance from the group of professional interpreters was clearly superior to the other two groups of participants and hence demonstrated a larger working memory capacity (i.e. strong expertise effect). The results will be interpreted in terms of the multi-component working memory model.
Email: Michael Yip, mcwyip@ied.edu.hk

(5080)

Processing and Storage in Working Memory. JASON DOHERTY, CANDICE MOREY and ROBERT LOGIE, *University of Edinburgh*. — A number of recent investigations into the structure and functional limits of working memory have focussed on the effect of increasing processing task demand on concurrent memory performance. Reporting a linear effect of increasing the demand of the former task on the performance on the latter, these studies appear incompatible with a large literature positing separable processing and storage components in working memory. In investigating possible reasons for the contrasting findings from these two research groups, we have found that the effect of increasing processing demand on memory performance is greatly diminished once tasks are titrated according to participants' abilities. The effect of processing on concurrent storage is considerably larger once participants are required to perform above their measured capacity, but this effect on memory is still negligible when compared to the considerably larger effect of increasing memory load.
Email: Jason Doherty, j.m.doherty@sms.ed.ac.uk

(5081)

Working Memory and Incidental Memory: What Do We Do With Useless Information? ISABELLE DAGRY, *University of Geneva*, EVIE VERGAUWE, *University of Missouri-Columbia*, PIERRE BARROUILLET, *University of Geneva*. — There are two opposite conceptions in accounting for the cognitive load effect in complex span task. The TBRS model (Barrouillet et al., 2004) assumes that a low cognitive load involves better immediate recall due to the increased proportion of time available to refresh memory traces. The SOB-CS model (Oberauer et al., 2012) proposes a different explanation: low cognitive load allows more time to remove distractors, hence the better recall. A way to decide between these two hypotheses is to study the status of distractors through delayed recall. If participants use free time to remove distractors, a low cognitive load condition should result in poorer delayed recall of distractors because low cognitive load involves more time to clear working memory. In two

experiments investigating incidental memory for distractors, we obtain results at odds with this prediction, suggesting that people do not use the available free time to remove distractors.
Email: Isabelle Dagry, isabelle.dagry@unige.ch

(5082)

Chunking Facilitates Memory Judgments of Relative Order. YANG S. LIU and JEREMY CAPLAN, *University of Alberta.* — When lists are temporally organized into groups of items, "chunks," serial recall is improved. The dominant explanation of this facilitation is that chunking causes participants to store item positions more accurately, with one code for list position and another for the position of each item within its chunk. This implies that chunking should facilitate judgments of relative order (JOR) wherein, participants judged the order of a pair of probe items from the target list. We presented participants lists of 9 consonants, either temporally grouped in 3s, or presented with even inter-stimulus interval. We found error rates were reduced with chunking for JOR, but different than serial recall, response times were lengthened. The results suggest chunking facilitates JOR, but as suggested by more detailed analyses, unlikely due to additional precision offered by a second position code.
Email: Yang Liu, everyyang@gmail.com

(5083)

The Effects of Irrelevant Speech Under Short-Term Cued and Serial Recall Procedures. MADELEINE ARBER and GEORGINA TOLAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland.* — The differential impact of irrelevant speech on cued and serial recall was investigated under proactive interference manipulations. The Irrelevant Speech Effect occurs when memory performance is disrupted by the simultaneous presentation of irrelevant spoken material with the to-be-remember (TBR) material. Of particular interest is the degree to which overlapping characteristics between the irrelevant speech stream and the TBR items exacerbate the effect. A total of 80 participants completed four different experiments. These included two experimental conditions where the irrelevant speech shared phonemic information with the TBR items under (1) cued recall procedures and (2) serial recall procedures and a further two control conditions; (3) cued recall and (4) serial recall in the absence of irrelevant speech. Overall, the irrelevant speech effect was apparent which demonstrates the importance of between stream similarity. Furthermore, this research considers the reasons for recall differences between cued and serial recall under a proactive interference manipulation.
Email: Madeleine Arber, madarber@hotmail.com

(5084)

Cued and Serial Recall Under Conditions of Irrelevant Speech and Articulatory Suppression. THOMAS BENNETT, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*, GEORGINA TOLAN, *Australian Catholic University.* — The joint effect of irrelevant speech and articulatory suppression on cued and serial recall was examined. The irrelevant speech, which is presented simultaneously with the to-be-remembered (TBR) items and is known to disrupt recall, shared overlapping phonemic information with the TBR material. In two experimental conditions, serial (n = 20) and cued recall (n = 20), during the presentation of the TBR items and the irrelevant speech participants were required to repeat the word "the" until recall. The continuous repetition of "the" served to prevent rehearsal through articulatory suppression. The two control groups (n = 40) performed the same experiment but in the absence of articulatory suppression. Overall irrelevant speech effects were apparent but attenuated under articulatory suppression. The pattern of performance for serial and cued recall is discussed.
Email: Thomas Bennett, t.bennett312@gmail.com

(5085)

Working Memory and the Complex Operation Span Task: A Measure of Working Memory Capacity. GEORGINA TOLAN and C.K. KENNEDY, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland.* — The complex operation span task is a well-established measure of working memory capacity and is strongly correlated with fluid intelligence, however, the mechanism that relates this task to working memory capacity remains unclear. As such, the current research aimed to identify the source of this relationship by designing a new fixed length version of the complex operation span task. This study consisted of 60, native English speaking, members of the general Australian population. Using a 2×2 repeated measures design, this study found recall to increase with repetition and to be equivocal in both list types at both testing occasions, strong test retest reliability for both list types, and the fixed list was shown to be a better predictor of fluid intelligence. These findings suggest that larger, highly taxing list lengths are more beneficial to the working memory capacity-fluid intelligence relationship than the traditional variable list length task.
Email: Georgina Tolan, anne.tolan@acu.edu.au

(5086)

Using Encoding Specificity to Assess the Nature of the Secondary Memory Component of Working Memory. DUNG BUI, JOEL MYERSON and SANDRA HALE, *Washington University in St Louis.* — Recent theories suggest working memory involves secondary memory as well as primary memory. It is unclear, however, how similar the secondary memory component of working memory is to the secondary memory component underlying episodic memory. The present study explored this issue by examining whether the effects of manipulating encoding specificity on working memory are similar to its well-established effects on episodic memory. Participants engaged in a modified operation span task where they learned related cue-target word-pairs. During recall, participants were either provided the same cues from earlier during the trial (match), new cues that were highly associated with the target word (mismatch), or no cues (free recall). In several experiments, performance in the free recall condition was better than the mismatch condition, consistent with the encoding specificity principle. The results suggest

that the same secondary memory component is utilized in performing both working memory and episodic memory tasks.
Email: Joel Myerson, jmyerson@wustl.edu

• HUMAN LEARNING AND INSTRUCTION III •

(5087)
Retrieval Practice With Children in the Classroom. JANELL BLUNT, LUDMILA NUNES, STEPHANIE KARPICKE and JEFFREY KARPICKE, *Purdue University*. — A wealth of research has demonstrated that practicing retrieval is a powerful way to enhance learning. However, nearly all prior research has examined retrieval practice effects with college students whereas less is known about the benefits of retrieval practice with children. In two experiments, we examined the effects of adding a brief free recall test at the end of children's typical classroom activities across 3 weeks. One week after the last session, children took a final short answer test that assessed verbatim knowledge. Practicing retrieval produced more learning than did a control condition in which students did not take free recall tests. These results contribute to the growing body of research supporting the educational benefits of retrieval practice in the classroom and provide preliminary evidence that practicing retrieval may be an effective learning strategy for children.
Email: Janell Blunt, jrblunt@purdue.edu

(5088)
Does Instructing Learners to Look for Differences Enhance Inductive Learning? SASKIA GIEBL, *University of California, Los Angeles,* CAROLE YUE, *Covenant College*, VERONICA YAN and ELIZABETH BJORK, *University of California, Los Angeles*. — Interleaving exemplars across categories, rather than blocking them within categories, enhances inductive learning. A reason suggested for this finding is that interleaving encourages contrastive processing, thereby improving encoding of the distinctions between categories. Students, however, overwhelmingly prefer blocking and, furthermore, blocking is used everywhere. Thus, our goal was to see if the benefits of interleaving might be extended to blocking by encouraging learners to engage in contrastive processing even during blocked study. Participants saw six paintings by six different artists (3 interleaved & 3 blocked) and tried to learn the artists' styles. The key manipulation was whether they were first told to consider the similarities within each artist or the differences between artists. On a final test, participants receiving the "differences" instruction, rather than the "similarities" instruction, were better at identifying new paintings by studied artists. Thus, instructing learners to look for differences may be a way to enhance learning while blocking.
Email: Saskia Giebl, saskia.giebl@gmail.com

(5089)
How Does Relatedness Affect the Benefits of Interleaving? COURTNEY M. CLARK, CAROLE YUE, ALEX JOHL, KATE KRASILEVA and ELIZABETH BJORK, *University of California, Los Angeles*. — Interleaving, or mixing study of different topics together, can be more beneficial than blocking. For instance, when trying to learn different artists' styles via examples of their paintings, it is better to see the paintings of the artists interleaved with those of other artists than to see each artist's paintings blocked together (Kornell & Bjork, 2008). Our study explored whether such benefits extend to learning text passages, and whether these benefits might be affected by the relatedness of the passages—akin to studying material from one course versus multiple courses. Participants read two passages on either related or unrelated topics (e.g., two about trees or one about trees and one about clocks) two times. In blocked study, the first passage was read twice before reading the second passage. In interleaved study, passages were alternated. Results show that interleaving was especially beneficial for related passages, as revisiting may help overcome any harmful effects of interference.
Email: Elizabeth Bjork, elbjork@psych.ucla.edu

(5090)
Differing Contributions of Encoding Variability and Reminding to the Spacing Effect in Recall and Recognition Memory. GEOFFREY MADDOX, *Rhodes College*, DUNG BUI and SANDRA HALE, *Washington University in St. Louis*. — Numerous mechanisms have been proposed to account for the spacing effect. In the current experiments, participants incidentally encoded words using a rating task involving two different judgments (i.e., animacy and size judgments). Some items were repeated after a short or long lag. Moreover, repeated items were judged with the same judgment or with different judgments across repetitions. At test, participants were asked to recall or recognize studied items. Participants also reported the frequency with which each item was presented and whether the item was judged with the same question or different question across repetitions. Results revealed an interaction between participant accuracy in detecting whether an item was presented with the same or different judgments and whether the item had truly been processed with the same or different judgments. This interaction suggests that subjective encoding variability may enhance performance when recollection of the repeated study event fails.
Email: Geoffrey Maddox, maddoxg@rhodes.edu

(5091)
Mind Wandering in and out of the Region of Proximal Learning. JUDY XU and JANET METCALFE, *Columbia University*. — Learning has been shown to be most efficacious in the region of proximal learning (RPL), which consists of currently unlearned items which are closest to being learned. Study of these items, rather than either overlearned items or too difficult items, should elicit more curiosity, should draw one's attention, and may mitigate against mind wandering. Experiments 1 and 2 indicate that people do, in

fact, mind wander less when studying items inside their RPL. Additionally, learning was best for these items.As one learns, though, the RPL should shift toward more and more difficult items. We hypothesized that changes in the RPL would be accompanied by changes in attentional focus and mind wandering. Results from Experiment 3 support the notion that shifts in the RPL are, indeed, accompanied by changes in mind wandering.

Email: Judy Xu, jxu@psych.columbia.edu

(5092)

Memory for Lecture Content: The Effects of Lecture Format on Recall. KENNETH BARIDEAUX JR. and PHILIP PAVLIK, *University of Memphis*. — Prior research suggests that concept maps may help students integrate, retain, and transfer facts during lecture learning (e.g. Lambiotte & Dansereau, 1992; Nesbit & Adesope, 2011). Meyer, Heiser, and Lonn (2001) indicated that text presented with concurrent audio narration may overload the information-processing channel, ultimately hurting retention. This experiment investigated the effects of three types of lecture presentations on memory. Participants watched a brief video lecture where the material was visually presented to them via an animated concept map (i.e., nodes and links were sequentially added to the map), a sequential listing of bulleted text, or no visual display (i.e., the participants just listened to the lecture). The results revealed that the bulleted text lecture largely aided recall of main ideas, whereas the listen only lecture aided recall of detail ideas. Additionally, a median-split on prior knowledge revealed that the concept map lecture primarily benefited those with high prior knowledge.

Email: Philip Pavlik Jr., pavlik@memphis.edu

(5093)

Relationships Between Instructor Fluency and Teaching Evaluations in Actual Courses. DEBBIE MAGREEHAN and MICHAEL SERRA, *Texas Tech University*. — Instructor fluency refers to content-independent qualities of a teacher's presentation style (e.g., volume; body language; PowerPoint design) that affect students' subjective experience of ease during learning. Research demonstrates that instructor fluency influences students' ratings of their learning and their instructors more than their objective learning does, but these findings were typically obtained in artificial settings only experienced for brief periods of time. As such, we examined the relationship between actual students' learning ratings, teaching evaluations, and experience of instructor fluency for actual courses. Although these students had a semester's worth of content-relevant information (e.g., assignments and exams) to consult, objective measures of learning were less-related to students' ratings of the quality of their instructors, the courses, and their learning than were content-independent perceptions of instructor fluency. As such, instructor fluency is a major biasing factor of students' ratings of their learning and instructors, even in actual, semester-long courses.

Email: Debbie Magreehan, debbie.magreehan@ttu.edu

(5094)

Feedback is More Beneficial Than Computer Scaffolding for Learning. FRANCESCA FLORES and MICHAEL SERRA, *Texas Tech University* (Sponsored by Philip Marshall). — Many textbooks include software that encourages students to engage in more effective study behaviors (e.g., restudying information that was not mastered on a practice test). Such scaffolding increases learning, but we do not know whether those benefits transfer to unassisted learning situations. In this experiment, participants read a text, answered practice questions, received feedback about their performance (or not), and were then either guided by the computer to restudy paragraphs corresponding to incorrect practice-test answers (computer-controlled groups) or chose paragraphs for restudy on their own (learner-controlled groups) before taking a final test. All participants then studied a second text controlling their own restudy. Computer-controlled restudy was not better than learner-controlled restudy, nor did feedback affect learning for the first topic. Performance on the final test for the second topic, however, revealed that feedback, but not restudy experience during the first topic, had the greatest impact on learning.

Email: Francesca Flores, francesca.flores@ttu.edu

(5095)

The Effect of Self-Explanation and Testing on Reading Comprehension. GERDIEN VAN EERSEL, PETER VERKOEIJEN and REMY M.J.P. RIKERS, *Erasmus University Rotterdam*. — Generating self-explanations is a promising technique of which the effects have been shown across different materials, age groups, and criterion tasks (Dunlosky et al. 2013). However, only a small number of self-explanation studies have involved learning from text. Furthermore, a general shortcoming of the self-explanation literature is that only a few studies controlled for time-on-task, with self-explanation typically taking more time than the control activity. The present study examines the effect of self-explanation compared to retrieval practice and rereading on text comprehension, while controlling for time on task. Self-explaining is compared to both an active learning activity (retrieval practice) and a passive learning activity (rereading). The texts and questions that are used are authentic exam materials. References: Dunlosky, J., Rawson, K.A., Marsh, E.J., Nathan, M.J., & Willingham, D.T. (2013). Improving students' learning with effective learning techniques: promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14 (1), 4-58.

