Abstracts
of the Psychonomic Society

Volume 17 • November 2012

53RD ANNUAL MEETING

Hilton Minneapolis Hotel
Minneapolis, Minnesota
Thursday, November 15–
Sunday, November 18, 2012

REGISTRATION

Minneapolis Grand Ballroom Foyer, Third Floor,
Hilton Minneapolis Hotel
Thursday, November 15 ..... 1:00 p.m.–8:00 p.m.
Friday, November 16.....7:30 a.m.–6:00 p.m.
Saturday, November 17 .....10:00 a.m.–1:00 p.m.

BUSINESS MEETING

Salon C, Hilton Minneapolis Hotel
Saturday, November 17 ..... 4:40 p.m.–5:50 p.m.
- Presentation of the Psychonomic Society 2012 Best Article Awards
- Business of the Psychonomic Society

POSTER SESSIONS

Ballroom A, Minneapolis Convention Center
Session I:
Thursday, November 15 ..... 6:00 p.m.–7:30 p.m.
Session II:
Friday, November 16.....12:00 noon–1:30 p.m.
Session III:
Friday, November 16..... 6:00 p.m.–7:30 p.m.
Session IV:
Saturday, November 17 .....12:00 noon–1:30 p.m.
Session V:
Saturday, November 17 ..... 6:00 p.m.–7:30 p.m.

FUTURE MEETINGS

2013 – Toronto, ON – November 14-17
2014 – Long Beach, CA – November 20-23
2015 – Chicago, IL – November 19-22
2016 – Boston, MA – November 17-20

KEYNOTE ADDRESS FOLLOWED BY THE WELCOME RECEPTION

Salon C, Hilton Minneapolis Hotel
Thursday, November 15 ..... 8:00 p.m.–9:00 p.m.
- **Presentation of the Psychonomic Society Outstanding Early Career Awards**
- **Using the Brain to Discover the Mind**
  John R. Anderson, PhD, Carnegie Mellon University
- **Welcome Reception**
  Minneapolis Grand Ballroom Foyer,
  Hilton Minneapolis Hotel

SYMPOSIA

Friday, November 16.....9:50 a.m.–12:00 noon
Symposium I: Motivations, Emotions, and Cognition: What Am I Afraid of, and Why Does It Matter?

Friday, November 16..... 1:30 p.m.–3:30 p.m.
Symposium II: *The American Journal of Psychology*: Celebrating 125 Years of Contributions Shaping Contemporary Scientific Psychology

Saturday, November 17.....9:50 a.m.–12:00 noon
Symposium III: The Adaptive Nature of Memory Illusions: Positive Consequences Can Arise from Illusory Memories

Saturday, November 17..... 1:30 p.m.–3:40 p.m.
Symposium IV: Psychonomics Without Experiments? Discovering Psychological Principles by Mining Large Data Sets

SPECIAL SESSION

Friday, November 16.....3:30 p.m.-5:30 p.m.
Improving the Quality of Psychological Science

A PSYCHONOMIC SOCIETY PUBLICATION
www.psychonomic.org

PRESENTATION OF THE PSYCHONOMIC SOCIETY OUTSTANDING EARLY CAREER AWARDS

PSYCHONOMIC SOCIETY KEYNOTE ADDRESS

John R. Anderson, PhD, Carnegie Mellon University

Using the Brain to Discover the Mind
8:00 p.m., November 15, 2012, Salon C

WELCOME RECEPTION

The Governing Board welcomes all attendees to the Welcome Reception, hosted by the PS Governing Board, held on November 15 immediately following the Keynote Address.

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NOTICES

- *Information on Funding Opportunities at Poster Sessions:* Representatives of funding agencies will be available during the poster sessions. Please stop by poster boards 155-156 during the poster sessions for an opportunity to pick up information and/or speak with representatives from various funding agencies. The schedule for agency poster sessions will be available at Registration and on the poster boards.
- *Designation of Psychonomic Society Outstanding Early Career Award Winners:* An asterisk (*) preceding an author's name indicates that he/she is a recipient of the Psychonomic Society's Outstanding Early Career Award for 2012.

HOTEL

The Hilton Minneapolis Hotel offers an ideal location in the heart of downtown Minneapolis, just steps from superior shopping, dining and entertainment. Connected via skyway to the Minneapolis Convention Center, financial district and other entertainment options, this downtown Minneapolis hotel boasts a convenient location to a variety of attractions. Walk to the Minnesota Orchestra, located next door, or visit The Guthrie Theater—a Tony Award-winning center for theater performance—all within walking distance of the Hilton Minneapolis Hotel. Travel by light rail the short distance to the Mall of America for premier shopping or spend a relaxing day at the Ivy Spa Club—Minneapolis' destination spa. There are many wonderful restaurants within walking distance of the Hilton Minneapolis Hotel that offer a variety of dining choices.

The hotel and adjacent Minneapolis Convention Center will be the site for all meetings, including the affiliate groups held in conjunction with the Psychonomic Society Annual Meeting. We are not charged for meeting space at the hotel because of the number of sleeping rooms attendees occupy. To maintain our practice of no registration fee, it is essential that all rooms reserved for the Annual Meeting be identified as such. To guarantee space and price, please make your reservation no later than **October 10**. The website to make reservations can be reached via a link from the Psychonomic Annual Meeting page: http://www.psychonomic.org/annual-meeting.html.

You may also call +1-612-376-1000 to secure your hotel reservation. When calling, please be sure to identify yourself as an attendee at the Psychonomic Society Annual Meeting. The room rate is $170 single or double per night plus tax. Be sure to obtain a confirmation number from the hotel for your room.

For more information on enjoyable activities, dining and shopping in Minneapolis please visit www.minneapolis.org.

TRAVEL IN MINNEAPOLIS

The Minneapolis Airport offers a few options for transportation to the downtown corridor.

Taxi Service:
Price: $40-$45 one-way. Taxis are available at the airport. Signs at the airport will direct you to their location.

Super Shuttle Shared Van Service:
Price: $16 one-way. Visit www.supershuttle.com or call +1-612-827-7777 for exact pricing and schedules. Advanced reservations are recommended.

Light Rail:
Price: $2.25 one-way. The light rail does not go directly to the Hilton Minneapolis Hotel. You will exit at the Nicollet Mall stop (5th Street and Nicollet), which is located approximately six blocks from the Hilton Hotel. A free Nicollet Mall bus is complimentary and will take you to within one block of the Hilton Hotel (exit at the 11th Street and Nicollet stop). You can purchase your ticket at the light rail stop at the Minneapolis Airport. There is a stop in Terminal 1 and Terminal 2. Trains run every 10-15 minutes. Visit www.metrotransit.org for more information (Hiawatha Line).

Self-parking at the Hilton Minneapolis Hotel is $13 per night and valet parking is $23 per night.

REGISTRATION

Registration is free for members and will be located at the Minneapolis Grand Ballroom Foyer, at the Hilton Minneapolis Hotel on the third floor, at the following times:

Thursday, November 15 ..... 1:00 p.m.–8:00 p.m.
Friday, November 16.....7:30 a.m.–6:00 p.m.
Saturday, November 17 ..... 10:00 a.m.–1:00 p.m.

You are encouraged to preregister through the Psychonomic Society Web site, www.psychonomic.org; just click on the "Annual Scientific Meeting" link to access registration. Preprinted badges will be available for all up-to-date dues-paying members, associate members, life members, presenters, and co-authors. Please check your membership status at www.psychonomic.org if you are not sure if your dues are current. If you choose not to preregister, please go to the PS Registration Desk when you arrive in Minneapolis and complete a registration form so the Society can obtain an accurate count of attendees.

PROGRAMS

Programs will be mailed to all current members of the Psychonomic Society. Please bring your program with you. Additional programs will be available at the registration desk for $20.

MEETING ROOMS

The meeting rooms for spoken papers are:

Hilton Hotel	Salon C (third floor) Salon D (third floor) Salon E (third floor) Salon G (third floor) Marquette II (second floor) Marquette VIII (second floor)
Minneapolis Convention Center	Ballroom A (Level 1) (Poster Session)

Exhibits will be located at the Hilton Minneapolis Hotel Grand Ballroom Foyer, on the third floor.

PSYCHONOMIC TIME

Persons chairing sessions this year will be asked to keep the spoken papers scheduled 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. **New this year:** laptop computers will be provided in each meeting room. Please bring your presentation on a jump 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 projectors and overhead projectors will not be provided unless the speaker has specifically requested such equipment.)

Presenters are strongly encouraged to visit the speaker ready room well in advance of their talks to review their presentations.

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

HOSPITALITY/RECEPTIONS

On Thursday, November 15, there will be a general reception with a cash bar between 5:30 p.m. and 7:30 p.m. in Ballroom A at the Minneapolis Convention Center, site of the poster session. A reception with cash bar will be held in the same area 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. Note that the reception is combined with the poster session on each evening.

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

THE PROGRAM

There were 1,066 submissions. Of the 1,045 papers that were accepted, 278 are spoken papers and 767 are posters. In addition, there were four Invited Symposia and one Invited Special Session.

POSTER SESSIONS

NOTE: The Governing Board has decided to reduce the size of posters to 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/sugg.html for suggestions on preparing your poster.

The poster sessions will be held in Ballroom A at the Minneapolis Convention Center. Use of the space at the convention center must be paid for by the Society, and in order 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 (hospitality). Authors of posters are asked to make their posters available for viewing on the following schedule:

Session	Viewing Time	Author Present
Thursday Evening, November 15 Poster Session I	4:00 p.m. –7:30 p.m.	6:00 p.m. –7:30 p.m.
Friday Noon, November 16 Poster Session II	10:00 a.m. –1:30 p.m.	12:00 noon –1:30 p.m.
Friday Evening, November 16 Poster Session III	4:00 p.m. –7:30 p.m.	6:00 p.m. –7:30 p.m.
Saturday Noon, November 17 Poster Session IV	10:00 a.m. –1:30 p.m.	12:00 noon –1:30 p.m.
Saturday Evening, November 17 Poster Session V	4:00 p.m. –7:30 p.m.	6:00 p.m. –7:30 p.m.

We have extended viewing time so that all interested attendees can see the posters of their choice and reduce the crowded conditions that occur at times 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 your session. The Psychonomic Society cannot be responsible for poster presentations that are left on the posterboards 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., 001–156).

PROGRAM HISTORY

Year – Site	Submissions	Accepted
2011 – Seattle	1,046	1,037
2010 – St. Louis	928	928
2009 – Boston	1,230	1,229
2008 – Chicago	1,040	950
2007 – Long Beach	936	928
2006 – Houston	905	883
2005 – Toronto	966	940

PROGRAM AND CONFERENCE ORGANIZATION

The Secretary/Treasurer, Ruth Maki, has the responsibility for organizing the program, and the Convention Manager, Andy Conway, has the responsibility for arranging facilities at the meeting. They do so with the indispensable help of Kathy Kuehn, Executive Director of the Society, Amy Bayer, John Hofmann, Linda Potchoiba, and Jane Shepard.

OTHER MEETINGS

- **APCAM—Auditory Perception, Cognition, and Action 11th Annual Meeting**, Thursday, November 15, Conrad D. Visit apcam.us for more information.

- **IAM—International Association for Metacognition,** Thursday, November 15, 12:30 p.m. - 4:30 p.m., Hilton Minneapolis Hotel, Salon F. Keynote address by John Dunlosky. Registration (12:30) is free; for more information, visit http://www.personal.kent.edu/~jdunlosk/metacog/.

- **OPAM—Conference on Object Perception, Attention, and Memory**, Thursday, November 15, Salon G. The 20th annual OPAM meeting is a one-day conference dedicated to issues in object perception, attention, memory and other areas of visual cognition. This year's keynote address will be given by Dr. Michael Tarr, Carnegie Mellon University. For more information visit www.opam.net or contact one of this year[1]s organizers: Carly Leonard (cjleonard@ucdavis.edu), Melissa Võ (mlvo@search.bwh.harvard.edu), Michael Mack (mack.michael@gmail.com), or Josh Cosman (joshua.d.cosman@vanderbilt.edu).

- **SCiP—Society for Computers in Psychology**, Thursday, November 15, Conrad A, B, C. For more information, visit www.scip.ws.

- **Tactile Research Group**, Thursday, November 15, 8:00 a.m. - 6:00 p.m., Duluth Room, Hilton Minneapolis Hotel. Invited speakers include Roberta Klatzky, Jürgen Konczak, Thomas James, Stephen Maricich, Ryo Kitada, and Andrew Pruszynski.

- **WICS—Women in Cognitive Science 12th Annual Meeting**, Thursday, November 15, 4:00 p.m. - 6:00 p.m., Salon E. For more information, visit http://womenincogsci.org/.

- **SJDM—Society for Judgment and Decision Making Annual Meeting**. Saturday, Sunday, and Monday, November 17 - 19, Hilton Minneapolis Hotel, Conrad A, B, D. For more information, visit www.sjdm.org.

OFFICERS OF THE SOCIETY

Past Chair	R. Reed Hunt (2011)
Current Chair	Jeff Zacks (2012)
Chair-Elect	Helene Intraub (2013)
Secretary/Treasurer	Ruth Maki (2011-2013)
Convention Manager	Andy Conway (2012-2017)

GOVERNING BOARD

D. Stephen Lindsay (2007-2012)
Robert M. Nosofsky (2007-2012)
R. Reed Hunt (2008-2013)
Jeffrey M. Zacks (2008-2013)
Michael C. Anderson (2009-2014)
Helene Intraub (2009-2014)
Colin M. MacLeod (2010-2015)
Jeremy M. Wolfe (2010-2015)
Cathleen Moore (2011-2016)
Lynne Reder (2011-2016)
Robert Logie (2012-2017)
Janet Metcalfe (2012-2017)

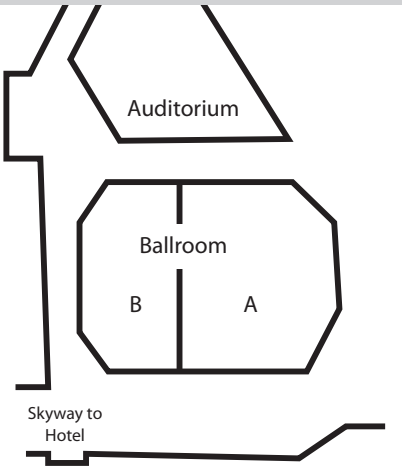
The names of two new members elected to the Governing Board for 2013-2018 will be announced at the Business Meeting on Saturday, November 17.