Email: Gerdien van Eersel, vaneersel@fsw.eur.nl

(5096)

Using Cued-Recall Tests to Potentiate Learning of Previously Tested and Untested Multimedia Material. CAROLE YUE, *Covenant College*, NICHOLAS SODERSTROM and ELIZABETH BJORK, *University of California, Los Angeles*. — Test-potentiated learning occurs when testing renders a subsequent study period more effective. We examined whether testing a subset of material from a multimedia lesson would potentiate restudy of the entire lesson. In Experiments 1a and 1b, participants studied

a multimedia lesson about star formation and then either read half the facts from the lesson or took a test on those facts. All participants then re-studied the entire lesson. On a final cued-recall test administered after 5 min (Exp 1a) or 20 min (Exp 1b), tested participants recalled an equal amount of previously untested and tested material, whereas read participants recalled less unread material than read material. Moreover, untested material was better recalled than unread material. In Experiment 2, this indirect testing benefit was extended to learning a new, unrelated multimedia lesson. Across all experiments, however, tested participants reported lower confidence in their learning than read participants. Thus, we demonstrate that taking a test on a subset of information from a multimedia lesson can aid restudy of both tested and untested material, but that learners may not appreciate such benefits.
Email: Carole Yue, carole.yue@gmail.com

(5097)

The Effect of Question Order on Predictions of Test Performance. GABRIELE BARD and YANA WEINSTEIN, *University of Massachusetts-Lowell*. — Weinstein and Roediger (2010, 2012) found that manipulating the order of questions on a general knowledge quiz resulted in differing evaluations of performance at the end of the quiz, with better performance postdicted when questions were given in an easy-hard order. In the current experiment, participants first studied all the questions along with correct answers for up to 5 minutes, and then predicted their performance on an immediate test with the same set of questions. Questions were arranged in easy-hard or hard-easy order in the study phase, and in the same order on the test. The hard-easy order produced longer study time and lower predictions of performance after study. These results support Weinstein and Roediger's findings that participants tend to anchor their impressions of a test based on the initial questions, and further suggest that students can be affected by question order not only at test, but also during study.
Email: Gabriele Bard, Gabriele_Bard@student.uml.edu

(5098)

Belief in Learning Styles Increases Miscalibration of JOLs. KEITH LYLE and JENNY D. SIMPSON, *University of Louisville*. — Belief in learning styles is common, especially the belief that some people learn visually and others verbally. Individual differences in visual/verbal learning have not been well established empirically but belief in such differences may nonetheless affect learning by influencing metacognitive judgments. For example, belief that one is a verbal learner, even if unfounded, may inflate one's perceived ability to learn verbal material. To explore this possibility, we administered a learning styles questionnaire, and then utilized a false-feedback procedure to induce different beliefs about visual/verbal style, regardless of subjects' actual scores. Subjects then performed self-paced study of verbal-only and verbal-plus-pictorial stimuli. Subjects made judgments of learning (JOLs) for each item, followed by a free recall test. The central finding was that inducing the belief that one possessed a

particular learning style increased miscalibration of JOLs by inflating confidence that one would remember items whose presentation format matched the supposed learning style.
Email: Keith Lyle, keith.lyle@louisville.edu

(5099)

Matching Learning Styles and Retrieval Activities. LUDMILA NUNES, MEGAN A. SMITH and JEFFREY KARPICKE, *Purdue University*. — Proponents of the existence of different learning styles suggest that instructional practices should be matched to students' preferences. "Visual learners" would learn best with visually-oriented instruction, while "verbal learners" would learn best with verbally-oriented instruction. But little work has investigated the relationship between individual differences and the effectiveness of retrieval-based tasks. In this study we identified students as "visual" or "verbal" learners using the SBLSQ and the VARK. All learners studied identical science content presented as diagrams (visual) or texts (verbal). Students then practiced retrieval by drawing a diagram (visual) or free recalling (verbal). One week later, performance on a short answer test was measured. Neither the matching of materials to learning style nor the matching of retrieval practice format to learning style mattered for learning. However, practicing retrieval enhanced learning in comparison to two study once baseline conditions regardless of format of materials, activity, and students' learning styles.
Email: Ludmila Nunes, nunes@purdue.edu

(5100)

Drawing Boosts Memory for Words: Specifying the Source of the Effect. JEFFREY D. WAMMES, MELISSA MEADE and MYRA FERNANDES, *University of Waterloo*. — We examined whether drawing pictures depicting study words boosted subsequent memory more than writing out the words. In Experiment 1, participants were visually presented with a list of words and asked to either draw a detailed image or repeatedly write each word on a notepad. In Experiment 2 instructions were opposite such that writing was detailed and drawing was repeated. In both, drawn words were better remembered than written. Experiment 3 extended these results to an ecologically valid lecture setting. Results show drawing is an effective encoding strategy which is far superior to writing notes. We then explored the source of the drawing effect. Experiment 4 showed drawing produced a similar benefit as a deep level of processing (LoP) and Experiment 5 showed drawing improved memory more than simple mental imagery. Together these experiments suggest drawing enhances memory because it produces a deep LoP and that enactment augments the effect.
Email: Myra Fernandes, mafernan@uwaterloo.ca

(5101)

Divergent Effects of Familiarity on Memory and Multiple Choice Test Performance. BAVANI PANEERSELVAM, ANDREW S. ROBERTS and AIMEE CALLENDER, *Auburn University*. — Two studies investigated how increasing the familiarity of information affects performance on multiple choice tests administered immediately and after a 48-hour

delay. Participants read several passages and were administered multiple choice tests. Study 1 investigated the effects of an all-of-the-above (AOTA) option on test performance using a pre-test that included correct and incorrect AOTA options and a final test without AOTA options. Results indicated correct AOTA options in pretesting facilitated selection of correct answers on the final test. Study 2 investigated how manipulating the perceptual salience of key terms within passages influences metacognitive judgments and test performance. Results revealed that, salient font (big and bold terms) significantly inflated students' judgments but did not improve test performance. Together, these findings suggest increasing familiarity can have divergent effects on memory and test performance.

Email: Aimee Callender, aac0005@auburn.edu

(5102)

Practice Makes Perfect? The Effects of Working Memory Load and Individual Differences During Math Learning. AMIRA IBRAHIM and PRITI SHAH, *University of Michigan, Ann Arbor*. — The limited capacity of working memory (WM) impacts the effectiveness of different learning strategies. Strategies that minimize WM load, such as studying worked examples, are often beneficial during math learning (Sweller et al., 1998). Although worked examples may support learning in the short term, learning activities such as problem solving that support deeper processing may better support long-term learning. Furthermore, individual differences in WM capacity, motivation, and math anxiety may interact with the effectiveness of learning strategies. In this study we consider the short and long-term effects of studying worked examples versus actively solving problems on learning a new computational procedure. We hypothesize that worked examples will positively affect performance on an immediate test but not at a one week delay. In addition, we hypothesize that worked examples will be more beneficial for individuals with high math anxiety and low WM capacity.

Email: Amira Ibrahim, ibrahiam@umich.edu

(5103)

The Update on Updating Tasks: The Effects of Working Memory and Note-Taking on Lecture Test Performance. SHAUNA BAKER and TAMIKO AZUMA, *Arizona State University*. — Previous research has yielded conflicting results regarding the relationship of working memory, note-taking and lecture test performance. In the current study, note-taking was experimentally manipulated by examining the effects of note-taking types (self-generated paper notes vs. PowerPoint handouts) on simulated lecture test performance. The effects of question type, presentation modality, and working memory on test performance were also examined. Working memory was assessed by the Operation Span task (OSPAN; Turner and Engle, 1989) and by three updating tasks in which stimuli were presented in different modalities. The results revealed that working memory test performance significantly predicted lecture test accuracy. The results suggest that note-taking methods, modality, and WM capacity all influence encoding and retrieval of lecture information.

Email: Shauna Baker, shauna.baker@asu.edu

(5104)

Instructor Fluency and the Biasing of Judgments of Instructional Effectiveness. CHRISTOPHER SANCHEZ, *Oregon State University*. — Research has demonstrated that changes in perceived perceptual fluency can have negative impacts on judgment. As instructors sometimes vary in their level of spoken English fluency, an open question is whether the presence of non-native accents similarly impacts subjective judgments of teaching effectiveness. Participants watched an instructional video about how to create a simple computer program that was either narrated by a fluent English speaker, or a fluent speaker with a non-native accent. Results indicate that while learning about the topic was equivalent across presentations, students rated both the ease of understanding the instructor and the effectiveness of the instruction as lower in the video with non-native narration. Further, these ratings also significantly predicted future attitudes towards future instruction and programming. These results suggest that the presence of a non-native accent does not impact understanding, but can have significant implications for evaluation of instruction and attitudes towards future instructional experiences.

Email: Christopher Sanchez,
christopher.sanchez@oregonstate.edu

• COLLABORATIVE MEMORY •

(5105)

The Influence of Confederate Age on the Social Contagion of Memory in Virtual and Implied Contexts. MICHELLE MEADE, KATYA NUMBERS and JAIMIE MCNABB, *Montana State University*. — We examined the impact of partner age (across virtual and implied collaborations) on the magnitude of socially suggested false memories in the social contagion of memory paradigm (Roediger, Meade, & Bergman, 2001). Young adult participants recalled household scenes in collaboration with a virtual confederate (old or young) or with an implied confederate (old or young). During collaboration, the confederate falsely suggested that incorrect items had appeared in the scenes. On subsequent individual recall and recognition tests, participants in both the virtual and implied conditions incorporated their partners' misleading suggestions into their own memory reports. However, the effect of partner age varied across conditions. Participants in the virtual condition were less likely to incorporate misleading suggestions from the older adult confederate, but participants in the implied condition were equally like to incorporate suggestions from old and young confederates. Participants discount older adult partners only when age is salient.

Email: Michelle Meade, mlmeade@montana.edu

(5106)

Individual Practice Beats Collaborative Retrieval for Learning and Retention of Key Term Definitions. KATHRYN T. WISSMAN and *KATHERINE RAWSON, *Kent State University*. — Prior research suggests that engaging in collaborative testing during practice enhances subsequent

individual memory. However, prior work involved simple verbal materials. The current experiments explored whether engaging in retrieval practice alone or with a partner leads to greater memory for more complex materials. Learners studied ten key term definitions and then engaged in retrieval practice either alone or in a dyad. All learners completed an individual final cued recall test two days later. When time on task was equated, individual retrieval practice resulted in higher final test performance, primarily because individual learners completed more practice trials within the allotted time (Experiment 1). When the number of practice trials was equated (Experiment 2), individual and collaborative retrieval practice resulted in similar final test performance but collaborative retrieval took more time. Overall, engaging in individual versus collaborative retrieval practice was more effective for learning and retention of key term definitions.
Email: Katherine Rawson, krawson1@kent.edu

(5107)

Working Together: How Collaboration Affects Retrieval of Knowledge. SARAH POCIASK, *Stony Brook University*, ELIZABETH MARSH, *Duke University*, SUPARNA RAJARAM, *Stony Brook University*. — Working in groups is common, such as when students study in groups or co-workers problem-solve together. Our question is how such collaboration affects the retrieval of knowledge. To answer this question, participants completed a series of general knowledge tests. In Experiment 1, participants completed two general knowledge tests in one of three sequences: collaboratively then individually, individually then collaboratively, or two successive individual tests. In Experiment 2, participants completed three general knowledge tests, with the first test always completed individually (as a baseline measure of knowledge), the second test either collaboratively in triads or individually, and the third test individually. Collaboration increased ability to retrieve general knowledge and decreased errors and omissions. Individuals demonstrated hypermnesia, with a small but significant improvement from the first to second test, but this effect did not approach the benefits observed as a result of collaboration.
Email: Suparna Rajaram, srajaram02@yahoo.com

(5108)

With a Little Help From My Fast Friends: How Intimacy and Divided Attention Affects Collaborative Recall. VANA WEBSTER, AMANDA JANE BARNIER and PENNY VAN BERGEN, *Macquarie University*, MICHELLE MEADE, *Montana State University*, KATYA NUMBERS, *Macquarie University*. — Groups of young adult strangers typically recall less together than the same number of individuals remembering alone, a finding called collaborative inhibition. We manipulated intimacy and cognitive need to determine if processes that benefit collaboration in older adult couples might reduce collaborative inhibition in young adult strangers. Pairs of participants studied categorized word lists and completed a task that promoted intimacy (fast friends) or did not promote intimacy (small talk). At Recall 1, participants completed a free recall test in pairs or alone, with or without a divided attention task (to manipulate cognitive need). At

Recall 2, participants completed a free recall test alone. All groups showed collaborative inhibition on Recall 1 and post collaborative benefits on Recall 2. Numerically, collaborative pairs in the fast friends and divided attention condition had lower levels of collaborative inhibition, greater recall accuracy, and greater post collaborative benefits.
Email: Vana Webster, vana.webster@students.mq.edu.au

(5109)

Preventing the Disruption: Previous Collaborative Recall Cancels Out Reconsolidation Disruption. IIONA SCULLY, *Lehigh University*, KERRI GOODWIN, *Towson University*. — Once you have consolidated a memory, it can be reactivated and brought into a labile state, this is called memory reconsolidation. Overall, the reconsolidation research paradigm has focused on disrupting the reconsolidation process when stimuli have been encoded and recalled individually. However, in real word situations, humans tend to remember information in the company of others. This process is known as collaborative recall. Using a 3-day reconsolidation paradigm, the present study examined the effects of collaborative recall on memories that were later disrupted using fear during reconsolidation. Results replicated the robust collaborative inhibition effect and showed that reconsolidation was only disrupted for nominal groups, suggesting that previous collaboration cancels out reconsolidation disruption. Theoretical explanations of these results and future directions are discussed.
Email: Iiona Scully, ids214@lehigh.edu

(5110)

The Social Transmission of Emotional Memory. HAE-YOON CHOI, *Stony Brook University*, ELIZABETH KENSINGER, *Boston College*, SUPARNA RAJARAM, *Stony Brook University*. — People frequently reminisce about emotional occurrences in social settings. Past research has shown the benefits and costs of emotional or social influences on memory but less is known about the interactive effects of these two factors. The present study examines how social interaction via collaboration would shape one's memory for emotional information, and how it would further modulate the transmission of emotional memory. Participants studied emotional (negative or positive) and nonemotional (neutral) categorized pictures with word labels. They completed three consecutive recall sessions either individually (I) or in groups of three (C), in one of three conditions: III, ICI, CCI. The results showed the memory enhancement effects of emotion in collaborative memory and post-collaborative individual memory, and that collaboration is less beneficial for memory for positive information than for negative and neutral information. Additional findings will be discussed to elaborate on group influences on emotional memory transmission.
Email: Elizabeth Kensinger, elizabeth.kensinger.1@bc.edu

(5111)

Automated Question Response During Collaborative Problem Solving in an Epistemic Game Environment. HAIYING LI, ZHIQIANG CAI and ARTHUR GRAESSER, *University of Memphis*, DAVID W. SHAFFER, *University of*

Wisconsin-Madison. — During collaborative problem solving environments in epistemic games, students asked questions when they were uncertain, confused, or seeking others' perspectives, goals, values for better problem solving. This paper investigated production rules to trigger automated responses to questions in an online epistemic game, Land Science. In the game, learners collaborated on a series of assigned tasks with the guidance of a mentor. In each game, players asked about 300 questions. As the mentor handles these questions from different players in different groups, the instant automated response could not only release the mentor's burdens, but also promote learning. Conditions for production rules included question categories and speech act categories to detect questions, and latent semantic space analysis, five-SKIVE categories such as epistemology, values, skill, identity and domain knowledge, and regular expressions to match the content of the questions. An AutoSuggestor tool was developed to evaluate and improve the performance of the systems.

Email: Haiying Li, haiyinglit@gmail.com

• COGNITIVE CONTROL OF WORKING MEMORY •

(5112)

Individuals With High Working Memory Capacity Are Less Susceptible to Mind-Wandering: Evidence From Cross-Modal Oddball Tasks. ANATOLE NÖSTL, *University of Gävle, Sweden*. — Mind-wandering is a common phenomena and is likely to happen when people perform some routine task where the consequences thereof are of little to no importance. However, when mind-wandering occurs during an effortful task, such as an attention heavy task, it can have dire consequences and may result in poor performance. Working memory capacity holds some predictive value for executive functions and a vast amount of studies show that individuals with high working memory are more resilient to external distraction than their low-capacity counterparts. By analyzing the correlation between WMC and the standard deviations during three different cross-modal oddball experiments, the current study shows that individuals with low WMC display higher variation in their response times than individuals with high WMC. As all external stimulus is held constant during the task the found difference in variation may be interpreted as susceptibility to mind-wandering. That is, WMC does not only predict resilience towards external stimuli but also towards internal stimuli. Interestingly however, this link is only apparent when the standard sound is held constant as opposed to changing with each occurrence.

Email: Anatole Nöstl, anenol@hig.se

(5113)

Working Memory Capacity and Cognitive Control: A Test of the Load Specific Interference Effect. MATTHEW HITCHINS, RACHEL M. WYNN and MYEONG-HO SOHN, *The George Washington University*. — Load theory predicts that concurrent working memory load impairs selective attention and increases distractor interference. The specialized load account predicts that when concurrent working memory load type shares processing with distractors, interference decreases. However, the question remains if this load specific interference effect (LSI) is modulated by working memory capacity (WMC). To test this, we used a version of a Stroop paradigm with a verbal target and spatial distractor. In experiment a) there was a verbal working memory load. In experiment b) there was a spatial working memory load. WMC was measured with 3 span tasks. Results showed LSI and that it was modulated by WMC. People with low WMC showed less of a decrease in interference when load type matched distractors and greater interference when load type matched the target. The results indicate that WM and cognitive control are highly inter-related cognitive processes.