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

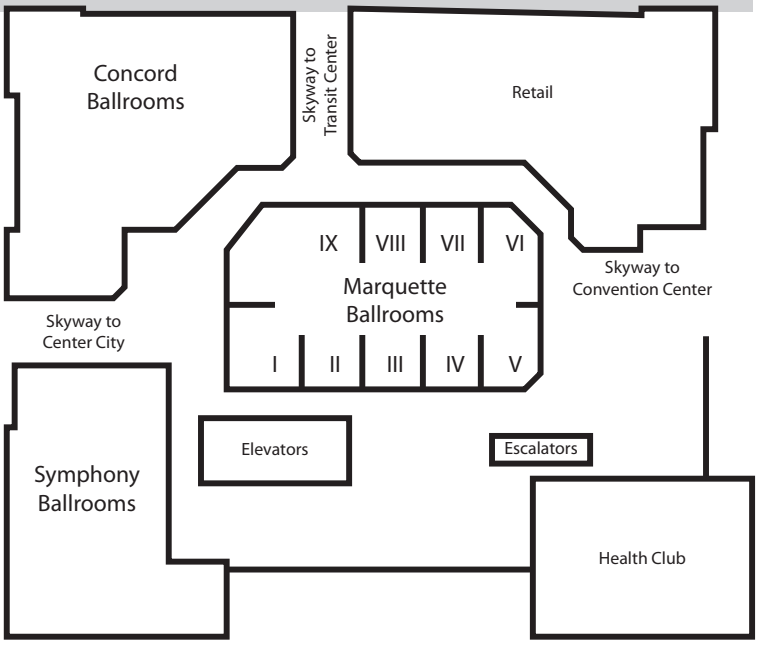
HILTON MINNEAPOLIS HOTEL & MINNEAPOLIS CONVENTION CENTER

- Keynote Address, Spoken Sessions, Other Meetings at the Hilton Minneapolis Hotel.
- Posters at the Minneapolis Convention Center - Level One.
- SJDM Annual Meeting at the Hilton Minneapolis Hotel, Conrad A, B, and D.

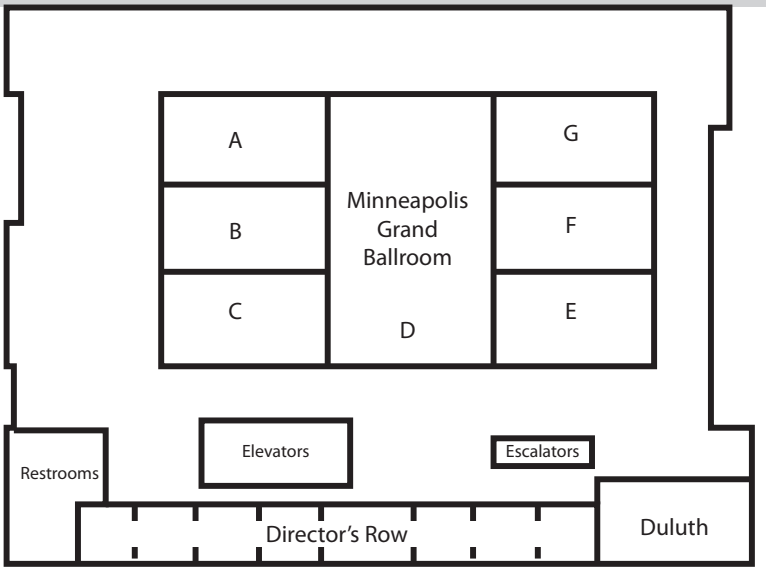
MINNEAPOLIS CONVENTION CENTER - LEVEL ONE



HILTON MINNEAPOLIS HOTEL - SECOND FLOOR



HILTON MINNEAPOLIS HOTEL - THIRD FLOOR



The Psychonomic Society Announces the Winners of the

2012 OUTSTANDING EARLY CAREER AWARD

The Board of Governors voted in 2011 to establish an Outstanding Early Career Award to recognize exceptional research accomplishments among our members. Nominees must have completed their terminal degree (typically PhD) no more than 10 years prior to the year the award is given and must be a member or associate 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.

Selection of the winners is made by a committee consisting of two members of the Governing Board and three members of the Society who are not members of the Governing Board. Reed Hunt and Cathleen Moore, representing the Governing Board, and David Balota, Marcia Johnson, and Thomas Zentall, from the membership, comprised the 2012 committee.

Sian Beilock

University of Chicago

For her research on acquisition of high levels of competency in complex tasks, which has advanced basic theories in cognitive science related to attention, memory, and performance.

Nominators:

- Nora Newcombe
- Mark Ashcraft

Scott Brown

University of Newcastle, Australia

For his development of mathematically tractable and empirically validated models of response time, which has enriched and linked the cognitive and neurosciences.

Nominators:

- Andrew Heathcote
- A. A. J. Marley

Thomas Griffiths

University of California, Berkeley

For his work on Bayesian models of causal induction, which has provided a unified account of causal learning and reasoning across a range of settings.

Nominators:

- Stephen Palmer
- James McClelland
- Richard Shiffrin

Nash Unsworth

University of Oregon

For his theoretical and empirical work demonstrating that individual differences in working memory are largely a matter of information retrieval from long-term memory.

Nominators:

- Randall Engle
- Nelson Cowan

The Psychonomic Society Announces the Winners of the 2012 Best Article Awards

The Publications Committee of the Psychonomic Society asked each Editor of a Psychonomic journal to select a Best Article of the Year Award winner. Potential winners were the first authors of all articles published or slated to be published in 2012. Editors used whatever criteria and procedure they deemed best to select the winning paper. The winners of the award, sponsored by Springer, will be identified at the Business Meeting on Saturday, November 17, 2012.


Dorothe Poggel

Attention, Perception, & Psychophysics (Editor Jeremy M. Wolfe)
Dorothe Poggel, Bernhard Treutwein, Claudia Calmanti, Hans Strasburger
The Tölz Temporal Topography Study: Mapping the visual field across the life span
Part I: "The topography of light detection and temporal-information processing"
DOI: 10.3758/s13414-012-0278-z
Part II: "Cognitive factors shaping visual field maps" DOI: 10.3758/s13414-012-0279-y

Behavior Research Methods (Editor Gregory Francis)
Michael Morten Steurer, Ulrike Aust, Ludwig Huber
"The Vienna Comparative Cognition Technology (VCCT): An innovative operant conditioning system for various species and experimental procedures"
DOI: 10.3758/s13428-012-0198-9


Michael Morten Steurer


Barnaby D. Dunn

Cognitive, Affective, & Behavioral Neuroscience (Editor Deanna Barch)
Barnaby D. Dunn, Davy Evans, Dasha Makarova, Josh White, Luke Clark
"Gut feelings and the reaction to perceived inequity: The interplay between bodily responses, regulation, and perception shapes the rejection of unfair offers on the ultimatum game"
DOI: 10.3758/s13415-012-0092-z

Learning & Behavior (Editor Geoffrey Hall)
Oren Griffiths, R. Frederick Westbrook
"A common error term regulates acquisition but not extinction of causal judgments in people"
DOI: 10.3758/s13420-011-0056-0


Oren Griffiths


Vanessa M. Loaiza

Memory & Cognition (Editor James Nairne)
Vanessa M. Loaiza, David P. McCabe
"Temporal–contextual processing in working memory: Evidence from delayed cued recall and delayed free recall tests"
DOI: 10.3758/s13421-011-0148-2

Psychonomic Bulletin & Review (Editor Cathleen Moore)
Chris Donkin, Robert M. Nosofsky
"The structure of short-term memory scanning: An investigation using response time distribution models"
DOI: 10.3758/s13423-012-0236-8


Chris Donkin

Please join the Publications Committee in congratulating these authors!

The 12th Annual Meeting of Women in Cognitive Science

Thursday, November 15, 2012
Hilton Minneapolis Hotel, Salon E
WICS Meeting: 4-6 pm
WICS Social Hour: 6-7 pm

Success from thesis to tomb: Professional visibility throughout the academic career

Panelists:

Deborah Burke
Pomona College

Morton Ann Gernsbacher
University of Wisconsin-Madison

Lynn Hasher
University of Toronto

Nikole Patson-Huffman
Ohio State University-Marion

Eleonora Rossi
Pennsylvania State University

Debra Titone
McGill University

Virginia Valian
Hunter College

Janet van Hell (moderator)
Pennsylvania State University

Acknowledgments:
WICS is supported by funds from the Perception, Action and Cognition Program at the National Science Foundation.

Organizers:
Laurie Feldman (lf503@albany.edu)
Janet van Hell (jgv3@psu.edu)
Judith Kroll (jfk7@psu.edu)
Suparna Rajaram (suparna.rajaram@sunysb.edu)
Natasha Tokowicz (Tokowicz@pitt.edu)

For more information visit: http://www.womencogsci.org/
Women in Cognitive Science is affiliated with the Psychonomic Society

CELEBRATING 50 YEARS

The Foundations of Cognitive Archaeology

Marc A. Abramiuk

"Cognitive archaeology—sometimes called the archaeology of mind—is a fast-growing field. In *The Foundations of Cognitive Archaeology* Marc Abramiuk poses challenging questions about the prehistory of mind which are central to the understanding of what it is to be human." — Colin Renfrew, McDonald Institute for Archaeological Research, University of Cambridge

328 pp., 27 illus., $40 cloth

Do Apes Read Minds?

Toward a New Folk Psychology

Kristin Andrews

"*Do Apes Read Minds?* provides a timely reminder that theory of mind should not be reduced to predicting behavior. There is more to it: belief and desire are used as justifying reasons, and it remains an open question just when children acquire this ability and whether animals have it at all." — Josef Perner, Department of Psychology and Centre for Neurocognitive Research, University of Salzburg

312 pp., $38 cloth

Language, Thought, and Reality

Selected Writings of Benjamin Lee Whorf
second edition

Benjamin Lee Whorf
edited by John B. Carroll, Stephen C. Levinson, and Penny Lee
introduction by John B. Carroll
foreword by Stephen C. Levinson

Writings by a pioneering linguist, including his famous work on the Hopi language, general reflections on language and meaning, and the "Yale Report."

424 pp., 18 illus., $35 paper

The Evolved Apprentice

How Evolution Made Humans Unique

Kim Sterelny

"In *The Evolved Apprentice*, Kim Sterelny casts a sharp philosopher's eye on rather contentious ideas about how we evolved into a highly distinctive species over the last few million years." — Peter Richerson, University of California-Davis

Jean Nicod Lectures • A Bradford Book • 240 pp., $35 cloth

Thought and Language

Revised and Expanded Edition

Lev S. Vygotsky
edited and with a new foreword by Alex Kozulin

A new edition of a foundational work of cognitive science that outlines a theory of the development of specifically human higher mental functions.

392 pp., $40 paper

Mind and Brain

A Critical Appraisal of Cognitive Neuroscience

William R. Uttal

"*Mind and Brain* presents the reader with a remarkably complete and clear understanding of cognitive neuroscience as a field. This book should be required reading for both research neuroscientists and instructors whose goal is to provide the clearest and most current understanding of the neuro-, cognitive, and behavioral sciences. It is exceptional." — Steven Schandler, Professor of Psychology and Director, Addiction Research and Cognitive Psychophysiology Laboratories, Chapman University

488 pp., 24 illus., $55 cloth

Evolution and the Mechanisms of Decision Making

edited by Peter Hammerstein and Jeffrey R. Stevens

A multidisciplinary examination of cognitive mechanisms, shaped over evolutionary time through natural selection, that govern decision making.

Strüngmann Forum Reports
488 pp., 7 color illus., 9 b&w illus., $50 cloth

Cognitive Search

Evolution, Algorithms, and the Brain

edited by Peter M. Todd, Thomas T. Hills, and Trevor W. Robbins

"We desperately need a better understanding of how people search for information in the real world. This book provides a comprehensive view of current knowledge and, importantly, lays out the direction for future research on 'satisficing' (as opposed to 'optimizing') search mechanisms in humans and other species." — Gerd Gigerenzer, Director, Max Planck Institute for Human Development

Strüngmann Forum Reports
416 pp., 11 color illus., 24 b&w illus., $45 cloth

Grounding Social Sciences in Cognitive Sciences

edited by Ron Sun

Exploration of a new integrative intellectual enterprise: the cognitive social sciences.