Email: Myeong-Ho Sohn, mhsohn@gmail.com

(5114)

Cognitive Control Aids in Conflict Resolution During a False Belief Task. RACHEL WYNN, MATTHEW HITCHINS and MYEONG-HO SOHN, *The George Washington University*. — We tested for a role of cognitive control in the successful completion of false belief (FB) trials. During FB tasks, participants are given two pieces of information: the location of an object and where a protagonist thinks that object is located. During FB trials, these two pieces of information conflict. FB trials are slower than true belief trials and we hypothesized that this effect is the result of cognitive control mechanisms working to resolve the conflict. We tested for sequential and proportional modulations of the FB effect as these effects are well established in the cognitive control literature. We did not find sequential modulations but did find the traditional proportional modulations. When the majority of trials were FB, the difference between true belief and FB trials was significantly smaller than when the majority of trials were true belief. We concluded that the sequential modulations may be too transient to detect in the FB paradigm but that the presence proportional modulations supports our hypothesis that the FB effect is the result of cognitive control processes.

Email: Rachel Wynn, rwynn@gwmail.gwu.edu

(5115)

The Influence of Working Memory Capacity in Resolving the Control Dilemma. ELEONORA D. VACCARIELLO, CHAD C. MOFFITT, JASON M. WATSON, A. EVE MILLER and DAVID L. STRAYER, *University of Utah*, KEITH A. HUTCHISON, *Montana State University*. — Relinquishing attentional control in favor of automatic responding is a solution to the control dilemma. In the current experiments we used a high proportion of prosaccade trials (75% prosaccade and 25% antisaccade). In Experiment 1, we had long (1000, 2000, and 3000 ms) fixation delays and argued that high-spans would voluntarily give up control under such conditions, due to longer delays providing time to consider the benefits of automatic processing. As expected, high-spans did not significantly differ from low-spans in antisaccade accuracy. In Experiment 2, we shortened the fixation delays

(250, 500, and 1000 ms) and hypothesized that short delays would implicitly trigger the exertion of control in high-spans. Short delays involve fast transitions, and thus should not allow enough time to consider benefits of relinquishing control. As expected, high-spans significantly outperformed low-spans. Results are interpreted in terms of the control dilemma and flexible transitions of control in high-spans.
Email: Jason Watson, jason.watson@psych.utah.edu

(5116)
Windows to Cognitive Control: A Novel Method for Quantifying Control Strategies. BART ABEN, *Vrije Universiteit Brussel*, TOM VERGUTS, *Ghent University*, EVA VAN DEN BUSSCHE, *Vrije Universiteit Brussel* (Sponsored by Eric Soetens). — Cognitive control can be exerted on-the-fly (reactive control; e.g. trial-by-trial adaptation), or in more sustained ways, for example by tracking the amount of previously encountered conflict (proactive control; e.g. list-wide control). However, it is not clear whether this dichotomy reflects a cognitive reality or instead is useful for methodological reasons only. Inspired by reinforcement learning models, we have used non-linear regression analysis to compute the effects of conflict from previous trials on performance on the current trial. In this way, we can quantify a continuous window in which cognitive control operates and thus generalize the dichotomy between reactive and proactive control. In particular, a small window (i.e., performance on the current trial is mainly affected by experienced conflict on the preceding trial) indicates reactive control. A large window (i.e., performance on the current trial is also affected by trials from a more distant past) is indicative of proactive control. This method offers promising opportunities to study the contexts and other parameters that affect cognitive control strategy. The method is illustrated on a number of data sets from cognitive control research.
Email: Bart Aben, bart.aben@vub.ac.be

(5117)
Using Pupillometry and Thought Probes to Measure Attentional Preparation Versus Mind Wandering as a Function of Task Expectancy, Delay, and Working Memory Capacity. KATHERINE HART, CHAD C. MOFFITT and JASON WATSON, *University of Utah*, FRANK MARCHAK, *Veridical Research and Design*, KEITH HUTCHISON, *Montana State University*. — Participants were randomly cued whether to execute a prosaccade or an antisaccade response to an upcoming stimulus. Pupil diameter was measured to index mental effort during the cue-stimulus intervals, which randomly varied between 500-8000 ms. Participants' pupil diameter remained constant throughout the delay when expecting to execute an antisaccade, but decreased when expecting a prosaccade. This pattern was exaggerated among high WMC individuals. Pupil diameter was also larger on trials in which participants reported being "on task" than when they reported mind wandering. In contrast, participants' self-reported mind wandering depended upon whether thought probes occurred immediately after their response to the pro/antisaccade stimulus or instead occurred in lieu of the stimulus. In the latter case, self-reported mind

wandering corresponded more closely to pupil diameter in demonstrating greater off-task behavior when participants expected to perform the easier prosaccade task. Results demonstrate that individuals regulate mind wandering based on expected task difficulty.
Email: Katherine Hart, kthart05@gmail.com

(5118)
Cognitive Control Deficits in Adults with ADHD. ALEXANDRA HALL-RUIZ and JOHN JONIDES, *University of Michigan*. — Attention-deficit/hyperactivity disorder (ADHD) is a common neurobehavioral disorder that originates in childhood and can persist into adulthood. Individuals with ADHD tend to exhibit performance deficits related to attention and executive control processes, including difficulties sustaining attention and resolving interference. Yet, individuals with ADHD do not show consistent impairment across tasks, and the impairments that characterize adults with ADHD are not well known. Our first aim is to identify at which stage of processing cognitive control deficits occur: at perception (requiring subjects to ignore a subset of upcoming information), in working memory (requiring subjects to forget a subset of already encoded items), and/or at response (requiring subjects to withhold a pre-potent response). Our second aim is to explore whether individual characteristics, such as medication status and symptom severity, affect task performance. This research will allow us to develop targeted cognitive control interventions to help mitigate the negative outcomes related to ADHD.
Email: Alexandra Hall-Ruiz, alexandra.hall.ruiz@gmail.com

(5119)
Mindfulness and Individual Differences in Working Memory, Creativity, Insight and Attention. KERRI GOODWIN and JACQUELYN PALMER, *Towson University*. — Mindfulness is defined as an awareness of the present moment, acceptance toward new experiences, and self-regulation of attention. Past research indicates that mindfulness training allows individuals to self-regulate their attention more efficiently during sustained attention and reading tasks (Mrazek et al., 2012; Ruocco & Direkoglu, 2013). Mindfulness training has also been shown to improve performance on working memory, creativity, and insight tasks (Mrazek et al., 2013; Greenberg et al., 2011; Ostafin & Kassman, 2012). The current study examined relationships between trait mindfulness and individual differences in working memory, creativity, insight and attention. Results from the current study indicate a significant relationship between working memory and facets of trait mindfulness including observation of and non-reactivity to inner experiences. Creativity and insight problem solving was not shown to be related to trait mindfulness. Theoretical implications of trait versus state mindfulness as related to individual differences in creativity and insight are discussed.
Email: Kerri Goodwin, kgoodwin@towson.edu

(5120)

It's All Part of the Plan: An fMRI Investigation of the Task Span Procedure. STARLA WEAVER, *Kessler Foundation Research Center*, CATHERINE ARRINGTON and KAITLIN M. REIMAN, *Lehigh University*, GLENN R. WYLIE, *Kessler Foundation.* — The current study assessed the neural architecture that underlies the implementation of plans. Participants completed the task span paradigm while undergoing fMRI. First cues were presented one at a time and participants memorized the cue sequence. Then a series of bivalent stimuli were presented and participants performed the task associated with the cue presented in the corresponding sequence position during the study phase. Brain activation in this task span condition was compared to that in a memory span condition in which participants memorized the task cues for recall (but not performance). Encoding cues in order to facilitate later plan performance (rather than for simple recall) led to large increases in brain activation in the frontal-parietal network including the superior and middle frontal gyri and the superior parietal lobe. The results suggest that how information is encoded is influenced by the intended use of that information.
Email: Starla M. Weaver, sweaver@kesslerfoundation.org

(5121)

Impact of Working Memory Capacity on Temporal Order Memory Retrieval. ILKE ÖZTEKIN and EDA MIZRAK, *Koç University*. — The speed–accuracy trade- off (SAT) procedure was used to investigate the relationship between working memory capacity (WMC) and the dynamics of temporal order memory retrieval. High- and low-span participants (HSs, LSs) studied sequentially presented five-item lists, followed by two probes from the study list. Participants indicated the more recent probe. Overall, accuracy was higher for HSs compared to LSs. Crucially, in contrast to previous investigations that observed no impact of WMC on speed of access to item information in memory (e.g. Öztekin & McElree, 2010), recovery of temporal order memory was slower for LSs. While accessing an item's representation in memory can be direct, recovery of relational information such as temporal order information requires a more controlled serial memory search. Collectively, these data indicate that WMC effects are particularly prominent during high demands of cognitive control, such as serial search operations necessary to access temporal order information from memory.
Email: Ilke Öztekin, ilke.oztekin@nyu.edu

(5122)

Declarative and Procedural Working Memory and the Voluntary Task Span. KAITLIN REIMAN and CATHERINE ARRINGTON, *Lehigh University*. — Logan (2004) found little difference between a task span, where subjects memorize a sequence of task cues then perform these tasks on subsequent stimuli, and traditional memory span. Recent work with a voluntary task span procedure (Reiman, Weaver, & Arrington, 2014) suggests that the two tasks may tap into different underlying memory and control processes. The current work explores this difference within the context of Oberauer's (2009) model of working memory, which distinguishes between

declarative (DWM) and procedural (PWM) systems. Logically, while both the task and memory span require DWM, the task span additionally requires PWM. Empirical evidence for this assumption is provided by manipulating WM load. Loading PWM altered pattern of RTs for the memory span, specifically yielding equivalent performance between the memory span with load and task span without load. Loading DWM yielded more biased task choice (simpler sequences) in the memory span but did not influence task span choice, supporting the distinction between these two memory subsystems. Task and memory span methodology appears useful for testing Oberauer's model, given the equivalent task environments with identical DWM and varying PWM demands.
Email: Kaitlin Reiman, kmr210@lehigh.edu

• DISCOURSE PROCESSES II •

(5123)

Causal Markers Influence Evaluation of Provided and Self-Produced Explanations. KATJA WIEMER, JANE NEAL, LILLIAN K. ASIALA, JUAN TAPIA and ARTURO ZAMORANO, *Northern Illinois University*. — In previous work we demonstrated a robust effect of causal connectives on perceived quality of explanations in text (Wiemer & Asiala, 2013). In this study, we tested the effect of students' use of causal markers in self-produced written explanations on their evaluation of these explanations. Participants wrote answers to 18 why-questions in the science domain, selected to be difficult but likely to elicit a commonsense theory to encourage productions of explanations. Participants used causal markers in 38% of their answers. Subsequently, they evaluated their own explanations on a quality-scale and decided whether their answer qualified as an explanation. Results are consistent with our previous findings: answers containing causal markers were rated significantly higher, and were more likely accepted as explanation. This effect holds up after controlling for answer quality, which was established in a blind coding procedure. We discuss implications for scientific reasoning in the context of explanations.
Email: Katja Wiemer, katja@niu.edu

(5124)

Does the Closeness-Communication Bias Extend to Group Membership? MIJA VAN DER WEGE, CARL BOU MANSOUR, LOREN CHERRY, CLAIRE COCROFT, ALEX CREWS, GUSTAV DANIELSSON, JESSI JACOBSEN, NICOLE MAGATS, SCARLET PARK and SOPHIA ROMAN, *Carleton College,* NORA SERRES, *St. Olaf College.* — People overestimate how much others understand them (Keysar & Henley, 2002), and overestimate more with friends and spouses (Savitsky, Keysar, Epley, Carter, & Swanson, 2010). This closeness-communication bias could be due to speakers remembering and relying on specific common ground shared with their interlocutors or to speakers assuming common ground based on heuristic information, such as category or community membership. Speakers could be classifying friends and partners as close to the self, rendering their

assessments more egocentric; other in-groups could show similar self-anchoring characteristics (Van Veelen, Otten, & Hansen, 2011). In three studies, we first replicate the Savitsky findings that speakers and addressees overestimate how much their friends understand them, and then test whether speakers and addressees make assumptions about common ground based on community membership, even when the community membership doesn't impact the current conversational task. Email: Mija Van Der Wege, mvanderw@carleton.edu

(5125)

The Impact of Connectives on Causal Integration Across Speakers. KEITH MILLIS, DAVID BOVERI, LILLIAN ASIALA and KATJA WIEMER, *Northern Illinois University*. — Connectives are cues to integrate ideas in discourse. We examined the role of the connective "because" on integrating causally-related expository information. Participants read transcripts of two teachers discussing Life Science topics (e.g., "tree frogs"). In three experiments, we manipulated whether the statements were conjoined by the connective because or stood alone as separate sentences. Later, we measured causal integration with a sentence verification task. In addition, we manipulated whether the two statements were spoken by the same or different teachers. Although switching speakers did not matter, we found the connective increased integration when the participants were not asked to remember "who said what" or when they scored high on vocabulary knowledge. When the connective started a sentence (e.g., "This is because…"), it resulted in less integration than when it linked the two statements within the same sentence. The results suggest that integration imposed by a connective depends on available resources. Email: Keith Millis, kmillis@niu.edu

(5126)

Community Commonality Improves Overhearer Comprehension. JACKSON TOLINS, CHARLOTTE ZEAMER and JEAN FOX TREE, *University of California, Santa Cruz*. — What causes overhearers to more easily comprehend referring expressions produced in dialogues rather than monologues? Three experiments tested two contrasting views. One is that the collaborative process of entrainment leads dyads to better conceptual perspectives. The other is that more common perspectives are better than less common perspectives regardless of entrainment. We observed that the number of people who entrained on a particular perspective was similar across dialogues and monologues (Experiment 1). We also found that those perspectives that represented a common description in that community were better understood by overhearers than uncommon descriptions, both in dialogues (Experiment 2) and monologues (Experiment 3). We conclude that it is not entrained perspectives that are better, but perspectives that capitalize on community commonality. Email: Jean E. Fox Tree, foxtree@ucsc.edu

(5127)

Insights Into Inferencing: Quantifying Thinking. CONNIE SHEARS, ADRIANA ARIZA, JAY KIM, MELISSA BOND, MAISY LAM and ERIKA SAM, *Chapman University*. — The assumption that measuring key-press accuracy and response-times captures the mental activities of participants during experimental tasks avoids dealing with what activities preceded their response. Most researchers agree that at resting state there is a constant flow of self-generated thought. Callard et al. (2012) suggest cognitive scientist's need to employ introspective methods, such as free association or mind wandering, in order to gain insight into what's occurring in self-generated mental activity. The problem with these methods, which drove psychological science away from employing these, is how do we quantify what is essentially thinking out loud? We compared participant's verbal responses to three levels of questions. Vocal response onset, duration of answers and accuracy, indicated a significant difference in responses to the three levels of comprehension questions. Thus, one way to quantify thinking using non-key press methods, is by measuring response onset, response duration, and accuracy across varying depths of questions. Email: Connie Shears, shears@chapman.edu

(5128)

Context and the Interpretation of Irony. JAMES BOYLAN and ALBERT KATZ, *University of Western Ontario*. — A handful of papers suggest that ironic verbal criticisms might make the discourse context in which the criticism is embedded appear more negative, relative to a non-ironic counterpart. Here we test that notion directly, employing a necessary baseline condition and a wider range of dependent measures. Participants were explicitly asked to rate short vignettes containing direct criticism, ironic criticism or a baseline in which there was no criticism. Relative to the no-criticism baseline the presence of direct criticism led to vignettes rated as less friendly, more aggressive, and more negative. Ironic vignettes were rated as more playful, humorous, and sarcastic than found with either direct criticism or baseline vignettes, but were not significantly different from the no-criticism ratings of friendliness, aggressiveness, and negativity. We take these findings as strong support for a face-saving function to irony. Email: Albert Katz, katz@uwo.ca

(5129)

A Change in Focus: How Readers Process Natural Language Quantifiers. SRI SIDDHI UPADHYAY and CELIA KLIN, *Binghamton University, SUNY*. — Natural language quantifiers (NLQs), such as "few," powerfully affect readers' focus. For example, different sets are in focus after reading "a few of the fans were at the match" (the fans at the match) than after reading "few of the fans were at the match" (the fans not at the match). According to the Presupposition Denial Account (Moxey, 2006), negative NLQs, such as "few" create a focus on the complement set (the fans not at the match) when readers comprehend the NLQ as a denial of a prior expectation, meaning fewer fans attended than was expected. Support for this hypothesis has been found primarily with

brief sentence materials, and when readers' expectations were explicit or character-based. However, readers must routinely infer expectations from discourse (e.g. novels). Three experiments are presented that extended these findings with more naturalistic materials, in which readers' expectations came from story context containing the NLQ "few."
Email: Sri Siddhi Upadhyay, supadhy1@binghamton.edu

(5130)

The Effects of Cooperation and Relationship Status on Alignment in Conversation. DAVID KOVAZ, *University of Memphis*, MONICA RIORDAN and LAUREN TRICHTINGER, *Chatham University*, ROGER KREUZ, *University of Memphis*. — Previous research suggests that various forms of structural alignment occur between participants in computer-mediated communication (Riordan, Markman, & Stewart, 2013). The present study aims to determine how conversational tone and the relationship between participants may affect alignment in instant messaging. We analyzed alignment in the length and duration of turns in a corpus of instant messaging conversations collected in prior studies (discussions included topics such as vaccinations, food preferences, cell phone use while driving, and open-ended discussion). These conversations differed in terms of tone (i.e., cooperative versus conflicting) and the relationship between the participants (i.e., strangers versus friends). Main effects show that alignment in both length and duration increased over time and was greater for cooperative tone. Interactions reveal that friends aligned more than strangers in cooperative conversations. These results suggest that there may be a variety of interacting factors that affect the development of alignment during instant messaging.
Email: David Kovaz, dmkovaz@memphis.edu

(5131)

How Do Listeners Encode Spatial Perspectives? RACHEL RYSKIN, RANXIAO WANG and SARAH BROWN-SCHMIDT, *University of Illinois at Urbana-Champaign*. — Little is known about how listeners represent another person's spatial perspective during language processing (e.g., two people looking at a map from different angles). Can listeners use contextual cues such as speaker identity to build a representation of the interlocutor's spatial perspective over time or do they compute it anew whenever interpreting spatial language? In an eye-tracking experiment, participants received auditory instructions to move objects around a screen from two perspectives (45° v. 315° or 135° v. 225° from their own viewpoint) that alternated randomly. Instructions were spoken either by 1 voice, where the speaker's perspective switched at random, or by 2 voices, where each speaker maintained one perspective. Eye-gaze analyses showed that interpretation of the instructions improved when each viewpoint was associated with a different voice. Thus, distinctive speaker-viewpoint mappings allowed listeners

to store and use spatial perspective information on-line to constrain sentence interpretation. A replication experiment is under way.
Email: Rachel Ryskin, ryskin2@illinois.edu

• SPEECH PERCEPTION •

(5132)

The Mental Lexicon — Strictly or Leniently Lexical? DORINA STRORI, *University of York*, ODETTE SCHARENBORG, *Radboud University*, SVEN MATTYS, *University of York*. — Previous research indicates that lexical representations might include both linguistic and indexical specifications. Recent evidence suggests that non-linguistic sounds co-occurring with spoken words are also incorporated in our lexical memory. We argue that this sound-specificity effect might not be due so much to a word-sound association as to the different acoustic glimpses of the words that the associated sounds create. In several recognition-memory experiments, we paired spoken words with one of two car honk sounds and varied the level of energetic masking from exposure to test. We did not observe a drop in recognition accuracy for previously heard words when the paired sound changed as long as energetic masking was controlled. However, when we manipulated the temporal overlap between words and honking to create an energetic masking contrast, accuracy dropped. The finding suggests that calling for an expansion of the mental lexicon to include non-speech auditory information might be premature.
Email: Sven Mattys, sven.mattys@york.ac.uk

(5133)

Perception of Locally Time-Reversed Words and Pseudowords. MAKO ISHIDA, *Sophia University, Stony Brook University*, ARTHUR SAMUEL, *Stony Brook University and the Basque Center on Cognition, Brain, and Language*, TAKAYUKI ARAI, *Sophia University* (Sponsored by Richard Gerrig). — We investigated the perception of locally time-reversed words and matched pseudowords. In local time-reversal, every N msec of speech is flipped along the time axis. For example, for N=50, the first 50 msec are reversed, then the next 50 msec are reversed, etc. Participants listened to 3-, 4-, or 5-syllable words and pseudowords that were locally time-reversed. Half of the items had many stop consonants (e.g., "propaganda"), and thus many loci of rapid spectral change; half had very few or no stops (e.g., "revelation"). The time-reversal was applied using segments of 10, 30, 50, 70, 90, or 110 msec. Consistent with prior work, the intelligibility of speech deteriorated dramatically across this range of segment size. Critically, the drop in performance was significantly steeper for stimuli that had many stops, and real words were more intelligible than matched pseudowords when locally time-reversed.
Email: Mako Ishida, makomako1228@gmail.com

(5134)

Cognitive Resources Needed in the Recalibration of Phonetic Category Boundaries. ELINA KAPLAN and ALEXANDRA JESSE, *University of Massachusetts, Amherst.* — Seeing a speaker can alter the stored boundaries of phonetic categories (Bertelson, Vroomen, & De Gelder, 2003). In this study, we determined whether visually-guided phonetic recalibration depends on cognitive resources. During exposure, listeners heard an ambiguous sound between /p/ and /t/, accompanied by seeing a speaker produce /p/ or /t/. In some exposure blocks, participants were also asked to detect a target object in a rapid serial visual presentation of complex objects, placed on the speaker's forehead. As expected, at test participants subsequently categorized more steps of an auditory /p/-/t/ continuum in line with their exposure. Critically, phonetic recalibration was reduced when participants had been also engaged in the visual task during exposure. Phonetic recalibration is thus a higher-level process that requires cognitive resources. Attention and working memory may be important for the processing of audiovisual speech information, or in the storage and maintenance of phonetic categories.
Email: Elina Kaplan, elina@cns.umass.edu

(5135)

Native and Non-Native Sentence Comprehension in the Presence of a Competing Talker. HUARDA VALDES-LARIBI, *The University of York*, DOROTHEA WENDT and EWEN N. MACDONALD, *Technical University of Denmark*, MARTIN COOKE, *University of the Basque Country*, SVEN MATTYS, *University of York*. — A competing talker can mask target speech through energetic masking (acoustic degradation) and informational masking (cognitive aspects of masking). We hypothesized that informational masking depletes processing resources that would otherwise be allocated to recognizing and understanding the target speech. Using a speeded picture selection task, we investigated native and non-native listeners' understanding of English sentences varying in syntactic complexity, played against a competing talker vs. an energetic mask. Non-native listeners were slower than native listeners, and both groups were slower at responding to more syntactically complex sentences. However, the results were not affected by mask type. Thus, contrary to research by other groups, we found no evidence that a competing talker requires greater processing resources than energetic masking alone. An ongoing eye-tracking version of this experiment will establish the nature of the discrepancy and the psycholinguistic mechanisms behind informational masking.
Email: Huarda Valdes-Laribi, huarda.valdes-laribi@york.ac.uk

(5136)

Phonological and Semantic Activation and Lexical Competition in Spoken Word Recognition. XUJIN ZHANG, *Stony Brook University, SUNY*, ARTHUR SAMUEL, *Stony Brook University and the Basque Center on Cognition, Brain, and Language.* — Current models of spoken word recognition suggest that multiple lexical candidates are activated in parallel upon hearing an utterance, with these lexical hypotheses competing with each other for recognition. The current study investigated this multiple lexical activation and competition at different processing levels, as a function of the goodness-of-fit between the speech signal and lexical representations and the lexical status of the input. In a set of auditory-auditory priming studies, participants listened to pairs of stimuli in which the primes were either nonwords or real words, and varied in degree of match to the word targets. Listeners performed either a rhyme task or a semantic association task on a visual stimulus presented with each target. The results across experiments and tasks provide insights into how match and mismatch between the speech signal and lexical representations affect lexical activation and competition at both the phonological and semantic levels.
Email: Xujin Zhang, xujin.zhang@stonybrook.edu

(5137)

The Role of Corticostriatal Learning Systems in Speech Categorization. HAN-GYOL YI, W. TODD MADDOX, JEANETTE MUMFORD and BHARATH CHANDRASEKARAN, *University of Texas.* — In this fMRI study, we investigated neural and computational mechanisms underlying feedback-dependent speech category learning in adults. Successful learning was contingent upon the activity of domain-general category learning systems: the fast-learning reflective system, involving dorsolateral prefrontal cortex (DLPFC) that develops and tests explicit rules based on the feedback content, and the slow-learning reflexive system, involving the putamen that implicitly associates stimuli with category responses based on the reward value in feedback. In particular, early learning was associated with DLPFC activity, while later learning was associated with putamen activity. Computational modeling of response strategies constrained by the neurobiology of the two category learning systems revealed greater use of reflexive strategies later in learning, which was associated with increased activity in the putamen. Our results demonstrate differential involvement of the corticostriatal learning systems as a function of response strategy and proficiency during speech categorization.
Email: W. Todd Maddox, maddox@psy.utexas.edu

(5138)

Training Improves Detection of Speech Alignment. THERESA COOK, JAMES W. DIAS and LAWRENCE D. ROSENBLUM, *University of California, Riverside* (Sponsored by Christine Chiarello). — People unconsciously imitate the speech and gestures of conversational partners (Chartrand & Bargh, 1999). Observers can detect this subtle mimicry when it takes the form of speech alignment (Goldinger, 1998) – perhaps gleaning information about social alliances and rapport. Can observers learn to better detect such alignment? We recorded two actors saying various words. We then recorded eight "shadowers" (four per actor) listening to the words and saying the word aloud after the actor. In each experimental trial, naïve raters listened to one actor and two shadowers – one who had shadowed that actor and the other who had shadowed the other actor – say these words. Raters judged which shadower sounded most like the actor, receiving feedback about accuracy. We found raters could detect speech

alignment, detection improved over time, and improvement transferred to new shadowers. Results suggest observers can quickly improve detection of automatic imitation, possibly offering meaningful advantages in social interactions.
Email: Theresa Cook, pencilproductions@yahoo.com

(5139)

Continued False Hearing by Older Adults: Resistance to Alter the Bases of Responding. JOHN MORTON, LARRY JACOBY and MITCHELL SOMMERS, *Washington University*. — Age groups were tested on word identification for sentence-final target words. The final (target) item was presented with the prior predictive/non-predictive semantic context presented in the clear. In one condition, target words were congruent with the preceding context. The baseline condition contained no semantic context and the incongruent condition presented a semantically acceptable phonological competitor of the congruent trial. Older adults are more susceptible to falsely hearing the contextually congruent target word on incongruent trials than younger adults. The greater reliance on contextual information by older compared to younger adults can be viewed as an inflexibility to adjust response techniques (sensory or context based). Experiments were conducted to see if this inflexibility would remain when a high priority on correct responding is implemented or when given the opportunity to ask for a repetition. Results showed that older adults were not differentially better than younger adults at improving accuracy when a high priority was placed on trials. Furthermore, older adults did not benefit as much as did younger adults when given the opportunity to replay an utterance.
Email: John Morton, jrmhvc333@gmail.com

(5140)

Gradient Perception of Within-Category Vowel Nasality. GEORGIA ZELLOU, *University of California at Davis*, DELPHINE DAHAN, *University of Pennsylvania*. — Participants heard a sentence while viewing four pictured objects on a computer screen and clicked on the mentioned object. Sentences consisted of pairs, e.g. he {bet his money/bent his knee}. One of three versions of the critical word ('bet') was heard: one unequivocally perceived as 'bet', one also always perceived as 'bet' but acoustically closer to 'bent', and one ambiguous between 'bet' and 'bent'. The speed with which participants moved their gaze toward the referred object, money, differed across versions. Compared to the unequivocal 'bet', listeners were slower after hearing the ambiguous 'bet'. Critically, they were also delayed after hearing the 'bet' that was closer to 'bent', compared to the unequivocal 'bet', despite hearing both versions as 'bet'. Thus, people hold onto noncontrastive phonetic differences past the end of a word and while interpreting subsequent words, in effect maintaining uncertainty regarding its identity while gathering more information.
Email: Delphine Dahan, dahan@psych.upenn.edu

(5141)

Semantic and Phonological Interference in Talker Discrimination. CHANDAN NARAYAN, LORINDA MAK and ELLEN BIALYSTOK, *York University*. — The ability to discriminate individuals from their vocalizations has been found in numerous species. In humans, this ability is complicated by language, which has voice as its primary medium. We describe an effect whereby listeners' discrimination of talkers is affected by linguistic content. Listeners (n=68) heard two voices (all combinations of two males and two females with a 500ms ISI) each saying a different English word and asked whether the talkers were the same or different person. The stimuli belonged to one of four word-pair conditions: lexical compound (day-dream), rhyme (day-bay), reversed compound (dream-day), or unrelated. There was a significant main effect of word pair and its interaction with speaker voices. Comparisons of accuracy according to each word pair and speaker voice type suggest that the lexical and phonological status of words both interferes with and facilitates talker discrimination. When listeners are presented with two instances of the same voice, they expect the semantic and phonological content of their words to be related. When different voices are presented, lexical and phonological processing interferes with talker discrimination in a top-down fashion.
Email: Chandan Narayan, chandann@gmail.com

(5142)

Vocal Alignment Toward Accented Speech. EVA M. LEWANDOWSKI and LYNNE NYGAARD, *Emory University*. — Vocal alignment is the tendency to change one's speech productions to more closely match those of another individual. Both social-motivational goals and basic perceptual-motor couplings have been proposed to underlie this tendency. The present study exploited the social and perceptual characteristics of Spanish-accented English to assess the interplay between these potential mechanisms of vocal alignment. Participants heard isolated English words spoken by four talkers (2 American English, 2 Spanish) and were asked to repeat each word in a shadowing task, thereby minimizing social context. Degree of vocal alignment was assessed by listener judgments of shadowed productions. The results indicated that participants aligned to both native English and Spanish-accented productions. However, alignment was greater to Spanish-accented than to native English speakers. These results suggest that when social interaction is minimized, vocal alignment may result primarily from the relationship between perception and production and serve to facilitate action understanding.
Email: Lynne Nygaard, lnygaar@emory.edu

(5143)

Grammatical Context Restricts Lexical Activation in Early Stages of Spoken Word Recognition. JULIA STRAND, ANDREA M. SIMENSTAD, JEFFREY J. BERG and JOSEPH A. SLOTE, *Carleton College*. — Models of spoken word recognition propose that multiple lexical candidates are activated in parallel as listeners perceive spoken words, and these candidates then compete for recognition. In contrast

to strictly bottom-up accounts of lexical activation, the preceding grammatical context of the sentence may influence which lexical representations are activated (Strand, Simenstad, Cooperman, & Rowe, 2014; Magnuson, Tanenhaus, & Aslin, 2008). The current study used the Visual World Paradigm (VWP) to evaluate the time-course of grammatical context effects in spoken word recognition. Participants received auditory instructions about which image in the VWP to click while their eye movements were tracked. Instructions were given in both a grammatically constrained context (e.g., "click on the . . .") and an unconstrained context (e.g. "click . . ."). The results indicated that the constrained context restricted activation to competitors that were of the same grammatical class as the target word, suggesting that grammatical class is integrated early in the time-course of auditory word recognition.

Email: Julia Strand, jstrand@carleton.edu

(5144)

Delayed Integration of Acoustic Cues in Spoken Word Recognition. BOB MCMURRAY and MARCUS E. GALLE, *University of Iowa*. — Spoken word recognition requires listeners to integrate multiple—often asynchronous—acoustic cues during a very short period of time. Without exception, previous work has demonstrated that listeners use acoustic cues as soon as they are available to activate lexical candidates (McMurray, Clayards, Aslin & Tanenhaus, 2008; Reinisch & Sjerps, 2013). We sought to extend these findings to a new speech contrast (/s/-/sh/) in which relevant contextual information (vowel rounding) was only available after the primary cue (fricative spectra). A visual world paradigm experiment found that quite unexpectedly, listeners do not utilize cues in the frication as soon as they arrive, but instead wait to activate lexical candidates until the onset of the vowel (200 msec). This was replicated in three experiments controlling for task or stimulus factors. The unique acoustic properties of fricatives may underly this effect suggesting the role of general auditory streaming mechanisms in speech perception. This also challenges the idea word recognition always proceeds from the earliest moments of the signal.