472 pp., 11 illus., $50 cloth

Inner Experience and Neuroscience

Merging Both Perspectives

Donald D. Price and James J. Barrell

"Donald Price and Jim Barrell combine their considerable scientific expertise in a thought-provoking treatise on science and human experience. Neuroscience and psychology are interwoven in compelling arguments for integrating traditional scientific approaches with methods for studying internal experiences." — Barry E. Stein, Department of Neurobiology and Anatomy, Wake Forest School of Medicine

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Open Minds

The Social Making of Agency and Intentionality

Wolfgang Prinz

"Wolfgang Prinz makes a powerful, well-argued and plausible case for the notion that social interaction, culture and communication design the very structure and operation of human minds as well as their selfhood and subjectivity." — Radu J. Bogdan, Tulane University; author of *Predicative Minds*, *Our Own Minds*, and others

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now in paper

Folk Psychological Narratives

The Sociocultural Basis of Understanding Reasons

Daniel D. Hutto

"The book is a stimulating and engaging read, and the debate about human social cognition should forever be transformed in its wake." — Neil C. Manson, *Philosophical Investigations*

368 pp., $20 paper

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The MIT Press

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THURSDAY EVENING, NOVEMBER 15, 2012

Hospitality ..... 5:30 p.m.-7:30 p.m., Minneapolis Convention Center, Ballroom A
Poster Session 1 ..... 4:00 p.m.-7:30 p.m. (Author Present between 6:00 p.m.-7:30 p.m.), Minneapolis Convention Center, Ballroom A

- Vision I (1001-1011)
- Perception I (1012-1024)
- Action and Perception I (1025-1032)
- Embodied Cognition I (1033-1041)
- Spatial Cognition I (1042-1051)
- Cognitive Skill Acquisition I (1052-1056)
- Explicit Memory I (1057-1068)
- Working Memory I (1069-1081)
- Metamemory/Metacognition I (1082-1090)
- Human Learning and Instruction I (1091-1098)
- Selective Attention I (1100-1109)
- Cognitive Control I (1110-1119)
- Speech Perception I (1120-1129)
- Psycholinguistics I (1130-1138)
- Concepts and Categories I (1139-1145)
- Letter and Word Processing I (1146-1154)

Psychonomic Society Outstanding Early Career Award ..... 8:00 p.m., Salon C
Keynote Address ..... 8:00 p.m., Salon C
Welcome Reception ..... Minneapolis Grand Ballroom Foyer

FRIDAY MORNING, NOVEMBER 16, 2012

Explicit Memory I (1-5) ..... 8:00 a.m.-9:40 a.m., Salon G
Reasoning and Problem Solving (6-9) ..... 8:00 a.m.-9:20 a.m., Salon C
Letter and Word Processing I (10-15) ..... 8:00 a.m.-10:00 a.m., Salon E
Cognitive Control (16-21) ..... 8:00 a.m.-10:00 a.m., Salon D
Perceptual Organization (22-27) ..... 8:00 a.m.-10:00 a.m., Marquette VIII
Bilingualism I (28-33) ..... 8:00 a.m.-10:00 a.m., Marquette II
SYMPOSIUM I:
Motivations, Emotions, and Cognition: What Am I Afraid of, and Why Does it Matter? ..... 9:50 a.m.-12:00 noon, Salon C
Concepts and Categories I (41-45) ..... 10:20 a.m.-12:00 noon, Salon D
Atttentional Processes (46-51) ..... 10:00 a.m.-12:00 noon, Salon G
Metamemory (52-56) ..... 10:20 a.m.-12:00 noon, Salon E
Statistics and Methodology (57-61) ..... 10:20 a.m.-12:00 noon, Marquette VIII
Motion Perception (62-66) ..... 10:20 a.m.-12:00 noon, Marquette II
Poster Session II ..... 10:00 a.m.-1:30 p.m. (Author Present between 12:00 noon-1:30 p.m.), Minneapolis Convention Center, Ballroom A

- Perception II (2001-2009)
- Spatial Cognition II (2010-2019)
- Cognitive Skill Acquisition II (2020-2023)
- Eyewitness Identification (2024-2032)
- Recognition Memory I (2033-2044)
- Implicit Learning and Memory (2045-2057)
- Working Memory II (2058-2067)
- Testing Effects I (2068-2077)
- Selective Attention II (2078-2090)
- Cognitive Control II (2091-2100)
- Speech Perception II (2101-2111)
- Psycholinguistics II (2112-2125)
- Bilingualism I (2126-2136)
- Reasoning and Problem Solving I (2137-2144)
- Judgment and Decision Making I (2145-2154)

FRIDAY AFTERNOON, NOVEMBER 16, 2012

Concepts and Categories II (67-72) ..... 1:30 p.m.-3:30 p.m., Salon G
Testing Effects in Memory (73-77) ..... 1:30 p.m.-3:10 p.m., Salon D
Judgment and Decision Making I (78-83) ..... 1:30 p.m.-3:30 p.m., Salon E
Spatial Cognition (84-88) ..... 1:30 p.m.-3:10 p.m., Marquette II
Multiple States of Working Memory: A New Era of Fractionation? (89-93) ..... 1:30 p.m.-3:10 p.m., Marquette VIII
SYMPOSIUM II: *The American Journal of Psychology*: Celebrating 125 Years of Contributions Shaping Contemporary Scientific Psychology ..... 1:30 p.m.-3:30 p.m., Salon C
Selective Attention I (100-105) ..... 3:30 p.m.-5:30 p.m., Marquette VIII
Special Session: Improving the Quality of Psychological Science (106-111) ..... 3:30 p.m.-5:30 p.m., Salon D
Judgment and Decision Making II (112-117) ..... 3:30 p.m.-5:30 p.m., Marquette II
Working Memory I (118-122) ..... 3:50 p.m.-5:30 p.m., Salon E
Motor Processes (123-126) ..... 3:50 p.m.-5:10 p.m., Salon G
Explicit Memory II (128-132) ..... 3:50 p.m.-5:30 p.m., Salon C

FRIDAY EVENING, NOVEMBER 16, 2012

Hospitality ..... 5:30 p.m.-7:30 p.m., Minneapolis Convention Center, Ballroom A
Poster Session III ..... 4:00 p.m.-7:30 p.m. (Author Present between 6:00 p.m.-7:30 p.m.), Minneapolis Convention Center, Ballroom A

Vision II (3001-3008)
Action and Perception II (3009-3018)
Spatial Cognition III (3019-3030)
Collaboration and Memory (3031-3039)
Recognition Memory II (3040-3047)
Human Learning and Instruction II (3048-3056)
Prospective Memory (3057-3065)
Metamemory/Metacognition II (3066-3079)
Cognitive Aging (3080-3092)
Selective Attention III (3093-3103)
Discourse Processes (3104-3111)
Language Production/Writing (3112-3123)
Judgment and Decision Making II (3124-3135)
Timing and Sequencing (3136-3138)
Cognition and Emotion (3139-3153)

SATURDAY MORNING, NOVEMBER 17, 2012

Embodied Cognition (133-137) ..... 8:00 a.m.-9:40 a.m., Marquette II
Working Memory II (138-141) ..... 8:00 a.m.-9:20 a.m., Salon C
Judgment and Decision Making III (142-147) ..... 8:00 a.m.-10:00 a.m., Salon E
Explicit Memory III (148-153) ..... 8:00 a.m.-10:00 a.m., Salon D
Timing and Sequencing (154-158) ..... 8:00 a.m.-9:40 a.m., Salon G
Human Learning and Instruction I (159-163) ..... 8:00 a.m.-9:40 a.m., Marquette VIII
Cognitive Aging (164-169) ..... 10:00 a.m.-12:00 noon, Marquette VIII
Action and Perception I (170-175) ..... 10:00 a.m.-12:00 noon, Salon G
Implicit Learning and Memory (176-181) ..... 10:00 a.m.-12:00 noon, Marquette II
Working Memory III (182-186) ..... 10:20 a.m.-12:00 noon, Salon D
Psycholinguistics I (187-191) ..... 10:20 a.m.-12:00 noon, Salon E
SYMPOSIUM III: The Adaptive Nature of Memory Illusions:
Positive Consequences Can Arise From Illusory Memories ..... 9:50 a.m.-12:00 noon, Salon C
Poster Session IV ..... 10:00 a.m.-1:30 p.m. (Author Present between 12:00 noon-1:30 p.m.), Minneapolis Convention Center, Ballroom A

Action and Perception III (4001-4006)
Test Effects II (4007-4018)
Associative Learning (4019-4027)
Explicit Memory II (4028-4052)
False Memory/Misinformation Effect (4053-4063)
Working Memory III (4064-4079)
Metamemory/Metacognition III (4080-4095)
Selective Attention IV (4096-4108)
Divided Attention (4109-4118)
Cognitive Control III (4119-4126)
Letter and Word Processing II (4127-4142)
Psycholinguistics III (4143-4152)

SATURDAY AFTERNOON, NOVEMBER 17, 2012

Action and Perception II (200-203) ..... 1:30 p.m.-2:50 p.m., Salon G
Judgment and Decision Making IV (204-207) ..... 1:30 p.m.-2:50 p.m., Salon E
Bilingualism II (208-211) ..... 1:30 p.m.-2:50 p.m., Marquette II
Automatic Processing (212-215) ..... 1:30 p.m.-2:50 p.m., Marquette VIII
Human Learning and Instruction II (216-219) ..... 1:30 p.m.-2:50 p.m., Salon D
SYMPOSIUM IV: Psychonomics Without Experiments?
Discovering Psychological Principles by Mining Large Data Sets ..... 1:30 p.m.-3:40 p.m., Salon C
Action, Cognition, and Object Manipulation (227-230) ..... 3:10 p.m.-4:30 p.m., Marquette VIII
Visual Processing (231-234) ..... 3:10 p.m.-4:30 p.m., Salon E
Associative Learning (235-238) ..... 3:10 p.m.-4:30 p.m., Salon G
Mechanisms of Linguistic Relativity (239-242) ..... 3:10 p.m.-4:30 p.m., Marquette II
Human Learning and Instruction III (243-246) ..... 3:10 p.m.-4:30 p.m., Salon D
Business Meeting ..... 4:40 p.m.-5:50 p.m., Salon C

SATURDAY EVENING, NOVEMBER 17, 2012

Hospitality ..... 5:30 p.m.-7:30 p.m., Minneapolis Convention Center, Ballroom A
Poster Session V ..... 4:00 p.m.-7:30 p.m. (Author Present between 6:00 p.m.-7:30 p.m.), Minneapolis Convention Center, Ballroom A

Embodied Cognition II (5001-5006)
Music Perception (5007-5011)
Event Cognition (5012-5015)
Social Aspects of Memory (5016-5021)
Explicit Memory III (5022-5033)
Human Learning and Instruction III (5034-5041)
Automatic Processing (5042-5046)
Cognitive Control IV (5047-5055)
Speech Perception II (5056-5063)
Motor Control (5064-5068)
Letter and Word Processing III (5069-5087)
Concepts and Categories II (5088-5106)
Psycholinguistics IV (5107-5114)
Bilingualism II (5115-5128)
Reasoning and Problem Solving II (5129-5136)
Judgment and Decision Making III (5137-5154)

SUNDAY MORNING, NOVEMBER 18, 2012

Speech Perception (249-254) ..... 8:00 a.m.-10:00 a.m., Marquette II
Selective Attention II (255-260) ..... 8:00 a.m.-10:00 a.m., Salon D
Biological Aspects of Memory (261-266) ..... 8:00 a.m.-10:00 a.m., Marquette VIII
Word Recognition (267-272) ..... 8:00 a.m.-10:00 a.m., Salon E
Language Processing (273-277) ..... 8:00 a.m.-9:40 a.m., Salon G
False Memory and Eyewitness Identification (278-282) ..... 8:00 a.m.-9:40 a.m., Salon C
Explicit Memory IV (283-287) ..... 10:20 a.m.-12:00 noon, Salon D
Psycholinguistics II (288-292) ..... 10:20 a.m.-12:00 noon, Marquette II
Perceptual Processes (293-297) ..... 10:20 a.m.-12:00 noon, Marquette VIII
Attentional Control (298-302) ..... 10:20 a.m.-12:00 noon, Salon E
Action and Perception III (303-308) ..... 10:00 a.m.-12:00 noon, Salon G
Letters and Word Processing II (309-314) ..... 10:00 a.m.-12:00 noon, Salon C

Salon C	Salon D	Salon E
Thursday Evening, November 15, 2012		
Keynote Address: Using the Brain to Discover the Mind, John Anderson, PhD *8:00 p.m.*		
Friday Morning, November 16, 2012		
Reasoning and Problem Solving *8:00 a.m.-9:20 a.m.*	Cognitive Control *8:00 a.m.-10:00 a.m.*	Letters and Word Processing I *8:00 a.m.-10:00 a.m.*
Symposium I: Motivations, Emotions, and Cognition: What Am I Afraid of, and Why Does it Matter? *9:50 a.m.-12:00 noon*	Concepts and Categories I *10:20 a.m.-12:00 noon*	Metamemory *10:20 a.m.-12:00 noon*
Friday Noon, November 16, 2012		
Friday Afternoon, November 16, 2012		
Symposium II: *The American Journal of Psychology*: Celebrating 125 Years of Contributions Shaping Contemporary Scientific Psychology *1:30 p.m.-3:30 p.m.*	Testing Effects in Memory *1:30 p.m.-3:10 p.m.*	Judgment and Decision Making I *1:30 p.m.-3:30 p.m.*
Explicit Memory II *3:50 p.m.-5:30 p.m.*	Special Session: Improving the Quality of Psychological Science *3:30 p.m.-5:30 p.m.*	Working Memory I *3:50 p.m.-5:30 p.m.*
Friday Evening, November 16, 2012		
Saturday Morning, November 17, 2012		
Working Memory II *8:00 a.m.-9:20 a.m.*	Explicit Memory III *8:00 a.m.10:00 a.m.*	Judgment and Decision Making III *8:00 a.m.10:00 a.m.*
Symposium III: The Adaptive Nature of Memory Illusions: Positive Consequences Can Arise From Illusory Memories *9:50 a.m.-12:00 noon*	Working Memory III *10:20 a.m.12:00 noon*	Psycholinguistics I *10:20 a.m.-12:00 noon*
Saturday Noon, November 17, 2012		
Saturday Afternoon, November 17, 2012		
Symposium IV: Psychonomics Without Experiments? Discovering Psychological Principles by Mining Large Data Sets *1:30 p.m.-3:40 p.m.*	Human Learning and Instruction II *1:30 p.m.-2:50 p.m.*	Judgment and Decision Making IV *1:30 p.m.-2:50 p.m.*
Business Meeting *4:40 p.m.-5:50 p.m.*	Human Learning and Instruction III *3:10 p.m.-4:30 p.m.*	Visual Processing *3:10 p.m.-4:30 p.m.*
Saturday Evening, November 17, 2012		
Sunday Morning, November 18, 2012		
False Memory and Eyewitness Identification *8:00 a.m.-9:40 a.m.*	Selective Attention II *8:00 a.m.-10:00 a.m.*	Word Recognition *8:00 a.m.-10:00 a.m.*
Letter and Word Processing II *10:00 a.m.-12:00 noon*	Explicit Memory IV *10:20 a.m.-12:00 noon*	Attentional Control *10:20 a.m.-12:00 noon*