Email: Bob McMurray, bob-mcmurray@uiowa.edu

(5145)

Listeners Differ in Whether They Perceive Speech Gradiently or Categorically: Consequences for Cue Integration. EFFIE KAPNOULA, *University of Iowa*, MATTHEW WINN, *University of Wisconsin*, EUNJONG KONG, *Korea Aerospace University*, JAN EDWARDS, *University of Wisconsin-Madison*, BOB MCMURRAY, *University of Iowa*. — Listeners use acoustic cues to identify speech sounds (phonemes), but there has been substantial debate about whether this mapping is gradient—preserving fine-grained within-category detail—or discrete. Recent research, however, suggests that there may be individual differences in the degree of gradiency across individuals (Kong & Edwards, 2011). We asked whether these differences are related to executive function and to other aspects of speech perception. The gradiency of listeners' phonetic categories was assessed with a visual analogue scaling (VAS)

task (Massaro & Cohen, 1983; Kong & Edwards, 2011). We also estimated listeners' use of multiple cues using a 2AFC phonetic categorization task in which two cues varied (VOT and F0). Listeners varied substantially in gradiency, and more gradient participants tended to use both cues, while categorical listeners relied mostly on the primary cue (see also Kong & Edwards, 2011). Neither effect was strongly related to executive function suggesting a perceptual, rather than general cognitive locus, to these individual differences.

Email: Jan Edwards, jedwards2@wisc.edu

(5146)

Perception of Emotion in Speech. JORDAN WYATT and ZEHRA PEYNIRCIOGLU, *American University*. — Tempo affects perception of emotion in speech. Slow rates convey sad and fast rates convey happy emotions (e.g., Banse & Scherer, 1996). However, to date, such research has generally focused only on prosody and ignored semantic content. Further, in a separate line of research with semantic content, fast rates have been shown to result in loss of comprehension (e.g., Foulke & Sticht, 1967). In the present two experiments, participants listened to monotone speech excerpts of happy, sad, or neutral content, which were presented at slow, normal, and fast rates. The results showed that the effects of tempo interacted with semantic content in emotion judgments. Sad excerpts were deemed less sad at fast tempos but more sad only at the exaggerated slow tempo. Neutral excerpts were not affected by tempo changes. Finally, happy excerpts were not affected by tempo changes either, except at the fastest tempo, where they were deemed less happy.

Email: Jordan Wyatt, jordanwyattchess@yahoo.com

(5147)

Understanding the Role of Speaker Identity in Compensation for Coarticulation. NAVIN VISWANATHAN and ANA N. BENNETT, *State University of New York*, *New Paltz*. — The phenomenon of compensation for coarticulation is used to study how listeners cope with acoustic variability due to coarticulation (Mann, 1980). One explanation is that compensatory perceptual shifts result from listeners' auditory systems experiencing spectral contrast between the precursor and target segment. In this study, we focus on a specific finding of Lotto & Kluender (1998; Experiment 1) that listeners demonstrate perceptual shifts despite a midway change in talker within a coarticulated segment. In our study, we examine whether such talker changes always produce perceptual shifts in a direction predicted by spectral contrast. In addition, we examine whether presenting talker changes in more ecologically plausible contexts (e.g., in the presence of a competing talker) alter the perceptual shifts demonstrated by listeners. Results of our investigation have implications for accounts of compensation for coarticulation as well as for future investigation into speech context effects.

Email: Navin Viswanathan, viswanan@newpaltz.edu

(5148)

Talker-Specificity and Memory for Foreign-Accented Speech. JESSICA ALEXANDER, *Centenary College of Louisiana*, TASHAUNA BLANKENSHIP, *Virginia Tech*,

KRISTEN E. T. MILLS, *University of Tennessee*, ERICA HOGAN, *Concord University*. — Perceptual difficulties can result in robust memory formation. Foreign-accent may serve as a desirable difficulty in some situations. The current study examined how spoken language presented in native and foreign accents and by same and different talkers may affect memory for spoken language. In previous studies, listeners showed better recognition memory for Spanish-accented than for native English words and better memory for hard words than for easy words. The current study examined memory for native and foreign-accented speech when novel talkers were used during the test phase. Listeners still showed better recognition memory for hard words than easy words, but they no longer showed the effect of accented speech as a desirable difficulty. Accented speech seems to enhance memory only in some contexts, indicating that listeners may be drawing on highly specific memory representations for spoken language.
Email: Jessica Alexander, alexander.jed@gmail.com

(5149)

Modeling McGurk Perception: Effects of Stimulus, Culture, Genetics, and Time. JOHN MAGNOTTI, *University of Texas Medical School at Houston*, GUO FENG and BIN ZHOU, *Chinese Academy of Sciences, Beijing*, DEBSHILA BASU MALLICK, *Rice University*, WEN ZHOU, *Chinese Academy of Sciences, Beijing*, MICHAEL BEAUCHAMP, *UT Health Science Center at Houston*. — In the McGurk Illusion, incongruent auditory and visual syllables are heard as a third, unique syllable. The illusion is a popular tool to study multisensory integration across individuals, cultures, and clinical groups. However, the illusion shows remarkable variability (rates of 0-100%). Most studies of the illusion use low sample sizes and few stimuli, obscuring the sources of this variability. We explored 4 potential sources: 1) Stimulus: we tested subjects on up to 14 stimuli. 2) Culture: we tested 324 subjects from China and 165 from the USA. 3) Genetics: we tested 162 twin pairs (73 MZ; 89 DZ) to assess heritability. 4) Time: we tested 40 subjects a year apart to assess stability. To estimate the effect of each factor, we fit a probabilistic model with two parameters for each subject (sensory noise and threshold) and one parameter for each stimulus. The model accurately reproduced the observed stimulus (mean RMSE=2.7%) and individual differences (mean RMSE=4.7%). Chinese participants were more likely to perceive the illusion (mean 56% vs. 43% for USA), twins' illusion rates were more similar than unrelated subjects (mean correlation 0.25 vs. 0.07), and illusion rates were stable over a 1-yr interval (mean change=2%).
Email: John Magnotti, john.magnotti@uth.tmc.edu

• PSYCHOLINGUISTICS IV •

(5150)

Input Variability and Acquisition of Novel First-Language Vocabulary. NICHOLE RUNGE, MITCHELL SOMMERS and JOE BARCROFT, *Washington University in St. Louis.* — Recent research has shown that some sources of input-variability can improve acquisition of novel vocabulary relative to conditions with more consistent input. Previous research has examined how form-based variability (e.g., having multiple versus single talkers) affects acquisition of novel words. The present research was designed to investigate whether semantic variability produces similar beneficial effects. In a minimal-variability condition, participants were asked to learn the meanings of unfamiliar first-language words and were presented the same word-definition pairing 6 times. In a high-variability condition, participants saw 6 word-definition pairings, but each definition was a different variant. In the test phase, participants were (1) shown the word and asked to produce the definition and (2) shown a novel definition and asked to produce the studied word it defines. We found that participants were more accurate in the high-variability than in the minimal-variability condition. Results are discussed using the TOPRA model of new word form learning.
Email: Nichole Runge, nrunge@gmail.com

(5151)

Picture and Word Processing Streams Compete for Limited Resources in Picture-Word Interference. CLAUDIO MULATTI, *University of Padova*, VITÓRIA PIAI, *University of California*, REMO JOB, *University of Trento*. — Performance in the Picture-Word Interference (PWI) task might be seen as a sequence of operations whose time courses depend upon the visual, semantic or lexical features of the picture and of the word stimulus independently, in a bottom-up fashion, resulting in a fixed, stable relation between the two processes. In three experiments, we manipulated the case status (same vs. aLtErNaTed) of the distractor word and timing parameters of the stimuli. Case status differently affected picture naming (i.e., effect present vs. absent) as a function of timing parameters. These results show that the interplay between picture and distractor processes is dynamic and depends upon the characteristics of the task-context. We offer an account of our findings in terms of the two processes competing for access to shared but limited resources.
Email: Claudio Mulatti, claudio.mulatti@unipd.it

(5152)

Structural Alignment is Greater in Dialogue Than in Monologue. IVA IVANOVA and VICTOR FERREIRA, *University of California, San Diego.* — Interlocutors in dialogue mirror each other's linguistic choices (interactive alignment), a process assumed to happen via an automatic priming mechanism which can still be affected by situational and partner-specific factors (Pickering & Garrod, 2004). Since such factors are different or absent in monologue, alignment should

differ between dialogue and monologue. In two experiments studying structural alignment, participants played a picture-matching game in a solo block, containing pre-recorded picture descriptions, and a partner block, performed either with another naive participant describing pictures (Exp. 1), or with an experimenter reading scripted sentences (Exp. 2). In Exp. 1, there was a greater priming effect in the partner than in the solo block. In Exp. 2, the effects in the two blocks were similar, possibly because processing depth of the prime sentences was influenced by the experimenters' reduced engagement in the task (due to performing it many times) or the non-natural prosodic contours of their utterances. These results suggest that alignment is indeed sensitive to situational and partner-specific factors, but these can be subtler than the sheer presence or absence of an interlocutor.
Email: Iva Ivanova, iva.m.ivanova@gmail.com

(5153)

Planning of Word Production but not Predicting in Comprehension Engages the Cortical Network for Language Production. VITORIA PIAI and ARDI ROELOFS, *Radboud University Nijmegen*, JOOST ROMMERS, *Max Planck Institute for Psycholinguistics*, ERIC MARIS, *Radboud University Nijmegen*. — Recent accounts propose that predictions during language comprehension are generated by the production system. Using magnetoencephalography, we compared brain activity of participants reading predictable and control sentences with the last word presented as a picture. Participants either named the picture or manually judged the expectancy of the picture given the sentence. Behavioural responses were faster after predictable than after control sentences. Brain activity was modulated by predictability in the picture-anticipation interval. In both tasks, modulations of oscillatory power were found in brain areas related to semantic and picture processing. Additionally, for picture naming only, modulations were observed in left temporal and inferior frontal cortex (core language-production areas), indicating that participants planned naming responses in the picture-anticipation interval. To the extent that power modulations in the language-production network reflect language-production processes, predictive comprehension does not (strongly) involve these processes. These results suggest limited involvement of the language-production network in predictive comprehension.
Email: Vitoria Piai, v.piai.research@gmail.com

(5154)

Political Party Differences in Language Use in Discourse on Conflict. KAYLA N. JORDAN, ERIN BUCHANAN, JAHNAVI DELMONICO and RUSSELL CARNEY, *Missouri State University*. — When it comes to politics in the United States, the map is dichotomously painted red and blue. Likewise, Republicans and Democrats demonstrate linguistic differences in political and group words such as citizen or constitution (Jarvis, 2007), and use of moral words such as harm or just (Graham, Haidt, & Nosek, 2009). Further, Slatcher, Chung, Pennebaker, and Stone (2007) found that presidential and depressive language varied by political party. In the present study, we examined potential dissimilarities in

linguistic usage by investigating how politicians from each party spoke about conflict with other nations, such as Iraq, Iran, North Korea, and Russia. Approximately 2500 language samples were obtained from the records of the Senate, House, and House/Senate Foreign Affairs Committees and were analyzed for linguistic categories with LIWC software (Pennebaker, Booth, & Francis, 2007). Multidimensional scaling analyses indicated that Democrats and Republicans show different clusters of concepts. Additional findings will be discussed.
Email: Russell N. Carney, russellcarney@missouristate.edu

(5155)

An Analysis of Language Use and Creativity in Poe's 'Masque of the Red Death' Using Google's Ngram. CHRISTOPHER H. RAMEY, JONATHAN P. MCCARTIN, NICOLE A. LOPEZ and ERIN A. SCHUBERTH, *University of Kansas*. — With a finite vocabulary and rule set, human beings can create a practically infinite number of novel sentences. All language is creative, but what sets apart recognized masterpieces from the mundane? Although creative writers do 'bend the rules', to communicate to a reader, they cannot break them (i.e., wholly invent a new grammar and vocabulary). Edgar Poe, for example, must weave together sequences of words that are novel and profound yet recognizable and accessible. What he can do is adjust the statistical likelihood (or unlikelihood) of certain sequences of words for emphasis and effect. Using Google Ngram, a database comprised of millions of digitized English-language books, we analyzed two-word sequences in the short story "Masque of the Red Death", calculating their relative novelty (i.e., occurrence in English) for the years immediately preceding and following the story's publication, investigating how his language use was 'ahead of its time'.
Email: Christopher H. Ramey, christopher.ramey@mac.com

(5156)

Cue Additivity in Predictive Processing of Word Order in German. NICK HENRY, *Pennsylvania State University*, HOLGER HOPP, *University of Mannheim*, CARRIE JACKSON, *Pennsylvania State University*. — Research on anticipatory sentence processing has focused on what information listeners use to make predictions and resolve competition. This visual world paradigm study investigates the interaction of lexical-semantic cues (verb information), morphosyntactic cues (case markings), and prosodic cues (contrastive focus) in German to address whether listeners use converging cues collectively or selectively. Participants heard sentences with unambiguous case markings in four conditions varying with respect to word order (SVO/OVS) and prosody (neutral/contrastive pitch accents). While participants heard the sentences, we tracked their eye-movements towards potential referents. In three experiments, sentences with contrastive versus neutral prosody were presented in either a mixed or blocked design. Results show that predictive use of these cues varied according to the presence of contrastive prosody and presentation type (blocked/mixed), suggesting that listeners use what they perceive as the most salient or reliable cue for prediction and do not attend to additive cues.
Email: Nick Henry, nah5157@psu.edu

(5157)

Speech Rate and Laughter Affect Judgments of Spontaneous Verbal Irony. MALLORY NAGY and GREGORY BRYANT, *University of California, Los Angeles*. — When producing indirect speech such as verbal irony, speakers often produce accompanying nonverbal signals. Speech rate is one of the few consistent prosodic features associated with spontaneous and scripted ironic speech, but no work has examined perceptual effects. Laughter often accompanies ironic speech, but has also not been examined for its effect on interpretative judgments. We extracted verbal irony from natural conversations with co-occurring adjacent laughter, either just before or after the ironic speech. Speech portions were isolated from laughter segments, and manipulated in duration (33% decrease and increase). Manipulated utterances (fast and slow) were presented to listeners either paired with laughter or not, and they were asked to rate how indirect the speakers were being. As expected, we found main effects for speed and laughter, with slowed utterances paired with laughter receiving the highest ratings of indirectness. Both main effects replicated in a low-pass filtering experiment suggesting lexical information is not necessary to make these judgments. Prosody and other nonverbal phenomena such as laughter can be described as procedural signals that direct listeners' interpretations of indirect speech.
Email: Mallory Nagy, mallorynagy@ucla.edu

(5158)

The Time-Course of Constituent Length Effects on the Resolution of Ambiguous Pronouns. HOSSEIN KARIMI and FERNANDA FERREIRA, *University of South Carolina*. — Constituent length has been shown to enhance accessibility and influence form of reference in language production. However, effects of length on comprehension of ambiguous pronouns, including its time-course, have remained largely unexplored. In two eye-tracking experiments, we investigated how antecedent length influenced the resolution of ambiguous pronouns. The results of Experiment 1 showed that participants looked more often at longer antecedents, but only for subject NPs. Experiment 2 revealed that the length effect can generalize to object NPs. More importantly, slope differences across the conditions revealed that the representation associated with the longer NP is retrieved faster from memory, lending direct support to the idea that length increases the accessibility of the associated NP. The results are discussed in relation to theories postulating that length enhances accessibility, and theories maintaining that discourse representations are sometimes left underspecified.
Email: Fernanda Ferreira, fernanda@sc.edu

(5159)

Speakers, Listeners and Context Memory. SI ON YOON, *University of Illinois*, SARAH BROWN-SCHMIDT, *University of Illinois, Urbana-Champaign*. — Previous research suggests that speakers and listeners form distinct memories: speakers outperform listeners. Less clear is whether speakers have superior memory for referential context, too. Participants played the role of speaker or listener in a referential communication task. An unexpected test queried memory for these referents and their contexts. Results of the communication task revealed lexical differentiation: Speakers used modifiers to differentiate current from past referents. The memory test revealed that speakers had better memory for past referents than listeners. Naming ("the dog") rather than locating ("top left") objects similarly improved referent memory for speakers and listeners, but differentially affected context memory: Listeners remembered context items better than speakers when referents were located rather than named. The fact that speakers and listeners have distinct memory representations for the referent and its context suggests that they are not perfectly coordinated: The act of speaking and naming supports future memory.
Email: Sarah Brown-Schmidt, brownsch@illinois.edu

(5160)

Recognizing Sarcasm in Twitter: A Comparison of Neural Network and Human Performance. DAVID KOVAZ and ROGER KREUZ, *University of Memphis*. — The types of words people use may serve as important cues in distinguishing sarcasm from literal language (e.g., Kovaz, Kreuz, & Riordan, 2013). To explore this issue in greater depth, we built a multi-layer perceptron network that uses 101 different word categories (i.e., LIWC) and part-of-speech tags to classify Twitter posts as sarcastic or nonsarcastic. The network was trained and tested using 10-fold cross-validation on a Twitter corpus in which half of the posts were marked with "#sarcasm" and half were not. The average network accuracy was 62%, whereas human raters recruited from Mechanical Turk were 70% accurate in classifying a subset of posts. In addition, we found a relationship between the network's errors and human accuracy, suggesting that the network and humans tended to agree on the same items. This suggests humans may make the same mistakes as machines when discriminating sarcasm from literal language.
Email: Roger Kreuz, rkreuz@memphis.edu

(5161)

Signers Automatically Generalize Phonological Rules. AMANDA DUPUIS and IRIS BERENT, *Northeastern University*. — Speakers readily extend phonological generalizations across the board, and they do so automatically, even contrary to task demands (e.g., in Stroop-like procedures; Berent, Tzelgov, & Bibi, 2006). Here, we ask whether signers likewise extend phonological generalizations automatically. As a case study, we examined the phonological reduplication rule (X —> XX; X=any syllable). Deaf ASL fluent participants were presented with monochromatic (e.g., yellow), dynamic videos of novel signs—either reduplicated (XX) or nonreduplicated (XY), and were asked to identify video color (e.g., sign back "yellow"). If signers automatically extend the reduplication rule to novel signs, then they should view reduplicated items as more sign-like, hence, harder to ignore. Consequently, participants should respond slower to novel XX signs relative to XY controls despite no relevance to color naming, and even

when comprised of nonnative features. Results are consistent with this prediction. Our findings suggest that signers compute productive phonological rules automatically.
Email: Amanda Dupuis, amandaleighdupuis@gmail.com

(5162)

Effects of Written and Auditory Language Processing Skills on Written Passage Comprehension in Middle and High School. GLORIA WATERS, *Boston University*, DAVID CAPLAN, *MGH*, JULIE BERTRAM, KAROLYN HOWLAND and ADAM OSTROWSKI, *Boston University*, JENNIFER MICHAUD, *MGH*. — 3192 middle and high school students were assessed for the ability to recognize and understand written and spoken morphologically simple words, morphologically complex words, the syntactic structure of sentences and comprehension of written passages. Confirmatory factor analysis of the tests of the first three levels of language resulted in three factors in both the auditory and written modalities, reflecting recognizing forms of simple and complex words, understanding simple and complex words, and structuring and understanding sentences. Structural equation models showed that the factors reflecting auditory language processing only influenced those reflecting written language processing and that the latter had direct effects on comprehension of written passages. The results provide evidence that individual differences in the development of skills in recognizing written morphologically simple and complex words and sentences, separate from these skills in the auditory modality, are important determinants of comprehension of written passages in middle and high school.
Email: Gloria Waters, gwaters@bu.edu

(5163)

Message Valence Constraints Information Density. DAVID VINSON and RICK DALE, *University of California, Merced*. — The information contained in a word is defined as a function of that word's local context (e.g., its probability conditioned on the preceding word). One notion related to language suggests that behavior is rational if optimally adapted to its environment. Work under the hypothesis of Uniform Information Density (Jaeger & Levy, 2007) shows that in some cases language users prefer to uniformly distribute information across a message. Here we show information density and uniformity is at least partially dependent on a message's affective valence. Analysis of over two hundred thousand Yelp, Inc. business reviews shows some amount variance in information can be accounted for by the user's explicit business review rating. This suggests that optimal language production may be dependent on a language user's cognitive state. We discuss these results in terms of the broader context that may shape the information structure of messages.
Email: David Vinson, dvinson@ucmerced.edu

(5164)

Is Reliance on Misinformation Due to Demand Characteristics? MEGHAN SALOMON and DAVID RAPP, *Northwestern University*. — Individuals exposed to inaccurate statements have been shown to utilize that misinformation to answer subsequent questions. The current study examined whether this might be due to expectations about the relevance of misinformation for such tasks given obvious similarities and associations between study and test materials/settings. Participants were presented with potentially inaccurate information, followed by a task obfuscating the purpose of those materials. Participants were then led to a second room in the same or a different building to complete an ostensibly different experiment involving an unrelated survey or memory task, respectively. Finally, participants completed a questionnaire to which they could potentially respond with the misinformation they were presented with earlier in the first room. Substantial reductions in the use of misinformation were observed when participants were queried in a different test setting. This suggests that reliance on misinformation can be influenced by the demand characteristics of learning experiences.
Email: Meghan Salomon, msalomon@u.northwestern.edu

(5165)

The Effects of Grammatical Aspect on Perceptions of Intentionality and Culpability. ANDREW SHERRILL, *Northern Illinois University*, ANITA EERLAND, *Open University, The Netherlands*, JOSEPH P. MAGLIANO, *Northern Illinois University*, ROLF A. ZWAAN, *Erasmus Universiteit Rotterdam*. — Recent research suggests that people perceive actions described in imperfective (e.g., "He was shooting a gun") as more intentional than actions described in perfective (e.g., "He shot a gun"). This finding might have important implications in the field of legal decision making. Therefore, we investigated the influence of grammatical aspect on the evaluation of legal discourse in more detail using a series of five experiments (i.e., multiple agents, diverse order of presentation of actions, punctive vs. durative verbs). Participants 1) read a vignette describing a provocative and a reactive act resulting in the death of the provocateur, 2) determined whether the murder warrants a first- or second-degree conviction, and 3) indicated the perceived intentionality of the defendant and the temporal features of each agent's actions. The results show that grammatical aspect of the provocation rather than the murder act affected conviction judgments and perceived intentionality. Additional results will be discussed.
Email: Anita Eerland, anita.eerland@gmail.com

(5166)

Processing of Written Irony in Autism Spectrum Disorder: An Eye-Movement Study. SHEENA K. AU-YEUNG, *University of Southampton*, JOHANNA KAAKINEN, *University of Turku*, SIMON LIVERSEDGE and VALERIE BENSON, *University of Southampton*. — Previous research has suggested that individuals with Autism have difficulties understanding others communicative intent and with using contextual information to correctly interpret irony. We recorded the eye movements of typically developing (TD) adults and adults with Autism Spectrum Disorders (ASD) when they read utterances that could either be interpreted as ironic or non-ironic depending on the context of the passage. Comprehension accuracy was equivalent for groups and both conditions. Similarly, eye movement data showed that total reading times were longer for the critical regions

of the utterances for the ironic compared to the non-ironic condition, suggesting that more effortful processing is required for irony utterances compared to when an utterance was to be interpreted literally. Individuals with ASD however spent more time overall than TD controls re-reading the passages, across both conditions suggesting that on-line integration or interpretation problems are not restricted to irony comprehension in ASD.
Email: Valerie Benson, v.benson@soton.ac.uk

(5167)
Picture Frequency and Phonological Relatedness in PWI & PNWI Paradigms. LISA CECCHERINI and MAX COLTHEART, *Macquarie University*, CLAUDIO MULATTI, *University of Padova*, STEVEN SAUNDERS, *Macquarie University*. — The aim of this study is to shed some light on basic mechanism of speech production using the Picture–Word and the Picture–Nonword Interference paradigms, which refer to the task of naming a picture while ignoring an overwritten distractor. We carried out two experiments. One was a PNWI experiment where we manipulated target frequency, target–distractor end–phonological relatedness (the pairs of stimuli could share the last two phonemes or none) and nonword distractor phonemic length (4/5 vs 7/8 phonemes). The second was a PWI experiment where we varied target frequency jointly with picture–word begin–phonological relatedness. We obtained an additive pattern in the first experiment and interaction in the second one. Human data will be presented combined with the corresponding simulations carried out using a Semantic version of the Dual Route Cascaded model. The implications of our results for models of speech production will be discussed.
Email: Lisa Ceccherini, lisa.ceccherini@gmail.com

• CONCEPTS AND CATEGORIES II •

(5168)
Optimal Training Sets in Natural Category Learning. TOSHIYA MIYATSU, *Washington University in St. Louis*, CRAIG SANDERS, *Indiana University*, MARK MCDANIEL, *Washington University in St. Louis*, ROBERT NOSOFSKY, *Indiana University*. — Laboratory category learning paradigms that expose participants to many different category exemplars may have limited educational implications, as instructors typically are not able to present students with exposure to a wide array of category exemplars. The current experiments examined what types of limited exemplar training sets might optimize category learning and generalization. Participants learned two categories, either with training sets of exemplars that were similar to the prototypical values of each category ("easy") or training sets sampled from the boundary areas of the each category ("difficult"). The categories' structure was reflective of natural science categories: multivariate normal distributions with overlapping feature values. For generalization performance, the results favored a combination of the difficult training set and explicit instruction about the overall category structure relative to the easy training set. This

pattern suggests that educational practice could benefit from using training exemplars from category boundaries rather than more prototypical exemplars.
Email: Toshiya Miyatsu, toshiya.miyatsu@gmail.com

(5169)
Scientific Category Learning: Benefits of Interleaving for Chemistry. LUKE G. EGLINGTON and SEAN KANG, *Dartmouth College*. — Interleaving of exemplars from different categories during training benefits perceptual category learning when the categories have high between-category similarity (e.g., Kang & Pashler, 2012). Most of this research has used categories that are hard to define (e.g., painting styles; bird/butterfly species). Organic chemistry is difficult for many in part because students have to learn numerous visually similar categories (compounds). The present study examined the efficacy of interleaved versus blocked presentation for learning of hydrocarbons. Subjects were presented exemplars one at a time from 5 hydrocarbon categories, in either interleaved or blocked fashion (between-subjects). On a test given 2 days later, the interleaved group was more accurate than the blocked group at categorizing new exemplars (from the same categories). Our finding suggests that the discriminative contrast fostered by interleaving benefits learning of categories that can be precisely defined (as in the case of hydrocarbons), and this has implications for science education.
Email: Luke G. Eglington, luke.eglington.gr@dartmouth.edu

(5170)
On the Role of Structural Alignment in Free Perceptual Categorization. JOHN CLAPPER, GREGORY J. SMITH and BENJAMIN A. MILLER, *California State University, San Bernardino*. — People often appear surprisingly insensitive to overall similarity in experiments on free categorization. In such experiments, all stimuli vary along the same discretely-varying dimensions and similarity is defined in terms of matching / mismatching values along those dimensions. Here, by contrast, we assume that the major determinant of overall similarity is structural alignment, i.e., whether objects have corresponding parts-in-relations that provide the basis for a shared schema or conceptual model. Using a new label generation task, we show that structural alignment, even without specific matching parts, is sufficient for people to perceive objects as essentially similar and group them into common family-level categories. Such alignment-based categories are highly salient, acquired rapidly under different presentation conditions, and people show some awareness of the structure on which they are based. Implications are discussed for the nature of real-world categories and for the role of structural correspondence versus statistical induction in human learning
Email: John Clapper, jclappe@csusb.edu

(5171)
Relative Proportion of Exemplars and Prototypes: What Best Promotes Category Learning? RANDY TRAN and HAL PASHLER, *University of California, San Diego*. — The role of exemplars versus prototypes in perceptual category

learning has long been debated. Little is known, however, about the effect of varying the relative number of exemplars and prototypes presented as training examples. In the present study, participants learned to classify computer-generated Pumpkins into two categories based on two features (size and hue). The ratio of exemplars to prototypes during training was varied (1:0, 0.75:0.25, 0.5:0.5, or 0.25:0.75). On a final test, participants were asked to categorize new exemplars. When the final test was immediately after training, participants exposed to some prototypes during training outperformed participants who saw only exemplars. In a separate experiment, we examined the effect of a week-long test delay. Theoretical implications will be discussed. The results may also have implications for optimal training in categories whose prototypes are known.
Email: Randy Tran, r4tran@ucsd.edu

(5172)

Learning Artists' Styles and Non-Parametric Statistics From Examples: Within- and Between-Category Similarity as a Moderator of Schedule Efficiency. FARIA SANA, *McMaster University*, VERONICA YAN, *University of California, Los Angeles*, JOSEPH KIM, *McMaster University*, ELIZABETH BJORK and ROBERT BJORK, *University of California, Los Angeles* (Sponsored by Geoff Norman). — Interleaving exemplars of to-be-learned categories, rather than blocking exemplars by category, enhances category learning. We examined the notion that interleaving is beneficial or detrimental depending on whether the primary task is to discriminate between exemplars of different categories or to encode commonalities of exemplars within categories, respectively. Participants studied exemplars of perceptual categories (artist styles, Exp1) and conceptual categories (non-parametric statistics, Exp2) and were then required to classify new exemplars of these categories. Whether presented blocked or interleaved during study, exemplars were chosen so that their similarity was high both within and between categories; was high within, but low between; or was low within and high between. Category learning benefited from interleaving when between-category similarity was high, but when within-category similarity was low the interleaving benefit was eliminated (Exp1) or reversed (Exp2). Whether interleaving or blocking facilitates category learning appears to depend, respectively, on whether the learners' primary task is to encode differences between exemplars of different categories or commonalities of exemplars within a category.
Email: Faria Sana, sanaf@mcmaster.ca

(5173)

Comparing the Effectiveness of Positive and Negative Feedback on Information-Integration Categorical Learning. MICHAEL FREEDBERG, *The University of Iowa*, W. TODD MADDOX, *University of Texas*, ELIOT HAZELTINE, *University of Iowa*. — Ashby and O' Brien (2007) concluded that in order to learn information-integration (II) category structures, both positive and negative feedback are required. Here we used a modified version of Ashby and O' Brien's task to determine whether one form of feedback is more effective in teaching II category structures. To address this question, 18 participants were divided into three groups: positive feedback only (PFB), negative feedback only (NFB), or both types of feedback (BFB). Participants performed 2400 categorizations across 3 sessions where an adaptive algorithm fixed the number of feedback trials at 20% of total trials (± 1% for each participant). The results reveal that by the last session the NFB group performed significantly better than both the PFB and BFB groups ($p < 0.05$, $d = 0.33$). These results suggest a more effective role for negative feedback in teaching II category structures.
Email: Michael Freedberg, michael-freedberg@uiowa.edu

(5174)

Sensitivity to Correlational Structure in Free Categorization. JOHN CLAPPER, BENJAMIN MILLER and GREGORY SMITH, *California State University, San Bernardino*. — Participants in free-sorting tasks generally show little awareness of categories based on fuzzy or probabilistic feature correlations, instead categorizing stimuli based on variation along a single dimension. To investigate the generality of this preference, we examined sensitivity to correlational structure in a different task, one in which participants categorize the stimuli by generating informative labels for each one. In a series of experiments, we found no evidence for sensitivity to categories based on probabilistic correlational structure (overall family resemblance). In fact, we found little evidence that people were strongly sensitive to even perfect correlational structure in this task. We did find evidence that people were sensitive to individual matching or mismatching features, as well as to overall object identity (perfect match on all features). Implications are discussed for formal or rational models of categorization, as well as for specific process-level models of learning.
Email: Gregory Smith, smithg.csusb@gmail.com

(5175)

Encoding of Individual Exemplars and Category-Level Information During Category Learning. PAULO CARVALHO and ROBERT GOLDSTONE, *Indiana University*. — Learning a category requires extending a concept from a set of studied examples to novel ones. Learners might either store individual items in memory or the statistical regularities across the category exemplars, or both. Storing only the statistical regularities has lower memory demands but is potentially less flexible for future use. The question of interest is: When study conditions potentiate encoding of individual exemplars over category-level information, is category learning indeed more effective? In this work we present evidence that a situation emphasizing encoding of individual items (repetition of a few category items during study) results in better generalization of natural categories than a situation emphasizing storage of category regularities (presenting a greater number of different items, Exp1). Moreover, test performance in each of these conditions is modulated by the type of information probed (item-specific questions or category-level questions) during study (Exp 2). One proposal is that effective category learning

can be achieved by extrapolating category regularities during test or by encoding these regularities along with individual items during study.
Email: Paulo Carvalho, pcarvalh@indiana.edu