Salon G	Marquette II	Marquette VIII	Convention Center, Ballroom A
			Hospitality *5:30 p.m.-7:30 p.m.* Poster Session I *6:00 p.m.-7:30 p.m.*
Explicit Memory I *8:00 a.m.-9:40 a.m.* Attentional Processes *10:00 a.m.-12:00 noon*	Bilingualism I *8:00 a.m.-10:00 a.m.* Motion Perception *10:20 a.m.-12:00 noon*	Perceptual Organization *8:00 a.m.-10:00 a.m.* Statistics and Methodology *10:20 a.m.12:00 noon*	
			Poster Session II *12:00 noon-1:30 p.m.*
Concepts and Categories II *1:30 p.m.-3:30 p.m.* Motor Processes *3:50 p.m.-5:30 p.m.*	Spatial Cognition *1:30 p.m.-3:10 p.m.* Judgment and Decision Making II *3:30 p.m.-5:30 p.m.*	Multiple States of Working Memory: A New Era of Fractionation? *1:30 p.m.-3:10 p.m.* Selective Attention 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.*
Timing and Sequencing *8:00 a.m.-9:40 a.m.* Action and Perception I *10:00 a.m.-12:00 noon*	Embodied Cognition *8:00 a.m.-9:40 a.m.* Implicit Learning and Memory *10:00 a.m.-12:00 noon*	Human Learning and Instruction I *8:00 a.m.-9:40 a.m.* Cognitive Aging *10:00 a.m.-12:00 noon*	
			Poster Session IV *12:00 noon-1:30 p.m.*
Action and Perception II *1:30 p.m.-2:50 p.m.* Associative Learning *3:10 p.m.-4:30 p.m.*	Bilingualism II *1:30 p.m.-2:50 p.m.* Mechanisms of Linguistic Relativity *3:10 p.m.-4:30 p.m.*	Automatic Processing *1:30 p.m.-2:50 p.m.* Action, Cognition, and Object Manipulation *3:10 p.m.-4:30 p.m.*	
			Hospitality *5:30 p.m.-7:30 p.m.* Poster Session V *6:00 p.m.-7:30 p.m.*
Language Processing *8:00 a.m.-9:40 a.m.* Action and Perception III *10:00 a.m.-12:00 noon*	Speech Perception *8:00 a.m.-10:00 a.m.* Psycholinguistics II *10:20 a.m.-12:00 noon*	Biological Aspects of Memory *8:00 a.m.-10:00 a.m.* Perceptual Processes *10:20 a.m.-12:00 noon*	

THURSDAY, NOVEMBER 15, 2012

6:00 p.m.–7:30 p.m.
Poster Session 1 (1001–1154)
Minneapolis Convention Center Ballroom A

Vision I
(1001) Schloss, Prinzmetal
(1002) Henderson, McClelland
(1003) Shyi, Lin
(1004) Barenholtz, Daskagianni
(1005) Wu, Klatzky, Hollis, Stetten
(1006) Gajewski, Wallin, Philbeck
(1007) Lanagan-Leitzel, Skow, Moore
(1008) McWilliams, Hulleman
(1009) Cain, Mitroff
(1010) Palatinus, Dixon, Stephen
(1011) Jaffee, Klopfer

Perception I
(1012) Koch, Broughal
(1013) Prazak, Burgund
(1014) Dickinson, Roy-Charland, Perron, Thomas, Beaudry
(1015) Wilford, Sjolund, West, Bailey
(1016) Kang, Williams
(1017) Holloway, McBeath
(1018) López, Tosun, Vaid
(1019) Schweickert, Han, Yamaguchi, Fortin
(1020) Boltz
(1021) Juola, Kuling, Kohlrausch
(1022) Stephens, Scrivens, Overman
(1023) Shaw, Depowski, Baart, Bortfeld
(1024) Cook, Dias, Rosenblum

Action and Perception I
(1025) Kahan, Mathis, Schriger
(1026) Bailey, Zacks, Kurby, Giovannetti
(1027) Nishimura, Michimata
(1028) Kim, Chang, Cho
(1029) Chan, Peterson, Pratt
(1030) Thomas, Wagman, McBride
(1031) Christman, Propper
(1032) Gozli, Moskowitz, Pratt

Embodied Cognition I
(1033) Gonzalez-Marquez, Becker
(1034) Tower-Richardi, Gagnon, Taylor, Brunyé
(1035) Davison, Griffin
(1036) Oakes, Yee
(1037) Alban, Kelley
(1038) Siakaluk, Newcombe, Campbell, Pexman
(1039) Shields, Swindell, Hubbard, Langston
(1040) Blasko, Kazmerski, Kerr
(1041) Krause, Lindemann, Bekkering, Toni

Spatial Cognition I
(1042) Möhring, Newcombe, Frick
(1043) Wang, Mou, Sun
(1044) Hund, Schmettow, Noordzij
(1045) Marchette, Morgan, Stigliani, Epstein
(1046) Chrastil, Warren
(1047) Ericson, Warren
(1048) Kramer, Philbeck, Kaminsky
(1049) Sturz, Kilday, Police, Bodily
(1050) Mou, Zhou
(1051) Jacovina, Rapp

Cognitive Skill Acquisition I
(1052) Green, McQueen, Seymour
(1053) Yamaguchi, Logan
(1054) Campbell, Hughes, Linck, Silbert, Tare, Smith, Bunting
(1055) Chrabaszcz, Dougherty
(1056) Ashcraft, Rudig, Moore, Carr

Explicit Memory I
(1057) Evans, Wolfe
(1058) Westfall, Maimberg
(1059) Coutanche, Gianessi, Chanales, Willison, Thompson-Schill
(1060) Papesh, Goldinger
(1061) Elmore, McBride
(1062) Olds, Westerman
(1063) Misirlisoy, Atalay
(1064) Ahmad, Hockley
(1065) Osth, Dennis, Sederberg
(1066) Aue, Criss, Fontaine
(1067) Underwood, Guynn
(1068) Huff, Bodner

Working Memory I
(1069) Minear, Brasher, Brandt Guerrero
(1070) Atkins, Dougherty, Bunting, Bolger
(1071) Kundu, Sutterer, Emrich, Postle
(1072) Richmond, Redick, Braver
(1073) Zhou, Thomas
(1074) Richmond, Mancuso, Wolk, Olson
(1075) Dorsi, Viswanathan
(1076) Miller, Roodenrys, Arcioni
(1077) Knickerbocker, Altarriba
(1078) Ljung
(1079) Busler, Barker
(1080) Greenlee, Boles
(1081) Hein, Oberauer, Lin

Metamemory/Metacognition I
(1082) Hartwig, Dunlosky
(1083) Tauber, Dunlosky, Rawson
(1084) England, Serra
(1085) Foster, Sahakyan
(1086) Soderstrom, Rhodes
(1087) Flores, Serra
(1088) Fulton, Greenberg, Schwarb, Schumacher, Hertzog
(1089) Jones, Eakin
(1090) Williams, Moulin

Human Learning and Instruction I
(1091) Taylor, Wiley
(1092) Whitten II, Whitten
(1093) Mullaney, White, Carpenter
(1094) Birnbaum, Kornell, Bjork, Bjork
(1095) Pyc, Balota, Tully, McDermott, Roediger III
(1096) Friedman, Castel, Noh
(1097) Clark, Bjork, Bjork
(1098) Garcia, Yan, Yu, Bjork, Bjork

Selective Attention I
(1100) Swallow, Jiang
(1101) Donovan, Pratt, Shomstein
(1102) MacLean, Hilchey, Klein
(1103) Snyder, Kheiravar
(1104) Musz, Weber, Thompson-Schill
(1105) Swan, Wyble
(1106) Simmons, Shin
(1107) Drew, Sherman, Wolfe
(1108) McDonnell, Dodd
(1109) Yigit-Elliott, Palmer, Moore

Cognitive Control I
(1110) Meeks, Rosnick
(1111) Brunyé, Mahoney, Giles, Rapp, Taylor, Kanarek
(1112) Kazanas, Altarriba
(1113) Moffitt, Hutchison
(1114) Moran, Moser, Altmann
(1115) Kuratomi, Kawahara, Yoshizaki
(1116) Markus, Eviatar
(1117) Nozari, Thompson-Schill
(1118) Washburn, Schultz, Phillips, Bramlett
(1119) Roseman, Stapleton, Rowland, Godwin, Taber, Laurienti, Dagenbach

Speech Perception
(1120) Large, Mantell, Sawusch
(1121) Toscano, McMurray
(1122) Kittleson, Schertz, Diehl, Lotto
(1123) Vitela, Carbonell, Lotto
(1124) Pinnow, Wolden, Osterland
(1125) Alexander, Mills, Ellison, Daniels
(1127) Tzeng, Nygaard
(1128) Morrill, Dilley, McAuley, Pitt
(1129) Trude, Brown-Schmidt

Psycholinguistics
(1130) Tanner, van Hell
(1131) Traxler, Boudewyn, Zirnstein, Swaab
(1132) Chabal, Marian
(1133) Kacinik, Eskine, Starr-Glass, Rodriguez
(1134) Aschenbrenner, Balota, Tse, Yap, Ratcliff
(1135) Sajin, Connine
(1136) Yu, Han, Bi, Zhu, Law
(1137) Zhu, Malt
(1138) Kapnoula, Packard, Apfelbaum, McMurray, Gupta

Concepts and Categories I
(1139) Crawford, Fine, Homa
(1140) Verheyen, Voorspoels, Storms
(1141) Brodhagen, Bjork, Donnelly, Kucksdorf, Budd
(1142) Eskenazi, Folk
(1143) Oliver, Rayman-Kinney, Macy, Hartley, Tressel, Carlile
(1144) Dailey, Carlson
(1145) Fific

Letter and Word Processing I
(1146) Hoffman, Zivotofsky
(1147) Madec, Rey, Courrieu, Konieczny, Grainger
(1148) de Wit, Kinoshita
(1149) Zdrazilova, Pexman
(1150) Angele, Rayner, Schotter, Bicknell
(1151) Tran, Angele, Rayner
(1152) Nakayama, Sears, Hino, Lupker
(1153) Turner, Kellogg
(1154) Massol, Molinaro, Carreiras

FRIDAY, NOVEMBER 16, 2012
8:00 a.m.–12:00 noon
Spoken Sessions (1–66)

Explicit Memory I (1–5), Salon G
8:00 a.m.–8:15 a.m. Janssen, Gralak, Kawasaki, Kristo, Rodrigues, Murre
8:20 a.m.–8:35 a.m. Nelson, Huber
8:40 a.m.–8:55 a.m. Jonker, MacLeod, Seli
9:00 a.m.–9:15 a.m. Brainerd, Gomes, Reyna
9:20 a.m.–9:35 a.m. Kumaran, McClelland

Reasoning and Problem Solving (6–9), Salon C
8:00 a.m.–8:15 a.m. Bujak, Catrambone, Caballero, Schatz, Marr
8:20 a.m.–8:35 a.m. Jahn, Braatz
8:40 a.m.–8:55 a.m. Rotello, Heit
9:00 a.m.–9:15 a.m. Goedert, Ellefson

Letters and Word Processing I (10–15), Salon E
8:00 a.m.–8:15 a.m. Keuleers, Brysbaert
8:20 a.m.–8:35 a.m. Ziegler, Hannagan, Dufau, Montant, Fagot, Grainger
8:40 a.m.–8:55 a.m. Kinoshita, Norris
9:00 a.m.–9:15 a.m. Andrews, Lo
9:20 a.m.–9:35 a.m. Morris, Still
9:40 a.m.–9:55 a.m. Wurm

Cognitive Control (16–21), Salon D
8:00 a.m.–8:15 a.m. Longman, Monsell, Lavric
8:20 a.m.–8:35 a.m. Henik, Kalanthroff
8:40 a.m.–8:55 a.m. Wenger, Murray-Kolb, Haas
9:00 a.m.–9:15 a.m. Schumacher, Schwarb, Cookson, McPherson, Hazeltine
9:20 a.m.–9:35 a.m. Lien, Ruthruff, Gaspelin
9:40 a.m.–9:55 a.m. Stevens, Carlson

Perceptual Organization (22–27), Marquette VIII
8:00 a.m.–8:15 a.m. Moore, Chung
8:20 a.m.–8:35 a.m. Peterson, Cacciamani, Barense, Scalf
8:40 a.m.–8:55 a.m. Townsend, Houpt, Silbert
9:00 a.m.–9:15 a.m. Palmer, Schloss, Sammartino
9:20 a.m.–9:35 a.m. Busey, Yu, Parada, Emerick, Vanderkolk
9:40 a.m.–9:55 a.m. Colonius

Bilingualism I (28–33), Marquette II
8:00 a.m.–8:15 a.m. Titone, Pivneva, Mercier
8:20 a.m.–8:35 a.m. Paap, Greenberg, Liu
8:40 a.m.–8:55 a.m. Humphrey, Valian
9:00 a.m.–9:15 a.m. Jared, Paivio, Poh
9:20 a.m.–9:35 a.m. Francis, Strobach, Penalver, Lara, Ochoa
9:40 a.m.–9:55 a.m. Isurin

Symposium I: Motivations, Emotions, and Cognition: What Am I Afraid of, and Why Does it Matter?, Salon C
9:50 a.m.–9:55 a.m. Carr
9:55 a.m.–10:15 a.m. Ashcraft, Moore, Rudig
10:20 a.m.–10:40 a.m. Beilock
10:45 a.m.–11:05 a.m. Worthy, Maddox, Markman
11:10 a.m.–11:30 a.m. Correll, Wittenbrink
11:35 a.m.–11:45 a.m. Carr
11:45 a.m.–12:00 noon Carr

Concepts and Categories I (41–45), Salon D
10:20 a.m.–10:35 a.m. Vul, Sullivan, Barner
10:40 a.m.–10:55 a.m. Cohen, Quinlan
11:00 a.m.–11:15 a.m. Landy, Davis, Guay, DeLaunay, Charlesworth, Silbert
11:20 a.m.–11:35 a.m. Sloutsky, Deng
11:40 a.m.–11:55 a.m. Treat, Farris, Smith, Viken

Attentional Processes (46–51), Salon G
10:00 a.m.–10:15 a.m. Cunningham, Wolfe
10:20 a.m.–10:35 a.m. Dampuré, Benraiss, Rouet, Vibert
10:40 a.m.–10:55 a.m. Irwin, Humphreys
11:00 a.m.–11:15 a.m. Mitroff, Biggs, Cain, Darling, Clark, Adamo, Dowd
11:20 a.m.–11:35 a.m. Mordkoff, Kenning
11:40 a.m.–11:55 a.m. Palmer, Scharff, Moore

Metamemory (52–56), Salon E
10:20 a.m.–10:35 a.m. Weinstein, McDermott, Gilmore, Szpunar
10:40 a.m.–10:55 a.m. Lanska, Westerman
11:00 a.m.–11:15 a.m. Hampton, Morandi
11:20 a.m.–11:35 a.m. Hanczakowski, Zawadzka, Higham
11:40 a.m.–11:55 a.m. Koriat

Statistics and Methodology (57–61), Marquette VIII
10:20 a.m.–10:35 a.m. Francis
10:40 a.m.–10:55 a.m. Kruschke
11:00 a.m.–11:15 a.m. Anderson
11:20 a.m.–11:35 a.m. Minda, Miles, Nadler, Rabi
11:40 a.m.–11:55 a.m. Budescu, Por, Marcus, MacLean

Motion Perception (62–66), Marquette II
10:20 a.m.–10:35 a.m. Hubbard, Ruppel
10:40 a.m.–10:55 a.m. Sperling, Sun, Chubb
11:00 a.m.–11:15 a.m. Huff, Papenmeier
11:20 a.m.–11:35 a.m. Skarratt, Gellatly, Cole
11:40 a.m.–11:55 a.m. Hidaka, Teramoto, Keetels, Vroomen

FRIDAY, NOVEMBER 16, 2012
12:00 noon–1:30 p.m.
Poster Session II (2001–2154)
Minneapolis Convention Center Ballroom A

Perception II (2001–2009)
(2001) Vaid, Tosum, Kharkhurin, Eslami
(2003) Nelson, Gong, Reiss
(2004) Yu, Kubovy
(2005) Overvliet, van Aarsen, Wagemans, Krampe
(2006) Diederich, Colonius
(2007) Wagman, Abney
(2008) Bloesch, Abrams
(2009) Asano, Kitajo, Thierry, Kita, Okada, Imai

Spatial Cognition II (2010–2019)
(2010) Sjolund, Kelly, McNamara
(2011) Gardony, Taylor, Brunyé, Wolford
(2012) Varner, Pyoun, Dopkins
(2013) Bodily, Kilday, Eastman, Gaskin, Graves, Roberts, Sturz
(2014) Gagnon, Brunyé, Tenbrink, Gopal, Gardony, Holcomb, Taylor
(2015) Scott, Georgopoulos, Sera
(2016) Miller, Simmering, Patterson
(2017) Rand, Thompson, Creem-Regehr
(2018) Galati, Avraamides
(2019) Wang, Taylor, Brunyé

Cognitive Skill Acquisition II (2020–2023)
(2020) Stepankova, Lukavsky, Buschkuehl, Kopecek, Ripova, Jaeggi
(2021) Schneider, Healy, Barshi
(2022) Macnamara, Conway
(2023) Jost, Misyak, Christiansen

Eyewitness Identification (2024–2032)
(2024) Fife, Perry, Gronlund
(2025) Carlson, Goodsell, Wetmore, Gronlund, Neuschatz, Wooten, Graham
(2026) Andersen, Carlson, Carlson, Gronlund
(2027) Earles, Kersten
(2028) Moreland, Clark
(2029) Tanjeem, Lindsay
(2030) Carlson, Carlson, Saladino, Weatherford
(2031) Goodsell, Gronlund, Neuschatz, Wetmore, McAdoo
(2032) Dobolyi

Recognition Memory I (2033–2044)
(2033) Prince, Averell, Heathcote
(2034) Kantner, Lopez, Frithsen, Miller
(2035) Ingram, Wixted
(2036) Didi-Barnea, Peremen, Goshen-Gottstein
(2037) Schneider, Anderson
(2038) Muntean, Kimball
(2039) Pazzaglia, Rotello
(2040) Kilic, Criss, Malmberg
(2041) Olchowski, Starns
(2042) Lindsay, Kantner, Baldassari, Rosenberg, Freeman
(2043) Kellen, Klauer, Bröder
(2044) Dede, Wixted

Implicit Learning and Memory (2045–2057)
(2045) D'Angelo, Jiménez, Lupiáñez, Milliken
(2046) Marsh, Glenberg
(2047) St-Louis, Bagramyan, Saint-Aubin, Tremblay
(2048) Brill, Morgan-Short
(2049) Jones, Kaschak
(2050) Was, Smith
(2051) Hemmer, Criss, Wagenmakers
(2052) Maddox, Zou, Bui, Hale
(2053) Andrews, Rapp
(2054) Kvavilashvili, Anthony
(2055) Walker, Rickard
(2056) de Zilva, Newell, Mitchell
(2057) Willits, Sibley, Seidenberg

Working Memory II (2058–2067)
(2058) Semizer, Boduroglu
(2059) Lilienthal, Hale, Myerson
(2060) Burns, Lagacé, Guérard
(2061) Gilchrist, Verhaeghen
(2062) Langerock, Vergauwe, Barrouillet
(2063) Nieuwenstein, Wyble
(2064) Morey, Bieler
(2065) Patterson, Yang
(2066) Tsuda, Saiki
(2067) Chen, Lin, Tzeng, Hung, Wu

Testing Effects I (2068–2077)
(2068) Coppens, Verkoeljen, Rikers
(2069) DeSoto, Nestojko, Roediger
(2070) Gordon, Thomas, Bulevich
(2071) Dudukovic, Gottshall, Cavanaugh
(2072) Keresztes, Kaiser, Kovács, Racsmány
(2073) Kubik, Söderlund, Nilsson, Jönsson
(2074) Harrison, Whiffen, Ware, Engle
(2075) Tsai, Lee
(2076) Wissman, Rawson
(2077) Bies-Hernandez, Copeland, Rudig, Moore, Ashcraft

Selective Attention II (2078–2090)
(2078) Buttaccio, Lange, Thomas, Hahn, Dougherty
(2079) Merrill, Yang
(2080) Meyerhoff, Huff, Schwan
(2081) Conley, Sudevan, David, Wutke, Calhoun, Evans
(2082) Leonard, Carlisle, Luck
(2083) Dambacher, Grzyb, Hübner
(2084) Gaspelin, Ruthruff, Jung, Crane
(2085) Mills, Dodd
(2086) Defer, Uhlrich, Maquestiaux, Goujon, Didierjean
(2087) Koshino, Olid
(2088) Kim, Kim, Cho
(2089) Rosenbaum, Jiang
(2090) Lee, Shomstein

Cognitive Control II (2091–2100)
(2091) Buetti, Lleras
(2092) Harada, Niida, Kase
(2093) Vazquez, Felton, Chiarello
(2094) Allen, Martin
(2095) Buss, Wifall, Spencer, Hazeltine
(2096) Chamberland, Tremblay
(2097) Hussey, Harbison, Mishler, Teubner-Rhodes, Novick
(2098) Reiman, Arrington
(2099) Barber, Harris, Rajaram
(2100) Lee, Hazeltine, Mordkoff

Speech Perception II (2101–2111)
(2101) Morini, Johnson, Singh, Newman
(2102) Astheimer, Berkes, Rakoczy, Bialystok
(2103) Zhang, Samuel
(2104) Heald, Kim, Lescop, Nusbaum
(2105) Wagge, Criss, Sewing
(2106) Galle, McMurray
(2108) Godfrey, White
(2109) Sumner
(2110) Brouwer, Bradlow
(2111) Mitchel, Stevenson, Gerfen, Weiss

Psycholinguistics II (2112–2125)
(2112) Becker, DeCot, Guerra, Knoeferle, Zwaan
(2113) Willits, Sibley, Seidenberg
(2114) Shaw, Demos, Arthur, Magnuson
(2115) Hammarlund, McDonald
(2116) Seidel, McDonald
(2117) Debey, Verschuere, Ridderinkhof, De Houwer
(2118) Desroches, Meller, Booth
(2119) Izura, Davies
(2120) Plummer, Rayner
(2121) Gagne, Spalding, El-Bialy
(2122) Hahn
(2123) Kelty, Fein, Naigles
(2124) Gillespie, Jaeger, Ferreira
(2125) Davison, Griffin

Bilingualism I (2126–2136)
(2126) Ting, Van Hell
(2127) Pu, Midgley, Holcomb, Grainger
(2128) Garcia, Heredia, Cieslicka
(2129) Leinenger, Bélanger, Slattery, Rayner
(2130) Heredia, Altamira, Cieslicka, García
(2131) Friesen, Hawrylewicz, Bialystok
(2132) Martin, Macizo, Bajo
(2133) Malt, Li, Ameel, Zhu
(2134) Gullifer, Dussias, Kroll
(2135) Lin, Schwartz
(2136) Wu, Shih, Frost, Lee, Lee, Tsai, Hung, Tzeng

Reasoning and Problem Solving (2137–2144)
(2137) Vendetti, Knowlton, Holyoak
(2138) Cushen, Wiley
(2139) Smith, Gentner
(2140) Quinn, Ellefson, Schlottmann, Taber
(2141) Blok, Grunewald, Freynik, Novick, Haarmann
(2142) Smeekens, Meier, Kane
(2143) Jarosz, Wiley
(2144) Han, Rehder

Judgment and Decision Making I (2145–2154)
(2145) VanDyke, Ferraro, Anderson, Gaddis
(2146) Taylor, Kusev
(2147) Wedell, Kim
(2148) Lemke, Kelley
(2149) Joslyn, Grounds, LeClerc
(2150) LeClerc, Joslyn
(2151) Yoon, Chapman
(2152) Liu, Luhmann
(2153) Kimura, Price
(2154) Jenny, Rieskamp, Nilsson

FRIDAY, NOVEMBER 16, 2012
1:30 p.m.–5:30 p.m.
Spoken Sessions (67–132)

Concepts and Categories II (67–72), Salon G

1:30 p.m.–1:45 p.m.	Jones
1:50 p.m.–2:05 p.m.	Little
2:10 p.m.–2:25 p.m.	Helie, Ell, Filoteo, Glass, Maddox
2:30 p.m.–2:45 p.m.	Ell
2:50 p.m.–3:05 p.m.	McDonnell, Gureckis
3:10 p.m.–3:25 p.m.	Storms, Longenecker, Voorspoels, Verheyen, Elevag

Testing Effects in Memory (73–77), Salon D

1:30 p.m.–1:45 p.m.	Pashler, Kang
1:50 p.m.–2:05 p.m.	Carr, Dewey, Dominko, Batsell, Hostetter
2:10 p.m.–2:25 p.m.	Karpicke, Grimaldi
2:30 p.m.–2:45 p.m.	Verkoeijen, Bouwmeester, Camp
2:50 p.m.–3:05 p.m.	Landon, Kimball

Judgment and Decision Making I (78–83), Salon E

1:30 p.m.–1:45 p.m.	Nelson, Divjak, Gudmundsdottir, Martignon, Meder
1:50 p.m.–2:05 p.m.	Wilke, Minich, Panis, Langen, Todd
2:10 p.m.–2:25 p.m.	Johnson, Koop
2:30 p.m.–2:45 p.m.	Gloeckner
2:50 p.m.–3:05 p.m.	Wang
3:10 p.m.–3:25 p.m.	Berkowitsch, Scheibehenne, Rieskamp

Spatial Cognition (84–88), Marquette II

1:30 p.m.–1:45 p.m.	Street, Wang
1:50 p.m.-2:05 p.m.	Shyan-Norwalt, Craig, Rand, Mesch, Morton, Flickinger
2:10 p.m.-2:25 p.m.	Shelton, Furman, Marchette, Brockman
2:30 p.m.–2:45 p.m.	Pettijohn, Thompson, Radvansky
2:50 p.m.–3:05 p.m.	Jiang, Swallow

Multiple States of Working Memory: A New Era of Fractionation? (89–93), Marquette VIII

1:30 p.m.–1:45 p.m.	Postle
1:50 p.m.–2:05 p.m.	Olivers
2:10 p.m.–2:25 p.m.	Woodman, Reinhart, Carlisle
2:30 p.m.–2:45 p.m.	Lewis-Peacock
2:50 p.m.–3:05 p.m.	Sligte

Symposium II: *The American Journal of Psychology*: Celebrating 125 Years of Contributions Shaping Contemporary Scientific Psychology, Salon C

1:30 p.m.–1:45 p.m.	Proctor
1:50 p.m.–2:05 p.m.	Fournier
2:10 p.m.–2:25 p.m.	Goolkasian
2:30 p.m.–2:45 p.m.	Roediger III, Arnold
2:50 p.m.–3:05 p.m.	Carlson
3:10 p.m.–3:25 p.m.	Altarriba

Selective Attention I (100–105), Marquette VIII

3:30 p.m.–3:45 p.m.	Klein, Hilchey, Satel
3:50 p.m.–4:05 p.m.	Becker, Bix, Bello, Sundar
4:10 p.m.–4:25 p.m.	Hollingworth, Maxcey-Richard
4:30 p.m.–4:45 p.m.	Theeuwes, Boon, Belopolsky
4:50 p.m.–5:05 p.m.	Glicksohn, Cohen
5:10 p.m.–5:25 p.m.	Wyble, Sense, Nieuwenstein

Special Session: Improving the Quality of Psychological Science (106–111), Salon D

3:30 p.m.–3:45 p.m.	Pashler
3:50 p.m.–4:05 p.m.	Francis
4:10 p.m.–4:25 p.m.	Fritz, Morris
4:30 p.m.–4:45 p.m.	Loftus, Masson
4:50 p.m.–5:05 p.m.	Kruschke
5:10 p.m.–5:25 p.m.	Lindsay

Judgment and Decision Making II (112–117), Marquette II

3:30 p.m.–3:45 p.m.	Young, Webb, Rung, Jacobs
3:50 p.m.–4:05 p.m.	Ludvig, Madan, Spetch
4:10 p.m.–4:25 p.m.	Reyna, Brust-Renck, Portenoy, Gichane, Wilhelms
4:30 p.m.–4:45 p.m.	Camilleri, Newell
4:50 p.m.–5:05 p.m.	Stevenson, Lavere, Gomez
5:10 p.m.–5:25 p.m.	White, Poldrack