(5176)
The Effect of Falsification and Induction Opportunities on Recategorization. JARED RAMSBURG, *University of Illinois at Chicago* (Sponsored by James Pellegrino). — Researchers argue that dissatisfaction with a misconception is a prerequisite for adopting an alternative conception. The present series of experiments investigated the importance of falsification and category induction opportunities when overriding a prior conception in favor of a new conception. A version of the recategorization paradigm (Cosejo, Oesterreich, & Ohlsson, 2009) was used in which participants needed to determine whether a fictitious alien bacterium was oxygen resistant or not based upon changing features of the bacterium and feedback. All three experiments suggest that, contrary to widespread belief in the conceptual change literature, removing direct falsification opportunities, but providing induction opportunities is an effective method for prompting conceptual change and can result in faster change. Implications for future research and limitations are discussed.
Email: Jared Ramsburg, jramsb2@uic.edu

(5177)
Uncertainty Signals in the Ventral Striatum May Reflect Post-Decisional Evaluation. TYLER DAVIS, BENJAMIN D. ENGLAND and MICHAEL SERRA, *Texas Tech University*. — Category learning research has shown that signals in the medial temporal lobes and ventral striatum track model-based measures of uncertainty. However, so far there has been little work in category learning on people's beliefs about their uncertainty and whether such metacognitive representations differ or overlap with those identified in previous studies. To this end, the present study examines how prospective and retrospective judgments of accuracy differ and how they relate to uncertainty processing during category learning. We find, compared to retrospective judgments, prospective accuracy judgments activate a number of prefrontal and visual regions that overlap with those active during categorization decisions along with areas of the rostro-lateral prefrontal cortex implicated in metacognitive judgments in perceptual decision making. Contrastingly, ventral striatum and ventromedial prefrontal cortex are more active for retrospective judgments, suggesting that previously identified ventral striatal uncertainty signals may indicate post-decisional processing about the uncertainty of a choice.
Email: Tyler Davis, thdavis5@gmail.com

• CONSCIOUSNESS AND AUTOMATIC PROCESSING •

(5178)
The Unawareness of Dual-Task Costs—Delayed Conscious Awareness or Timing Demands? DONNA BRYCE and DANIEL BRATZKE, *University of Tübingen*. — The finding that participants are not aware of the dual-task costs in their own reaction times has been offered as support for the idea that attention is necessary for conscious awareness (Corallo et al. 2008; Marti et al. 2010). These studies propose that while participants attend to one task, they are not consciously aware of another because conscious awareness of the second task is delayed until a decision is reached on the first. In these experiments, participants provide their reaction time estimates for each task via a visual analogue scale. We have evidence that participants' estimates of their own reaction times can be influenced by both the feeling of difficulty of each task, and by the inter-response interval in a given trial. Such introspective dual-task experiments place considerable timing demands on participants, as the timing of four events (S1, S2, R1, R2) must be converted into durations. To remove this demand we collected participants' introspective reports of each dual-task trial via a timeline with markers that represent each event. These results may provide a better insight into participants' temporal representation of a dual-task trial, and allow us to better assess the effect of attention on consciousness.
Email: Donna Bryce, donna.bryce@uni-tuebingen.de

(5179)
Introspection as Mental Perception: Manipulating Bias in Reporting Mind Wandering. MIKAEL BASTIAN, VALENTIN WYART and JÉRÔME SACKUR, *Ecole Normale Superieure* (Sponsored by Patrick Cavanagh). — How are mental states introspected? Are they self-evident, and there is no more than language between experiencing them and reporting them? Or is introspection analogous to a perception of mental contents, with signal-detection-theory-inspired sensitivity and criterion? To address these questions, we ran three experiments assessing mind wandering in continuous visual discrimination tasks. We found that mind wandering reports were associated with lower but also slower processing of stimuli, and decreased pupil response to one's own action. Next, we tested whether participants' likelihood to report mind wandering can be manipulated as an introspective bias. We observed that, indeed, the less participants reported mind wandering, the more deleterious its effects were on stimuli processing. Hence, more conservative introspective decision criteria participants seemed to need more internal evidence before reporting that their minds were wandering. These results shed light on the nature, possible implementation and specificity of introspective mechanisms.
Email: Mikael Bastian, mikael.bastian@ens.fr

(5180)
Is Contextual Cueing an Implicit Phenomenon? SARAH POULET and ANDRE DIDIERJEAN, *University of Franche-Comte*, ERIC RUTHRUFF, *University of New Mexico*, ANNABELLE GOUJON, *CNRS & Université Paul Sabatier*.

— Contextual cueing refers to the learning of contextual regularities while searching for a target in repeated visual scenes, thereby making search more efficient. In artificial scenes, such as arrays of letters, this learning has long been considered to be implicit (e.g. Chun and Jiang, 1998; 2003). However, Smyth and Shanks (2008) argued that the tests were not statistically powerful enough to detect a true awareness effect. Based on a longer series of tests, they concluded that explicit awareness of regularities necessarily accompanies contextual cueing. Like Smyth and Shanks (2008), we used an extended version of a target generation task to test participants' explicit memory for contextual regularities. Our results indicated that some knowledge about regularities was indeed explicitly retrievable. Nevertheless, a strong contextual cueing effect remained even in the absence of awareness. We argue that spatial contextual is an implicit phenomenon.
Email: Andre Didierjean, andre.didierjean@univ-fcomte.fr

(5181)
Using Machine Learning Techniques to Explore Conscious Access in Dual-Task. SEBASTIEN MARTI, *NeuroSpin, Unicog*, JEAN-RÉMI KING and STANISLAS DEHAENE, *Inserm U992-NeuroSpin CEA Saclay-Collège de France.* — Human observers have only a limited capacity to process information. A telling example of this is when participants are asked to perform two tasks in close succession: their response to the second task is typically slower (the psychological refractory period, PRP), or they can even fail to detect the second target (the attentional blink, AB). Here, we recorded brain activity with MEG and used multivariate pattern analysis generalized in time to track the chain of brain events related to two independent tasks. Subjects were instructed to identify a sound followed at a variable asynchrony (100-900 ms) by a target letter embedded in a series of distractor. Results revealed that up to ~300-400 ms, processing of task 1 and 2 occurred in parallel and did not interfere with each other. After ~400 ms however, the brain activity became serial: task 2-related information was decodable only once task 1 was completed. Importantly, parallel brain activations were observed in both seen and unseen trials while serial brain processes were observed only in seen trials. These results support models of a bottleneck in attentional selection and argue against models of shared resources in dual-task situations.
Email: Sebastien Marti, sebastien.marti@yahoo.fr

(5182)
Influence of Stimulus Duration and Frequency on the Auditory Simon Effect: Evidence From a Reaction-Time Distribution Analysis. AIPING XIONG and ROBERT PROCTOR, *Purdue University.* — The Simon effect decreases across the reaction-time distribution for left-right visual stimuli but, in prior studies, not for left-right tone stimuli. Wascher and colleagues interpreted these results as indicating that the visual and auditory Simon effects are due, respectively, to direct visuomotor activation and cognitive stimulus-response transformation. We varied tone duration and frequency in three experiments to determine whether the distribution functions for the Simon effect are influenced by availability of the stimulus information. Although short-duration tones

of 1,000- or 1,500-Hz showed a nondecreasing function, as in prior experiments, short-duration tones of 200- and 500-Hz displayed a decreasing function. When tones of the latter frequencies were response-terminated, the Simon effect first increased as reaction-time increased but then decreased. The decreasing function cannot be attributed to visuomotor activation or cognitive stimulus-response transformation. Overall, the results are consistent with an account in which response activation builds up and then dissipates.
Email: Aiping Xiong, xionga@purdue.edu

(5183)
Eye Movements and Female Attractiveness in Hispanics. NELSA LIENDO, RAY GARZA, ROBERTO HEREDIA and ANNA CIESLICKA, *Texas A&M International University.* — Using eye movements, we investigate female attraction in relation to waist-to-hip ratio (WHR), breast size, and skin tone. According to evolutionary theory, WHR and breast size are morphological traits that are associated with female attractiveness. Previous studies using line drawings of females have shown that males across cultures rate low WHRs (0.6, 0.7) as most attractive. In two eye tracking-experiments participants made attractiveness ratings on female pictures varying in WHR (0.5-.09), breast size, and skin tone. We specifically recorded measurements related to first fixation duration, gaze duration, and total time. The overall results of both studies revealed that visual attention fell mostly on the breasts and midriff areas of the female body, supporting the evolutionary perspective that reproductive relevant areas of the female body are important in female attractiveness. The findings from these studies also support a cross-cultural preference for low WHRs.
Email: Nelsa Liendo, nelsaliendo@dusty.tamiu.edu

(5184)
Effects of Reflective Verbalization on Implicit Learning. SACHIKO KIYOKAWA, *Nagoya University.* — In the present study, we investigated the effects of two types of reflective verbalization; failure-focused and success-focused, on implicit learning. Participants were assigned to either one of the three conditions: Failure-focused verbalization, success-focused verbalization or the control condition. They were asked to engage in the sugar factory task twice. Between the two task sessions a 2-min verbalization session was inserted. During the verbalization session, the participants in the failure-focused verbalization condition were asked to write down what they thought was wrong during the first task session. Correspondingly, those in the success-focused verbalization condition provided a description of what they thought was effective in the first task session. Those in the control condition described their current interests. The results showed that only the failure-focused verbalization facilitated performance on the task. It was concluded that the effects of reflective verbalization on implicit learning differ according to the type.
Email: Sachiko Kiyokawa,
kiyokawa.sachiko@b.mbox.nagoya-u.ac.jp

(5185)

Acoustic Startle Response Inhibition in an Acoustic N-Back Task. TERRY BLUMENTHAL and ANGELIQUE CILIBERTI, *Wake Forest University*. — The startle response, a brainstem reflex that is evoked by a sudden intense stimulus, is attenuated by the presentation of a stimulus (prepulse) 30-500 ms before the intense stimulus. This phenomenon is known as prepulse inhibition (PPI), and may serve to preserve the cognitive processing of the prepulse from the interrupting effects of the startle response. Although this hypothesis has been widely accepted and cited in the literature, few studies have tested it. The present study examined the Protection of Preattentive Processing Theory by combining an acoustic n-back task with an acoustic startle paradigm (N = 38 college students). Pure tones (85 dB, 40 ms duration, 400-1900 Hz) were presented as targets and distractors in a 1- and 2-back design, with startle stimuli (100 dB, 50 ms duration broadband noise) following Target 1 by either 120 or 800 ms (within and outside the range of PPI). Tones served as prepulses, inhibiting startle, but startle did not affect detection of Target 2 on the n-back tasks. Without interruption of T1 processing, protection by inhibition of startle could not be evaluated. These data suggest that T1 processing is not interfered with by a startle response.
Email: Terry Blumenthal, blumen@wfu.edu

(5186)

Short- and Long-Term Effects of Unconscious Brand Logos. EVA VAN DEN BUSSCHE and CHARLOTTE MUSCARELLA, *Vrije Universiteit Brussel*, KAROLIEN SMETS, *Katholieke Universiteit Leuven*, ERIC SOETENS, *University of Brussels*, GETHIN HUGHES, *University of Essex*. — The supposed short-livedness of unconscious representations casts doubt on its applicability in daily life. We conducted a masked priming study with well-known brand logos while recording EEG. To assess short- and long-term effects, a short (300ms) and long (2500ms) Stimulus Onset Asynchrony (SOA) condition were created. Results indicated that, even after the long SOA, unconscious brand logos (e.g., logo of McDonald's) facilitated categorization of related brand names (e.g., MCDONALD'S) and related non-brand words (e.g., HAMBURGER). A modulation of the N400, a negative ERP deflection over the centro-parietal scalp thought to reflect semantic processing, was observed. Although present for both SOAs, this N400 modulation was moderated by the nature of the target (i.e., brand names versus non-brand words). This implies that unconscious brand logos can be semantically processed, that this processing is not necessarily short-lived, and that it is moderated by the degree of semantic closeness between prime and target.
Email: Eva Van den Bussche, eva.van.den.bussche@vub.ac.be

• ANIMAL LEARNING AND COGNITION •

(5187)

Running-Induced Pica in Rats. SADAHIKO NAKAJIMA and TOMOMI KATAYAMA, *Kwansei Gakuin University*. — Voluntary running in an activity wheel establishes aversion to the paired taste in rats. A proposed mechanism underlying this taste aversion learning is gastrointestinal discomfort caused by the running. We tested this hypothesis by measuring pica behavior (kaolin clay intake) of rats, because it is known that rats engage in pica behavior after various illness-inducing treatment including irradiation, motion-sickness, and injection of drugs such as cisplatin, cyclophosphamide, morphine, and lithium chloride (LiCl). Following a demonstration of LiCl-induced pica in Experiment 1, we successfully showed running-induced pica behavior in Experiment 2 where the running treatment was compared with a non-running control treatment (i.e., confinement in a locked wheel). These results suggest that not only LiCl but also running induce nausea in rats, supporting the gastrointestinal discomfort hypothesis of running-based taste aversion learning.
Email: Sadahiko Nakajima, nakajima@kwansei.ac.jp

(5188)

Many to Many Category Learning: Building or Pruning? Implications for Human Word Learning. E. A. WASSERMAN, TANJA ROEMBKE, DARIN CASLER and BOB MCMURRAY, *University of Iowa*. — Basic research on learning emphasizes problems in which many stimuli are mapped to a small number of responses (e.g., categories). However, the question of how organisms learn many-to-many-mappings (e.g., in word learning) has received less attention. An important issue is whether such learning proceeds by building stimulus-response associations, or if there is also a component of pruning—eliminating partially formed incorrect association. We addressed this in a recent animal model of category learning (Wasserman, Brooks & McMurray, submitted). Four pigeons were trained to criterion on 16 stimulus-response mappings using 2AFC discrimination training with reinforcement. S-R associations were arranged within two clusters during training, so that some foil responses never appeared with some stimuli (which potentially impedes the pruning of these associations). At test, pigeons performed less accurately with foils they had never seen with that target than on trials with foils were previously seen with the target. This suggests that pruning incorrect associations is an important aspect of learning many-to-many mappings, and this may be implicated in human word learning (c.f., McMurray, Horst & Samuelson, 2012).
Email: E. A. Wasserman, ed-wasserman@uiowa.edu

(5189)

Can Monkeys Learn Attention Control? DAVID WASHBURN, JESSICA BRAMLETT and RACHEL CALLERY, *Georgia State University*. — Numerous studies have shown that human and nonhuman primates exhibit similar attention skills (e.g., focusing, scanning, sustaining) and control constraints (e.g., environmental, experiential, executive). However, the relative potency of these sources of control over attention appears to vary reliably between species. Compared to human adults, rhesus monkeys are significantly less capable of executive attention and much more influenced by stimulus control. Thus, humans and monkeys alike are affected by incongruous cues on Stroop-like tasks, but the species differ with respect to the variables that alter

the magnitude of this interference. In three studies reported here, we attempted to determine whether rhesus monkeys' executive-attention performance can be improved by various targeted training procedures. For example, four animals were trained on a computerized battery of cue-competition tasks to determine whether any improvements would generalize to performance on a flanker task with incongruous cues. The consistent findings from these studies are that attention control is altered by training, but generalized improvements in the intentional/executive/cognitive control of attention have not been reliably observed.
Email: David Washburn, dwashburn@gsu.edu

(5190)
The Influence of Object and Location Consistency on Sequential Behavior in the Pigeon. JULIA SCHROEDER, DENNIS GARLICK and AARON BLAISDELL, *University of California, Los Angeles*. — Pigeons were trained on an object-location task in which four different objects appeared in four different locations. In group Both (n=2), the objects and locations occurred in a consistent sequence. In group Object (n=2), the objects occurred in a consistent sequence but the locations were randomized. In group Location (n=2), the location sequence was consistent but object order was randomized. In group Neither (n=2), both location and object orders were randomized. During non-reinforced probe trials the object, location, or both were randomized. The Location group had an increase in response time when the sequence of locations was disrupted, while the Object group had minimal disruption. Surprisingly, birds in group Both had large response time costs to disruptions of the object or location sequences, but a smaller cost when both were disrupted concurrently. This suggests that pigeons encode sequential information and that co-varying object and location information facilitated their perceptual binding.
Email: Julia Schroeder, Jeschroeder@ucla.edu