Working Memory I (118–122), Salon E

3:50 p.m.–4:05 p.m.	Camos, Mora, Barrouillet
4:10 p.m.–4:25 p.m.	Mathy, Chekaf
4:30 p.m.–4:45 p.m.	Oberauer, Lewandowsky
4:50 p.m.–5:05 p.m.	Logie, Doherty
5:10 p.m.–5:25 p.m.	MacKay, Johnson

Motor Processes (123–127), Salon G

3:50 p.m.–4:05 p.m.	Logan, Crump
4:10 p.m.–4:25 p.m.	Wright, Lee
4:10 p.m.–4:25 p.m.	Rieger, Massen
4:30 p.m.–4:45 p.m.	Eder, Rothermund, De Houwer, Hommel
4:50 p.m.–5:05 p.m.	Hahn, Buttaccio

Explicit Memory II (128–132), Salon C

3:50 p.m.–4:05 p.m.	Finn, Roediger
4:10 p.m.–4:25 p.m.	Chan, LaPaglia
4:30 p.m.–4:45 p.m.	Metcalfe, Smith, Huelser
4:50 p.m.–5:05 p.m.	Annis, Malmberg, Criss, Shiffrin
5:10 p.m.–5:25 p.m.	Sahakyan, Smith

FRIDAY, NOVEMBER 16, 2012
6:00 p.m.–7:30 p.m.
Poster Session III (3001–3153)
Minneapolis Convention Center Ballroom A

Vision II (3001–3008)
(3001) Rieth, Vul
(3002) Bilge, Woodman
(3003) Christie, Hilchey, Singh, Ramesh, Klein
(3004) Hayes, Petrov
(3005) Petrov
(3006) Steele, Baker, Kimura, Gray, Strickland, Barrett
(3007) Niimi, Watanabe
(3008) Yokosawa, Asano

Action and Perception II (3009–3018)
(3009) Chihak, Plumert, Grechkin, Cremer, Kearney
(3010) Brown, Tikasz, Palmer
(3011) Isham
(3012) Shaw, Leboe-McGowan
(3013) Jardin, Lien, Proctor
(3014) Gallimore, Fournier
(3015) Miles
(3016) Dolk, Liepelt, Hommel, Prinz
(3017) Chapman, Weiss
(3018) Gabbard, Caçola

Spatial Cognition III (3019–3030)
(3019) Weisberg, Nardi, Newcombe, Shipley
(3020) Bennett, Loomis, Klatzky, Giudice
(3021) Holden, Newcombe, Shipley
(3023) Caçola, Gabbard
(3024) Giudice, Bennett, Klatzky, Loomis
(3025) Veronelli, Vallar, Marinelli, Primativo, Arduino
(3026) Maloney, Risko, Waechter, Wieth, Beilock, Fugelsang
(3027) Doyle, Voyer
(3028) Sutton
(3029) Chen, McNamara, Kelly
(3030) Treccani, Sellaro, Job, Cubelli

Collaboration and Memory (3031–3039)
(3031) Erdman, Sjolund, Kelly
(3032) Numbers, McNabb, Meade
(3033) Choi, Blumen, Congleton, Rajaram
(3034) Andrews, Horton
(3035) Blunt, Rahman, Karpicke
(3036) Congleton, Rajaram
(3037) Pociask, Rajaram
(3038) Barnier, Priddis, Addis
(3039) Stevens, Winke

Recognition Memory II (3040–3047)
(3040) Landon, Kimball, Mann
(3041) Ryals, Cleary, Seger
(3042) Palmer, Havelka, van Hooff
(3043) Dopkins, Pyoun, Varner
(3044) Naveh-Benjamin, Brubaker, Fine
(3045) Hatano, Kitagami, Kawaguchi
(3046) Meltzer, Bartlett, Arduengo
(3047) Arikan, Kapucu

Human Learning and Instruction II (3048–3056)
(3048) Werner
(3049) Galotti
(3050) Yue, Bjork, Bjork
(3051) Nguyen, McDaniel
(3052) Boncoddo, Thevenow-Harrison, Rogers, Alibali, Kalish
(3053) Fiorella, Mayer
(3054) Allen, Clark, Morere
(3055) Sana, Teeter, Kim
(3056) Palmer-Landry, Christianson

Prospective Memory (3057–3065)
(3057) Einstein, Hess, Mullet
(3058) Rose, Craik, Kleigel, Hering, Rendell
(3059) Lee, Bugg, McDaniel
(3060) Ball, Wingert, Eren, Brewer
(3061) Thomas, McBride
(3062) Rummel
(3063) Kuhlmann, Rummel, Touron
(3064) Lourenco, Hill, Maylor
(3065) Waldum, McDaniel

Metamemory/Metacognition II (3066–3079)
(3066) Zakrzewski, Perdue, Beran, Church, Smith
(3067) Susser, Mulligan
(3068) Zawadzka, Higham
(3069) Coutinho, Church, Smith
(3070) Holder, Hertzog
(3071) Magreehan, Schwartz, Narciss, Krille
(3072) Izaute, Bacon
(3073) Tullis, Benjamin
(3074) Sitzman, Rhodes, Tauber
(3075) Miller, Geraci
(3077) Wright, Bond, Taylor-Moody, Berry, Iqbal, Joseph, McElroy, Price
(3078) Kelly, Metcalfe
(3079) Thuaire, Izaute, Bacon

Cognitive Aging (3080–3092)
(3080) Gomes, Brainerd, Reyna
(3081) McDonough, Kennedy, Rodrigue, Hebrank, Park
(3082) Dutilh, Forstmann, Vanderkerckhove, Wagenmakers
(3083) Shafto, Randall, Tyler
(3084) Wright, Clement, Atkins, Park, Bond, Price, Neuschatz
(3085) Barber, Mather
(3086) Nutile, Garrison, Drummey, Kan
(3087) Carson, Murphy, Moscovitch, Rosenbaum
(3088) Maquestiaux, Didierjean, Ruthruff, Chavel, Hartley
(3089) Westbrook, Braver
(3090) VanWormer, Sober
(3091) Kurby, Asiala, Mills
(3092) Bangert, Dorgo, Reed-Jones, Heydarian, Montes, Bulusu

Selective Attention III (3093–3103)
(3093) DaSilva, Haerich
(3094) Stokes, Arnell
(3095) Inukai, Kawahara
(3096) Della Libera, Perlato, Santandrea, Chelazzi
(3097) Jackson, Balota, Duchek, Fagan, Holtzman
(3098) Elliott, Morey, Morey, Eaves, Shelton, Lutfi-Proctor
(3099) Chiou, Rich
(3100) Burnham, Bruno
(3101) Risko, Maloney, Fugelsang
(3102) Shimomura, Kumada
(3103) Ivanoff, Jollie

Discourse Processes (3104–3111)
(3104) Paxton, Dale
(3105) Gunawan, Osman, Copeland, Larson
(3106) Kendeou, Walsh, Smith, O'Brien
(3107) Clinton, Seipel
(3108) Higgs, Magliano, Vidal-Abarca, McNamara
(3109) Zeamer, Fox Tree
(3110) Singer, Doering
(3111) Harris, Peoples, Phelan, Coello

Language Production/Writing (3112–3123)
(3112) James, Sprague, Bowman, Crandall, Oberle
(3113) Davis, Abrams
(3114) Jacobs, Dell
(3116) Kleinman, Runnqvist, Ferreira
(3117) Baese-Berk
(3118) Oppenheim
(3119) White, LaBat, Rhynes, Abrams
(3120) Cohen-Shikora, Schotter, Balota, Yap
(3121) Brehm, Bock
(3122) Chen, Taft
(3123) Kutta, Kaschak

Judgment and Decision Making II (3124–3135)
(3124) Cousineau, Harding, Engmann, Mestari
(3125) Yang, Hu
(3126) Hawkins, Forstmann, Wagenmakers, Brown
(3127) Acuff, Franco-Watkins, Johnson
(3128) Andraszewicz, Scheibehenne, Rieskamp
(3129) Freedman, Broadbent, Gengler, Lyle
(3130) VanDyke, Petros
(3131) Halali, Bereby-Meyer, Meiran
(3132) Ketels, Healy, Wickens, Buck-Gengler, Bourne Jr.
(3133) Mathews, Ledet
(3134) Nakamura, Wajima, Terai, Yamagishi, Nakagawa
(3135) Pan, Shah, Miller

Timing and Sequencing (3136–3138)
(3136) Attarha, Vecera, Moore
(3137) Plant, Turner
(3138) Grant

Cognition and Emotion (3139–3153)
(3139) Lepping, Atchley, Martin, Brooks, Clair, Ingram, Savage
(3140) Bowman, Yamauchi
(3141) Smith, Cunningham, Dennis, Sederberg
(3142) Burch, Wenner, Schlesinger
(3143) Negley, Kelley, Lewis
(3144) Karam, Lane, Cook
(3145) Johnson, MacKay
(3146) Li, Altarriba
(3147) Vogt, Koster, De Houwer
(3148) Huang, Lee
(3149) Dowman, Toia
(3150) Chiew, Braver
(3151) Taylor, Lien, Ruthruff
(3152) Knickerbocker, Johnson, Altarriba
(3153) Broadwell, DeYoung, Domansky, Deason, Marsolek

SATURDAY, NOVEMBER 17, 2012
8:00 a.m.–12:00 noon
Spoken Sessions (133–191)

Embodied Cognition (133–137), Marquette II

8:00 a.m.–8:15 a.m.	Soliman, Ferguson, Glenberg
8:20 a.m.–8:35 a.m.	Weidler, Abrams
8:40 a.m.–8:55 a.m.	Davoli, Thomas, Brockmole
9:00 a.m.–9:15 a.m.	Creem-Regehr, Gagnon, Tarampi
9:20 a.m.–9:35 a.m.	Masson, Bub, Lavelle

Working Memory II (138–141), Salon C

8:00 a.m.–8:15 a.m.	Jackson, Linden, Raymond
8:20 a.m.–8:35 a.m.	Barrouillet, Plancher
8:40 a.m.–8:55 a.m.	Lange, Thomas, Buttaccio, Davelaar
9:00 a.m.–9:15 a.m.	Koutmeridou, Roy-Charland, Plamondon, Poirier

Judgment and Decision Making III (142–147), Salon E

8:00 a.m.–8:15 a.m.	Yechiam, Hochman, Telpaz
8:20 a.m.–8:35 a.m.	Keysar, Hayakawa, An
8:40 a.m.–8:55 a.m.	Franco-Watkins, Johnson
9:00 a.m.–9:15 a.m.	Brown, Hawkins, Marley, Heathcote, Louviere, Flynn
9:20 a.m.–9:35 a.m.	Luan, Schooler, Gigerenzer
9:40 a.m.–9:55 a.m.	Maloney, Tee, Zhang

Explicit Memory III (148–153), Salon D

8:00 a.m.–8:15 a.m.	Aβfalg, Bernstein
8:20 a.m.–8:35 a.m.	Murayama, Kitagami
8:40 a.m.–8:55 a.m.	Nairne, VanArsdall, Cogdill, Pandeirada
9:00 a.m.–9:15 a.m.	Smith, Murray
9:20 a.m.–9:35 a.m.	Loft, Humphreys
9:40 a.m.–9:55 a.m.	Kelley, Neath, Surprenant

Timing and Sequencing (154–158), Salon G

8:00 a.m.–8:15 a.m.	Horowitz, Maher, Levin-Gleba, Oliva
8:20 a.m.–8:35 a.m.	Palmer, Lidji, Peretz
8:40 a.m.–8:55 a.m.	Chaffin, Demos, Kant, Lisboa
9:00 a.m.–9:15 a.m.	Pfordresher, Mantell
9:20 a.m.–9:35 a.m.	Schellenberg, Stalinski, Marks

Human Learning and Instruction I (159–163), Marquette VIII

8:00 a.m.–8:15 a.m.	Lindsey, Mozer, Pashler
8:20 a.m.–8:35 a.m.	Oppenheimer, Mueller
8:40 a.m.–8:55 a.m.	Fazio, Thompson, Siegler
9:00 a.m.–9:15 a.m.	Kang, Pashler
9:20 a.m.–9:35 a.m.	Barber, Mather

Cognitive Aging (164–169), Marquette VIII

10:00 a.m.–10:15 a.m.	Thomas, Lee, Bulevich
10:20 a.m.–10:35 a.m.	Lemaire, Leclere
10:40 a.m.–10:55 a.m.	Biss, Campbell, Ngo, Rowe, Hasher
11:00 a.m.–11:15 a.m.	Bryce, Dodson
11:20 a.m.–11:35 a.m.	Pollock, Khoja, Lien, Allen
11:40 a.m.–11:55 a.m.	Rogers, Jacoby, Sommers, Wingfield

Action and Perception I (170–175), Salon G

10:00 a.m.–10:15 a.m.	McBeath, Naylor
10:20 a.m.–10:35 a.m.	Janczyk, Pfister, Crognale, Kunde
10:40 a.m.–10:55 a.m.	Taylor, Macken
11:00 a.m.–11:15 a.m.	Tversky, Jamalian
11:20 a.m.–11:35 a.m.	Day
11:40 a.m.–11:55 a.m.	Pepperberg, Nakayama

Implicit Learning and Memory (176–181), Marquette II

10:00 a.m.–10:15 a.m.	Todd, Provost, Whitson, Heathcote
10:20 a.m.–10:35 a.m.	Gaskell, Warker, Frost, Guest, Snowden, Stackhouse
10:40 a.m.–10:55 a.m.	Chechile, Sloboda, Warren, Barch, Chamberland
11:00 a.m.–11:15 a.m.	Goujon, Didierjean
11:20 a.m.–11:35 a.m.	Bueno, Bigand, Firmino
11:40 a.m.–11:55 a.m.	Miller, Polack

Working Memory III (182–186), Salon D

10:20 a.m.–10:35 a.m.	Raymond, Thomas
10:40 a.m.–10:55 a.m.	Endress, Potter
11:00 a.m.–11:15 a.m.	Mäntylä
11:20 a.m.–11:35 a.m.	Cowan, Blume, Saults
11:40 a.m.–11:55 a.m.	Harrison, Shipstead, Hicks, Redick, Hambrick, Engle

Psycholinguistics I (187–191), Salon E

10:20 a.m.–10:35 a.m.	Finley
10:40 a.m.–10:55 a.m.	McCauley, Christiansen
11:00 a.m.–11:15 a.m.	Berent, Dupuis, Brentari
11:20 a.m.–11:35 a.m.	Schnur
11:40 a.m.–11:55 a.m.	Goldrick, Chu

Symposium III: The Adaptive Nature of Memory Illusions: Positive Consequences can Arise from Illusory Memories, Salon C

9:50 a.m.–9:55 a.m.	Howe
9:55 a.m.–10:15 a.m.	Roediger III
10:15 a.m.–10:35 a.m.	Schacter
10:35 a.m.–10:55 a.m.	Conway
10:55 a.m.–11:15 a.m.	Reyna, Brainerd
11:15 a.m.–11:35 a.m.	Howe, Wilkinson, Monaghan
11:35 a.m.–11:50 a.m.	Lindsay
11:50 a.m.–12:00 noon	Howe

SATURDAY, NOVEMBER 17, 2012

12:00 noon–1:30 p.m.
Poster Session IV (4001–4152)
Minneapolis Convention Center Ballroom A

Action and Perception III (4001–4006)
(4001) Behmer Jr., Fournier
(4002) Pfister, Janczyk, Dignath, Hommel, Kunde
(4003) Demos, Chaffin, Marsh
(4004) Hsu
(4005) Huestegge, Kreutzfeldt
(4006) Sellaro, Treccani, Cubelli

Testing Effects II (4007–4018)
(4007) Vaughn, Rawson
(4008) Picklesimer, Mulligan
(4009) Tse, Altarriba
(4010) Pierce, Hawthorne, Gallo, Bolson
(4011) Weber, Seror, Neill
(4012) Smith, Goldwater, Hinze
(4013) Mensink, Hinze, Lewis, Weishaar
(4014) Rose, Butler, Nunes, Roediger III
(4015) Jennings, Taraban
(4016) Tse, Pu
(4017) Arnold, McDermott
(4018) Wisniewski, Mercado III, Church

Associative Learning (4019–4027)
(4019) Clark-Foos, Draheim, Mennie
(4020) Weber, Messing, Thompson-Schill
(4021) Germain-Mondon, Izaute
(4022) Carney, Levin, Dyn, Locke, Richmond
(4023) Huelser, Metcalfe
(4024) Otsuka, Nishiyama, Kawaguchi
(4025) Klein, Cleary
(4026) Cushman, Mutter, Owen, Steen
(4027) Kersten, Earles, Berger

Explicit Memory II (4028–4052)
(4028) Ozubko, Winocur, Moscovitch
(4029) Maddox, Balota
(4030) Cho, Neely
(4031) LaVoie, Olbinski, Gupta, Perszyk
(4032) Potts, Shanks
(4033) Gray, Fishman, Gallo
(4034) Divis, Benjamin
(4035) Kim, Park
(4036) Nestojko, Roediger III
(4037) Racsmány, Pajkossy, Szőllősi
(4038) Lyle, Edlin
(4039) Schilling, Storm
(4040) Koppel, Storm
(4041) Delaney, Godbole, Verkoeijen, Chang
(4042) Hicks, DeWitt
(4043) Dennis
(4044) Kuhn, Lohnas, Kahana
(4045) Morton, Polyn
(4046) Bays, Foley
(4047) Hamilton
(4048) Hanczakowski, Beaman, Jones
(4049) Guillory
(4050) Butler, Marsh
(4051) Ariel, Castel
(4052) Tat, Azuma

False Memory/Misinformation Effect (4053–4063)
(4053) Oliveira, Albuquerque, Machado
(4054) Wilkinson, Howe
(4055) Wynne, Tolan, Tehan
(4056) Fenn, Zaragoza
(4057) Festini, Reuter-Lorenz
(4058) Goodwin, Holden, Ensor
(4059) Mullet, Umanath, Marsh
(4060) Carneiro, Fernandez, Albuquerque, Garcia-Marques
(4061) Nunes, Garcia-Marques, Ferreira
(4062) Giammattei, Arndt, Dethier
(4063) Salleh, Goh

Working Memory III (4064-4079)
(4064) Chow, Macnamara, Conway
(4065) Tan, Acheson, Martin
(4066) Elliott, Hughes, Macken, Briganti, Kytola
(4067) Anderson, Miyake, Turley-Ames
(4068) Lilienthal, Tamez, Rose, Myerson, Hale
(4069) Saint-Aubin, Guérard
(4070) Ricker, Cowan
(4071) Poirier, Taylor, Heussen, Hampton
(4072) Harris, Elliott
(4073) Gustavson, Miyake
(4074) DeCaro
(4075) Silasi-Mansat, Worthy
(4076) Fischer-Baum
(4077) Weldon, Sohn
(4078) Vergauwe, Langerock, Barrouillet
(4079) Sprenger, Atkins, Colflesh, Briner, Buchanan, Chavis, Chen, Iannuzzi

Metamemory/Metacognition III (4080-4095)
(4080) Finley, Benjamin, McCarley
(4081) Stevens, Carlson
(4082) Tan, Eakin, Moss, Wong
(4083) Thiede, Redford, Wiley, Griffin
(4084) Pilegard, Mayer
(4085) Abushanab, Bishara
(4086) Wright, Wade, Watson
(4087) Takarangi, Strange, Lindsay
(4088) Juback, Dasse, Evans, Morissette, Weaver III
(4089) Fraundorf, Benjamin
(4090) Ricks, Fenn, Hambrick
(4091) Frank, Touron, Hertzog
(4092) de Bruin, Kok, Camp
(4093) Kornell
(4094) Ackerman
(4095) Roberts, Callender, Franco-Watkins

Selective Atttention IV (4096-4108)
(4096) Kim, McAuley
(4097) Tellinghuisen, Cohen
(4098) Nöstl, Sörqvist
(4099) Dixon, Westbury
(4100) Schröter, Birngruber, Ulrich, Miller
(4101) Blagrove, Watson
(4102) Lamy, Zivony
(4103) Chao
(4104) Waechter, Ehrlich, Stolz, Besner
(4105) Shimi, Scerif
(4106) Vinski, Unwalla, Watter
(4107) Schad, Engbert
(4108) Anderson, Yantis

Divided Attention (4109–4118)
(4109) Zhang, Yonelinas
(4110) Houpt, Heathcote, Eidels, Medeiros-Ward, Watson, Strayer
(4111) Bratzke, Seifried
(4112) Yanko, Spalek
(4113) Pieczykolan, Huestegge
(4114) Wifall, Hazeltine
(4115) Shepherdson, Miller
(4116) Thomson, Danis, Watter
(4117) Liu, Becker
(4118) Kim, Chang, Cho

Cognitive Control III (4119–4126)
(4119) Grzyb, Hübner
(4120) Halvorson, Hazeltine
(4121) Alzahabi, Becker
(4122) Viau-Quesnel, Fortin
(4123) Faust, Multhaup, Barakzai, Plumeau, Ross, Stubblefield
(4124) Bissett, Logan
(4125) Naylor, Lien, Ruthruff
(4126) Faizal, Yap, Rickard Liow

Letter and Word Processing II (4127–4142)
(4127) Schotter, Bicknell, Levy, Rayner
(4128) Jones, Rawson
(4129) Juhasz, Brewer, Tolman, Johnson
(4130) Job, Treccani, Sulpizio, Mulatti
(4131) Jones, Fuss
(4132) Buchanan, Valentine, Teasley
(4133) Trinh, Jared
(4134) Mirman, Britt, Chen
(4135) Zhuravleva, Lupker
(4136) Bicknell, Higgins, Rayner
(4137) Hino, Kusunose, Lupker, Jared
(4138) Li, Gu, Liu, Rayner
(4139) Tao, Healy
(4140) Levy, Staub
(4141) Barnhart, Goldinger
(4142) McGowan, White, Paterson

Psycholinguistics III (4143–4152)
(4143) Abbott, Rayner
(4144) Vanyukov, Warren, Reichle
(4145) Huette, Matlock, Spivey
(4146) Isberner, Richter
(4147) Yee, Heller, Sedivy
(4148) Ivanova, Salmon, Gollan
(4149) Spalding, Gagné
(4150) Zhao, Berent
(4151) Pardo, Jordan, Mallari, Scanlon, Lewandowski
(4152) Lindemann, Krause

SATURDAY, NOVEMBER 17, 2012
1:30 p.m.–4:30 p.m.
Spoken Sessions (200–246)

Action and Perception II (200–203)
1:30 p.m.–1:45 p.m. Ziemer, Plumert, Chihak, Cremer, Kearney
1:50 p.m.–2:05 p.m. Wright, Carrigan, Martinez, Shamshiri, Yee
2:10 p.m.–2:25 p.m. Gomez, Perea
2:30 p.m.–2:45 p.m. Witt, Sugovic

Judgment and Decision Making IV (204–207), Salon E
1:30 p.m.–1:45 p.m. Wolfe, Fisher
1:50 p.m.–2:05 p.m. Zhang, Maloney
2:10 p.m.–2:25 p.m. Ratcliff, Thompson, McKoon
2:30 p.m.–2:45 p.m. Hastie, Rottman

Bilingualism II (208–211), Marquette II
1:30 p.m.–1:45 p.m. Caldwell-Harris, Aycicegi-Dinn
1:50 p.m.–2:05 p.m. Gollan, Goldrick
2:10 p.m.–2:25 p.m. Ryskin, Brown-Schmidt
2:30 p.m.–2:45 p.m. Schwartz, Lin

Automatic Processing (212–215), Marquette VIII
1:30 p.m.–1:45 p.m. Reynolds, Blumenthal
1:50 p.m.–2:05 p.m. Perry, Lupker
2:10 p.m.–2:25 p.m. Neely, Thomas, Kahan
2:30 p.m.–2:45 p.m. Content, Guillaume

Human Learning and Instruction II (216–219), Salon D
1:30 p.m.–1:45 p.m. Schwartz, Brothers
1:50 p.m.–2:05 p.m. Erev, Hochman
2:10 p.m.–2:25 p.m. Roediger III, Pyc, Tully, Balota, McDermott
2:30 p.m.–2:45 p.m. Novick

Symposium IV: Psychonomics without Experiments: Discovering Psychological Principles by Mining Large Data Sets, Salon C
1:30 p.m.–1:40 p.m. Goldstone
1:40 p.m.–1:58 p.m. Oliva
2:01 p.m.–2:19 p.m. Griffiths
2:22 p.m.–2:40 p.m. Christiansen
2:43 p.m.–3:01 p.m. Berger
3:04 p.m.–3:22 p.m. Pope
3:25 p.m.–3:40 p.m. Goldstone

Action, Cognition, and Object Manipulation (227–230), Marquette VIII
3:10 p.m.–3:25 p.m. Rosenbaum
3:30 p.m.–3:45 p.m. Weiss, Chapman
3:50 p.m.–4:05 p.m. van der Wel
4:10 p.m.–4:25 p.m. Herbort

Visual Processing (231–234), Salon E
3:10 p.m.–3:25 p.m. Altieri, Townsend
3:30 p.m.–3:45 p.m. Jacob, Breitmeyer
3:50 p.m.–4:05 p.m. Cole, Kuhn
4:10 p.m.–4:25 p.m. Picchioni, McWhirter, Morrow, Lee, Shrinivas, Zametkin, Balkin, Smith

Associative Learning (235–238), Salon G
3:10 p.m.–3:25 p.m. Butler, Franks
3:30 p.m.–3:45 p.m. Jamieson, Chubala, Hannah, Crump
3:50 p.m.–4:05 p.m. Sakaki, Ycaza, Mather
4:10 p.m.–4:25 p.m. Suzuki, Honma, Suga

Mechanisms of Linguistic Relativity (239–242), Marquette II
3:10 p.m.–3:25 p.m. Malt
3:30 p.m.–3:45 p.m. Gentner
3:50 p.m.–4:05 p.m. Bock
4:10 p.m.–4:25 p.m. Lupyan

Human Learning and Instruction III (243–246), Salon D
3:10 p.m.–3:25 p.m. Smith, Handy, Nichols, Angello
3:30 p.m.–3:45 p.m. Rickard, Walker
3:50 p.m.–4:05 p.m. Baggett, Ehrenfeucht
4:10 p.m.–4:25 p.m. Kalish, Griffiths, Lewandowsky

SATURDAY, NOVEMBER 17, 2012
6:00 p.m.–7:30 p.m.
Poster Session V (5001–5154)
Minneapolis Convention Center Ballroom A

Embodied Cognition II (5001–5006)
(5001) Gill, Durtschi, Cutting, Jordan
(5002) Hsu, Schlichting, Thompson-Schill
(5003) Liew, Vaid
(5004) Miller, Brookie
(5005) Kontra, Lyons, Fischer, Beilock
(5006) Seli, Jonker, Smilek

Music Perception (5007-5011)
(5007) Hedger, Heald, Nusbaum
(5008) Ngo, Vu, Strybel
(5009) Cook, Rouse, Wilson, Reichmuth
(5010) Dowling
(5011) Mathias, Palmer, Perrin, Tillmann

Event Cognition (5012-5015)
(5012) Hafri, Papafragou, Trueswell
(5013) Clinton, Briner, Sherrill, Magliano
(5014) Swets, Kurby
(5015) Eisenberg, Sargent, Zacks

Social Aspects of Memory (5016-5021)
(5016) Gauer, deSouza
(5017) Leshikar, Gutchess
(5018) Kole, Healy
(5019) Wenzel, Gerrig
(5020) Anderson, Healy, Jones, Bourne Jr.
(5021) Cho, Feldman

Explicit Memory III (5022–5033)
(5022) Fitzgerald, Wright, Soucie
(5023) White-Schwoch, Jacovina, Culpepper, Rapp
(5024) Deffler, Ogle, Rubin
(5025) Morais, Olsson, Schooler
(5026) Smith, Olarano, Vul, Huber
(5027) Yu, Hussey, Dougherty, Harbison, Davelaar
(5028) Lehman, Smith, Karpicke
(5029) Miyatsu, Friedman, Castel, Bjork
(5030) Forrin, Jonker, MacLeod
(5031) Rich, Zaragoza
(5032) Chalmers, Turon
(5033) Bright, Besch, Noice, Noice