(5191)
Do Dynamic Stimuli Facilitate Acquisition During Pavlovian Occasion Setting Procedures? JOSHUA WOLF and KENNETH LEISING, *Texas Christian University*. — In the domain of visual perception, motion cues are critical for the success of both predator and prey. The superiority of motion over static cues during predictive learning has been found within basic Pavlovian and instrumental conditioning paradigms. To evaluate the superiority of motion cues in conditional relations, we trained rats on a feature-positive discrimination. During feature-positive training, an animal must learn to respond to a target stimulus (e.g., A) in the presence of a feature (XA+) but not in its absence (A-). Two groups of rats were tested with a visual stimulus as the feature and an auditory stimulus as the target. Group Dynamic received a visual feature in motion, whereas Group Static received a single snapshot of the same visual feature. We observed a motion superiority effect during acquisition of the discrimination; however, additional transfer tests revealed interesting details regarding how the discrimination was solved.
Email: Josh Wolf, josh.e.wolf@gmail.com

(5192)
When Good Pigeons Make Bad Choices. JEFFREY PISKLAK, *University of Alberta*, MARGARET MCDEVITT, *McDaniel College*, ROGER DUNN, *San Diego State University*, MARCIA SPETCH, *University of Alberta*. — In the context of uncertainty, signals for delayed food can lead pigeons to behave suboptimally, choosing an outcome that leads to less food overall. In contrast, signals for timeout seem to have little effect on choice, suggesting that time away from choice opportunity is not a controlling variable. In our experiments pigeons chose between two alternatives: One produced either a short or a long delay to food and the other produced either a short delay to food or a long delay to no food. When outcomes were unsignaled, pigeons chose the optimal alternative that always led to food. However, when outcomes were signaled, pigeons frequently chose the suboptimal alternative that only sometimes led to food, thereby reducing their overall reinforcement. These results establish that signaled delays leading to no food are not punishing. However, the same delay can devalue a signal that sometimes ends in food.
Email: Jeffrey Pisklak, pisklak@ualberta.ca

(5193)
Rhesus Monkeys Fall for the Decoy Effect in a Perceptual Discrimination Task. AUDREY PARRISH and MICHAEL BERAN, *Georgia State University*. — The decoy effect is a phenomenon in which choice behavior is impacted by the introduction of a decoy option. The decoy, which is never chosen, enhances preference for one of the other options that it is similar to in some ways and inferior to in other ways. Rhesus monkeys attempted to choose the larger of two rectangular stimuli that varied in their size and orientation (horizontally or vertically oriented). In probe trials, a third stimulus (the decoy) was presented that was smaller than the other two rectangles but matched the orientation of one of them. Half of the probe trials presented a decoy that matched the orientation of the larger stimulus, and the other half presented a decoy that matched the orientation of the smaller stimulus. Monkeys rarely selected the decoy stimulus. However, their performance increased relative to the baseline trials (with only two choices) when the decoy was congruent in its orientation with the largest rectangle, but decreased relative to baseline when the decoy was incongruent with the largest rectangle. Thus, a decoy stimulus impacted perceptual choice behavior among rhesus monkeys even when it was not itself a viable choice option.
Email: Audrey Parrish, audrey.parrish1@gmail.com

• **REASONING AND JUDGMENT II** •

(5194)
Mechanisms of Intuition in Problem Solving. KRISTIN GRUNEWALD and MARK BEEMAN, *Northwestern University*. — Researchers have proposed that intuition in the Remote Associates Test (RAT), first demonstrated by Bowers et al. 1990, results from sensitivity to the problem's solution; however, this assumption has not yet been tested. Using a new

and extensive material set of 152 coherent and 152 incoherent compound remote associate items (CRAs), we found evidence for intuition (d' = 0.06 reliably different from 0, p<.01) and a statistically reliable correlation between d' and a measure of trait Faith in Intuition (R=.27, p<.05). In addition, we examined priming for solution and related words post intuitive judgment. Although we did not find a statistically reliable relationship between solution word priming and intuition, the effect may be masked by a large proportion of guessing trials. Implications for the difficulty of studying the underlying mechanisms of intuition will be discussed.
Email: Kristin Grunewald, kristingrunewald@gmail.com

(5195)
Analogical Reasoning and Cognitive Effort: Using Processing Fluency to Test the Boundaries of Desirable Difficulties. MICHAEL VENDETTI, *University of California, Berkeley*, SHARON NOH, *University of Texas at Austin*, TYSON KERR, *University of California, Los Angeles*, MICHAEL FRIEDMAN, *Harvard University*. — Numerous studies have investigated the effects of perceptual fluency (e.g., the subjective ease with which participants process information) on subsequent cognitive functions. These studies indicated that information that is perceived as being easier to learn tends to be rated as easier to remember, more likeable, etc. However, it is unclear if perceptual fluency will influence a task that does not ultimately depend on its perceptual features. Analogical reasoning provides a way to test the boundary limits of the effects of processing fluency on cognition. In our study, participants were presented with 4-term verbal analogies in three Calibri-based font sizes: small (8-point), medium (32-point), and large (64-point). Participants solved 84 trials (50% valid) in a block-randomized fashion. Across multiple experiments, we tested whether changing the fluency of the analogy influenced 1) participants' subjective ratings of difficulty and 2) processing speed on a lexical decision task. We found that the font size of the analogy impacted both participants' metacognitive judgments and how fast they were during the lexical decision task, suggesting that disfluency may be a desirable difficulty across multiple contexts.
Email: Michael Vendetti, m.vendetti@berkeley.edu

(5196)
Get Out of My Head! Overcoming Fixation and Executive Functioning. REBECCA KOPPEL, *University of Illinois at Chicago*, BENJAMIN STORM, *University of California, Santa Cruz*, JENNIFER WILEY, *University of Illinois at Chicago*. — Problems can be difficult to solve, but they can become even more difficult when people are fixated by exposure to unhelpful or misleading information. Smith and Tindell (1997), for example, showed that exposing participants to words that primed misleading solutions to word-fragment-completion problems caused fixation and reduced solution rates. The overarching goal of the present research is to examine how different individual differences in executive functioning predict problem-solving performance under various conditions by manipulating whether or not participants are exposed to misleading information.

Preliminary results suggest distinct roles for working memory capacity and memory inhibition (as measured by retrieval-induced forgetting) during problem solving.
Email: Rebecca Koppel, rkoppe2@uic.edu

(5197)
Information About Inherent Features Is Highly Accessible: Support for an Inherence Heuristic in Explanation. LARISA HUSSAK and ANDREI CIMPIAN, *University of Illinois*. — According to a recent proposal (Cimpian & Salomon, in press), people often generate explanations using a heuristic process that oversamples inherent facts. These are facts about the constitutive, stable characteristics of the entities that make up the observation being explained (as opposed to external, contextual, etc., facts). A central claim of this account is that inherent facts are highly accessible when people retrieve information from memory to construct their explanations. Across two studies (N = 257), we found consistent support for this claim. When subjects were asked to produce "facts that come to mind" about a variety of concepts (e.g., lion), a majority of the features generated were inherent (e.g., tawny). Furthermore, individual facts that were (a) produced more frequently (across subjects) or (b) generated more quickly (within subjects) were more likely to be inherent. These results suggest that inherent information is accessible during retrieval and potentially integrated into explanations.
Email: Andrei Cimpian, acimpian@illinois.edu

(5198)
A Chromatic Interception: NFL Super Bowl Team Preferences Generalize to Preferences for Similarly Colored College Teams. KAREN B. SCHLOSS and DAVID M. SOBEL, *Brown University*. — People favor colors associated with their social group, such as colors of their university or political party (e.g., Schloss & Palmer, 2014). Does this bias extend to other decisions about alternatives associated with similar colors? We addressed this question during the 2014 Super Bowl (Seahawks vs. Broncos) by testing whether people root for lesser-known Division-3 college teams whose colors match their preferred Super Bowl team. Participants saw pair-wise combinations of eight college logos whose colors corresponded to NFL team colors, including Endicott College (Seahawks colors) and Utica College (Broncos colors), and were asked which team they hoped would win a football game (2AFC). Afterwards, they rated their preference for the Seahawks and Broncos during the game. Participants rooted for the college team who matched their preferred Super Bowl team's colors, suggesting that people generalize their feelings about social groups to other like-colored groups, at least when other information is sparse.
Email: Karen B. Schloss, karenschloss@gmail.com

(5199)
Visualization Bias in Moral Judgment: Attenuation Using Moral Scenarios with Graphic Dual Outcomes. JUSTIN LUDWIG, DOUGLAS J. NAVARICK and THOMAS A. MORALES, *California State University, Fullerton* (Sponsored by Barbara Cherry). — This study asked whether visualizing the consequences of both action and inaction in difficult

moral dilemmas can change moral judgments. Our study utilized a novel design that differed in two characteristics from past research. Response sets included graphic descriptions of the consequences of taking action (killing someone to save others) and inaction (choosing to do nothing). We call such vignettes dual-outcome scenarios. We also included a "can't decide" option allowing the expression of moral ambivalence. One hundred fourteen participants were randomly assigned to either the dual-outcomes condition or single-outcome condition. We found that participants had higher endorsement rates for taking action in the dual-outcomes condition compared to the single-outcome condition. Also, when all 10 high-conflict scenarios were combined, there were higher can't-decide rates in the dual-outcomes condition compared to the single-outcome condition. We concluded that visualizing the consequences of inaction increases utilitarian judgments as well as expressions of moral ambivalence.
Email: Justin Ludwig, jludwig@csu.fullerton.edu

(5200)

The Upside of Down-Regulated Self-Control: Depletion Improves Insight. CHARLES A. VAN STOCKUM and MARCI DECARO, *University of Louisville.* — Prior exertions of self-control (i.e., ego depletion) often lead to poorer performance on subsequent attention-demanding tasks. Such depletion effects are thought to occur either because limited executive resources are exhausted or motivation and attention are shifted away from further deliberative control. We tested whether depletion would improve accuracy on a task that benefits from a more diffuse focus of attention—an insight problem-solving task. Participants performed a repetitive stimulus detection task, during which some participants (depletion condition) were given complex rules that required inhibiting a previously established response. Then, participants attempted several insight matchstick arithmetic problems. Individuals in the depletion condition significantly outperformed those in the non-depletion condition. These findings suggest that, although self-control is critical for success at many skills, depleting self-control resources promotes associative processes important for insight.
Email: Marci DeCaro, marci.decaro@louisville.edu

G

Gaafar, Jessica, 4012
Gade, Miriam, 4147
Gagne, Christina, 2133, 4165
Gagnon, Kyle, 2013
Gaitan, Helena, 52
Galaburda, Albert, 142
Galati, Alexia, 2012
Galeucia, Christopher, 3041, 3168
Gallant, Sara, 1052
Galle, Marcus E., 5144
Gallimore, Jonathan, 173
Gallo, David, 3073, 3074, 3075, 3104, 4061
Galotti, Kathleen, 1019
Gao, Yang, 1198
Garabet, Angela, 1140
Garcia, Clarissa, 241
Garcia, Michael, 1108, 1114
Garcia-Marques, Leonel, 262
Garcia-Marques, Teresa, 1148
Garcia-Retamero, Rocio, 91, 4189
Gardner, Emma, 3103
Gardony, Aaron L., 2022, 2166
Garlick, Dennis, 159, 5190
Garner, Sarah, 28, 309, 3087
Garnsey, Susan, 167
Garrison, Rebecca, 273, 1136
Garry, Maryanne, 3086, 4035
Garza, Ray, 5183
Gash, Hannah, 10
Gaskell, Gareth, 191
Gaspar, John M., 122
Gaspelin, Nicholas, 2107
Gaston, Jeremy, 2004, 2010
Gates, Christopher, 1192
Gauffroy, Caroline, 5, 3186
Gaut, Garren, 253
Gauvrit, Nicolas, 148
Gehlbach, Hunter, 1116
Geller, Jason, 2128
Gélinas, Renée, 1063
George, Tim, 3159
Geraci, Lisa, 1073, 3083, 3094, 4100
Gerald Tehan, Kennedy, 5085
Gerbier, Emilie, 4041
Gerfen, Chip, 2147
Gergely, Ambrus Geza, 2026
Gerrig, Richard, 181
Gerstenberg, Tobias, 4172
Geuss, Michael N., 1040
Geyer, Thomas, 3044
Ghazal, Saima, 91
Ghetti, Simona, 230
Ghiraldi, Loraina, 1059
Giammarco, Maria, 1142
Gibb, Maia, 6
Giebl, Saskia, 5088
Giesen, Carina, 1067

Giezen, Marcel, 4155
Giglio, Rebecca E., 168
Gilbert, Jason, 1033
Gilchrist, Amanda, 1085
Gill, Devin, 171, 1045
Gillet-Perret, Estelle, 2005
Giovanello, Kelly, 1094
Glanc, Gina, 1075
Glavan, Joseph, 4134
Glenberg, Arthur, 1042
Godwin, Hayward, 1013, 4133, 4136
Goedert, Kelly, 5032
Goh, Winston, 4144
Gokce, Ahu, 3044
Golay, Hannah, 4046
Goldinger, Stephen, 3013
Goldman, Susan, 2190
Goldrick, Matt, 281, 3144
Goldstein, Rebecca R., 3123
Goldstone, Robert, 1106, 2062, 5175
Goldwater, Micah, 1109
Goldzweig, Ayelet, 65
Golestani, Narly, 2150
Gollan, Tamar, 279, 281, 1174, 4153
Gollwitzer, Peter, 324
Golonka, Ewa, 2154
Gomes, Carlos, 4047
Gomes, Dayna, 4020
Gomez, Juan-Carlos, 3183
Gomez, Pablo, 1153
Gómez, Rebecca L., 227
Gomez-Ariza, Carlos, 1171
Gong, Xue, 4135
Gonthier, Corentin, 2076, 2114
Gonzalez, Brittney, 3133
Goodchild, Michael F., 3037
Goodman, Adam M., 2188
Goodman, Sara, 178
Goodsell, Charles, 2056, 5072
Goodwin, Kerri, 5109, 5119
Goolsarran, Merissa, 4121
Goossens, Nicole A.M.C., 244
Gordon, Jason, 1031
Gordon, Michael, 23
Gordon, Peter, 115
Gorfein, David, 58
Gorlick, Marissa, 3105, 3192
Goschke, Thomas, 323, 1056, 2115
Gosselin, Emma, 3109
Gosselin, Frédéric, 1002
Gosseries, Olivia, 152
Goto, Tomonobu, 5056
Gougeon, Florian, 1098
Goujon, Annabelle, 2087, 5180
Grady, Cheryl, 291
Graesser, Arthur, 3134, 5111
Grafman, Jordan, 180
Grafton, Scott T., 1033
Graham, Kristin, 1105
Grainger, Jonathan, 80

Grandhi, Sukeshini A., 4076
Granowski, Maryvonne, 3024
Grate, Amanda, 3093
Gratton, Gabriele, 167
Gray, Stephen J., 3073
Gray, Suzanne L., 160
Green, Christopher, 4158
Green, Leonard, 269, 4190
Greenberg, Daniel, 4029
Greenberg, Talia, 4046
Greene, Michelle, 50
Gregg, Julie, 81, 1162
Grendahl, Evan, 4066
Grey, Sarah, 2139
Griffin, Nicholas R., 4077
Griscom, William S., 224
Gronau, Nurit, 54, 1145
Grondin, Simon, 2002
Gronlund, Scott, 2053, 2056, 2096, 5072
Gross, Georgina, 14
Grovak, Andrea, 175
Grubaugh, Jordan, 322, 1004
Gruberg, Nicholas, 9
Grund, Cynthia, 2163
Grunewald, Kristin, 5194
Gu, Xuan, 4027
Guan, Maime, 2179
Guay, Karianne, 42
Guedin, Nolwenn, 5016
Guerard, Katherine, 1043
Guerin-Dugue, Anne, 215
Guerrette, Marie-Claude, 1043
Guillory, Jimmeka, 3083
Gulgoz, Sami, 4033, 4034
Guo, Mengqi, 5032
Gustafson, Erin, 2161
Gutchess, Angela, 1070
Gutiérrez, Eva, 79
Gwinn, Rachael, 274

H

Haaf, Julia, 255
Haass, Michael, 4139
Hadar, Daniel, 65
Hagmann, Carl, 51
Hahn, Carina A., 83
Hahn, Lance William, 4167
Hahn, Sowon, 1115
Halamish, Vered, 304, 1093
Hale, Sandra, 1078, 2082, 5086, 5090
Hall, Michael, 4003
Hall-Ruiz, Alexandra, 5118
Halpern, Andrea R., 2164
Halvorson, Kimberly, 1132
Hamamé, Carlos M., 3139
Han, Hye Joo, 196, 4108
Handy, Justin D., 289
Hannagan, Thomas, 80
Hannah, Stephen, 131