Human Learning and Instruction III (5034–5041)
(5034) de Jonge, Tabbers, Jang, Pecher, Zeelenberg
(5035) Hays, Finley, Bjork, Benjamin, Walker
(5036) Nestojko, Bui, Roediger III
(5037) Yan, Vetter, Bjork
(5038) Park, Nah, Ji, Kim
(5039) Goossens, Camp, Verkoeijen, Tabbers, Zwaan
(5040) Mechanik, Marsh
(5041) Brusnighan, Folk

Automatic Processing (5042–5046)
(5042) Uzzaman, Joordens
(5043) Faulkenberry, Montgomery
(5044) Snyder, Ashitaka, Logan, Shimada
(5045) Giesen, Rothermund
(5046) Tane, Michimata

Cognitive Control IV (5047–5055)
(5047) Friedrich, Nelson, Costa
(5048) Bugg, Dayan
(5049) Dreisbach, Fischer
(5050) Crump, Gureckis, McDonnell
(5051) Hydock, Philbeck, Sohn
(5052) Teubner-Rhodes, Bolger, Novick
(5053) Chrysikou, Johnson, Vickers
(5054) Wynn, Hitchins, Sohn
(5055) Hitchins, Wynn, Sohn

Speech Perception II (5056–5063)
(5056) Slevc, Simmons, Martin
(5057) Mitterer, Reinisch
(5058) Newman
(5059) Apfelbaum, McMurray
(5060) Szostak, Pitt, Dilley
(5061) Bergelson, Dahan
(5062) Krestar, Incera, McLennan
(5063) Reinisch, Holt

Motor Control (5064–5068)
(5064) Chen, Proctor
(5065) Ford, Aberdein
(5066) Murchison, Proctor
(5067) Vaughan, Lantz, Andrews, Geduldig, Wildman
(5068) Slifkin, Eder

Letter and Word Processing III (5069–5087)
(5069) Sturgill
(5070) Sheridan, Reingold
(5071) Kelly, van Heuven, Pitchford, Ledgeway
(5072) New, Doré-Mazars, Issard, Barra
(5073) Vergara-Martínez, Perea, Gomez, Swaab
(5074) Tamaoka
(5075) Eddy, Grainger, Holcomb, Gabrieli
(5076) Coane, Sanchez Gutierrez
(5077) Belanger, Mayberry, Rayner
(5078) Coane, Caron, LaViolet, LaRose-Sienkiewicz, Broder
(5080) Kihas, Robidoux
(5081) Morris, Grainger, Holcomb
(5082) Roy-Charland, Saint-Aubin, Lawrence, Klein
(5083) Adelman
(5084) Harris, Gabbard, Perfetti
(5085) Schotter, Rayner
(5086) Still, Morris
(5087) Whitford, Titone

Concepts and Categories II (5088–5106)
(5088) Shanks, Marsh
(5089) Rottman, Prochaska, Deaño, Meltzer
(5090) Hill, Bohil, Maddox
(5091) Conaway, Kurtz
(5092) Austerweil, Griffiths
(5093) Jung, Hummel
(5094) Corral, Jones
(5095) Canty, Pellegrino, Goldman
(5096) Weine, Kim
(5097) Hoffmann, von Helversen, Rieskamp
(5098) Sera, Shao
(5099) Cate, Herron, Woods
(5100) Sifonis, Memering
(5101) Kelly, Heit
(5102) Roberts, Burgeson, Ohler, Kantner
(5103) Little, McDaniel, Cahill
(5104) Clapper
(5105) Higgins, Bohil, Keebler
(5106) Carvalho, Goldstone

Psycholinguistics IV (5107–5114)
(5107) Shears, Barr, Brown, Flax
(5108) Daniel, Collins, Virtue, Cossio, Rivas, Ozier, Boylan
(5109) Faleer, Llewelyn, Ashby
(5110) Ozuru, Kaufman, Bowie
(5111) Yoon, Brown-Schmidt
(5112) Riordan, Kreuz, Olney
(5113) Stafura, Perfetti
(5114) Katz, Boylan

Bilingualism II (5115–5128)
(5115) Linck, Jackson, Silbert, Tare, Bowles, Campbell, Bunting
(5116) Linck, Osthus, Koeth, Bunting
(5117) Gundersen, Eberhard
(5118) Phillips, Eddington, Phillips, Tokowicz
(5119) Degani, Phillips, Tokowicz
(5120) Fink, Goldrick
(5121) Rossi, Newman, Diaz, Kroll
(5122) Litcofsky, van Hell
(5123) Gil, Carreiras, Salillas
(5124) Ratiu, Azuma
(5125) Li, Lin, Tzeng, Hung, Wu
(5126) Olmstead, Viswanathan, Aivar, Manuel, Mason
(5127) Kim, Wang
(5128) Peters, Wilson, Almor

Reasoning and Problem Solving II (5129–5136)
(5129) Rhodes, Rodriguez, Shah
(5130) Pennycook, Cheyne, Koehler, Fugelsang
(5131) Ramey
(5132) Taylor
(5133) Grimm, Braham, Pagan
(5134) Trippas, Handley, Verde
(5135) Barch, Chechile, Schultz, Smith, Sommers, Nickerson
(5136) Dietz, Goldman

Judgment and Decision Making III (5137–5154)
(5137) Powell, Holyoak
(5138) Cavrak, Kleider
(5139) Martin
(5140) Schwikert, Curran
(5141) Matsuda, Sugimori, Kusumi
(5142) Miclat, Estep, Burgess
(5143) Malavanti, Weaver III
(5144) Vanderveldt, Green, Myerson
(5145) Greenstein, Xu
(5146) von Helversen, Mata, Samanez-Larkin, Wilke
(5147) Pittman, Toglia, Leone, Mueller-Johnson
(5148) Pachur, Olsson
(5149) Stein, Sapochetti, Coy, Wolford
(5150) Berkowitsch, Rieskamp, Scheibehenne
(5151) Johnson, Zhou
(5152) Hotaling, Busemeyer
(5154) Isham, Gwinn, Geng

SUNDAY, NOVEMBER 18, 2012
8:00 a.m.–12:00 noon
Spoken Sessions (249–314)

Speech Perception (249–254), Marquette II

8:00 a.m.–8:15 a.m.	Remez, Thomas, Crank, Porter, Koinis, Kostro, Paddu, Cheimets
8:20 a.m.–8:35 a.m.	Bent
8:40 a.m.–8:55 a.m.	Samuel, Larraza
9:00 a.m.–9:15 a.m.	Baart, Vroomen, Shaw, Bortfeld
9:20 a.m.–9:35 a.m.	Bradlow, Vaughn, Brouwer
9:40 a.m.–9:55 a.m.	Gow, Nied

Selective Attention II (255–260), Salon D

8:00 a.m.–8:15 a.m.	Hübner, Töbel
8:20 a.m.–8:35 a.m.	Matsukura, Cosman, Roper, Vatterott, Vecera
8:40 a.m.–8:55 a.m.	Gronau
9:00 a.m.–9:15 a.m.	Lleras, Buetti
9:20 a.m.–9:35 a.m.	Bocanegra, Zeelenberg
9:40 a.m.–9:55 a.m.	Hoffman, Kennedy, Rawding, Most

Biological Aspects of Memory (261–266), Marquette VIII

8:00 a.m.–8:15 a.m.	Diana, Yonelinas, Ranganath
8:20 a.m.–8:35 a.m.	Yonelinas, Aly
8:40 a.m.–8:55 a.m.	Mitchell, Ankudowich, Durbin, Johnson
9:00 a.m.–9:15 a.m.	Wixted, Papesh, Goldinger, Jang, Steinmetz
9:20 a.m.–9:35 a.m.	Rose, Craik, Buschsbaum
9:40 a.m.–9:55 a.m.	Nelson, Arnold, Gilmore, Najjar, Finn, McDermott

Word Recognition (267–272), Salon E

8:00 a.m.–8:15 a.m.	Behrmann, Dundas, Plaut
8:20 a.m.–8:35 a.m.	Chetail, Content
8:40 a.m.–8:55 a.m.	Feldman, Filipović Đurđevic
9:00 a.m.–9:15 a.m.	Forster
9:20 a.m.–9:35 a.m.	Schroeder
9:40 a.m.–9:55 a.m.	Choi, Gordon

Language Processing (273–277), Salon G

8:00 a.m.–8:15 a.m.	Staub, Grant, Astheimer, Cohen
8:20 a.m.–8:35 a.m.	McCormick, Rastle
8:40 a.m.–8:55 a.m.	Crepaldi, Rastle, Davis
9:00 a.m.–9:15 a.m.	Izura, Playfoot
9:20 a.m.–9:35 a.m.	Fostick, Korecky, Maltz, Babkoff

False Memory and Eyewitness Identification (278–282), Salon C

8:00 a.m.–8:15 a.m.	Tolan, Roche, Tehan
8:20 a.m.–8:35 a.m.	Hunt
8:40 a.m.–8:55 a.m.	Umanath, Marsh
9:00 a.m.–9:15 a.m.	Mickes, Flowe, Wixted
9:20 a.m.–9:35 a.m.	Clark, Moreland, Gronlund

Explicit Memory IV (283–287), Salon D

10:20 a.m.–10:35 a.m.	Rouder, Province, Swagman
10:40 a.m.–10:55 a.m.	Sadeh, Moran, Goshen-Gottstein
11:00 a.m.–11:15 a.m.	Starns, Pazzaglia, Rotello, Hautus, Macmillan
11:20 a.m.–11:35 a.m.	Steyvers, Turner
11:40 a.m.–11:55 a.m.	Mulligan, Peterson

Psycholinguistics II (288–292), Marquette II

10:20 a.m.–10:35 a.m.	King, McRae
10:40 a.m.–10:55 a.m.	Caplan, Evans
11:00 a.m.–11:15 a.m.	Trueswell, Nicol Medina, Hafri, Gleitman
11:20 a.m.–11:35 a.m.	Dumay, Damian, Bowers
11:40 a.m.–11:55 a.m.	Goodman

Perceptual Processes (293–297), Marquette VIII

10:20 a.m.–10:35 a.m.	Bridgeman
10:40 a.m.–10:55 a.m.	Herzog
11:00 a.m.–11:15 a.m.	Palomares
11:20 a.m.–11:35 a.m.	Gao, McClelland
11:40 a.m.–11:55 a.m.	Vo, Wolfe

Attentional Control (298–302), Salon E

10:20 a.m.–10:35 a.m.	Leber, O'Toole
10:40 a.m.–10:55 a.m.	Folk, Kendzierski, Wyble
11:00 a.m.–11:15 a.m.	Gibson, Adam, Davis
11:20 a.m.–11:35 a.m.	Schubert, Redel, Eder, Finke, Strobach
11:40 a.m.–11:55 a.m.	Hyman, Duskin, Pearson, Cutshaw

Action and Perception III (303–308), Salon G

10:00 a.m.–10:15 a.m.	van Elk, Kannape, Blanke
10:20 a.m.–10:35 a.m.	Purcell, Stewart
10:40 a.m.–10:55 a.m.	Bertenthal, Boyer, Han
11:00 a.m.–11:15 a.m.	Vinson, Jordan
11:20 a.m.–11:35 a.m.	Wu, Klatzky, Galeotti
11:40 a.m.–11:55 a.m.	Cox, Coltheart, Langdon

Letters and Word Processing II (309–314), Salon C

10:00 a.m.–10:15 a.m.	Eidels, Devine, Algom
10:20 a.m.–10:35 a.m.	Gorfein
10:40 a.m.–10:55 a.m.	Molinaro, Lizarazu, Duñabeitia, Carreiras
11:00 a.m.–11:15 a.m.	Christianson, Stoops
11:20 a.m.–11:35 a.m.	Raney, Ali, Bovee
11:40 a.m.–11:55 a.m.	Bowers, Damian, Vankov, Davis

Explicit Memory I
Salon G, Friday Morning, 8:00-9:40
Chaired by Steve Janssen, Flinders University

8:00-8:15 (1)
Cross-Cultural Differences in the Temporal Distribution of Autobiographical Memory. STEVE M. J. JANSSEN, *Flinders University,* ANNA GRALAK, *Warsaw School of Social Sciences and Humanities,* YAYOI KAWASAKI, *Nihon University,* GERT KRISTO, *University of Tilburg,* PEDRO M. RODRIGUES and JAAP M. J. MURRE, *University of Amsterdam*—The temporal distribution of autobiographical memory was investigated with the Galton-Crovitz cueing technique through the Internet. The online questionnaire was translated into six languages. A large group of participants (over 18,000) from 11 countries was presented 10 cue words. They first described for each word the specific event that came to mind first and then dated these personal events. The increased recall of recent events was removed from the distributions with an algorithm that allows separate estimation of forgetting and encoding. All groups showed a reminiscence bump. Participants recalled more events from the period in which they were between 5 and 20 years old than from adjacent time periods. There was no difference between the distributions of female and male participants and no consistent differences across cultures. The results supported the biological account for the occurrence of the reminiscence bump in the temporal distribution of autobiographical memory, at least when the personal events are elicited with cue words.
Email: Steve Janssen, steve.janssen@flinders.edu.au

8:20-8:35 (2)
Disillusions of Memory: Estimating the Contributions of Perceptual Priming and Memory Priming to Primed Recognition. ANGELA B. NELSON and DAVID E. HUBER, *University of California, San Diego* (read by David E. Huber)—Jacoby and Whitehouse (1989) found a bias to recognize a test word (i.e., a memory illusion) presented immediately after its presentation as a subliminal prime. Furthermore, this bias was reversed for visible primes. The first effect was credited to enhanced perceptual fluency; the bias reversal was credited to an attribution process, correcting for perceptual fluency. However, repetition priming involves not only repeating the perceptual response, but also the memory response—If a generalized feeling of recognition carries over from prime to test word, this may contribute to the memory illusion for primed targets. We estimated the separate contributions of each priming component by also including conditions with a studied prime word followed by a different studied test word. Our results indicate that perceptual priming and memory priming both contribute to the Jacoby/Whitehouse memory illusion with subliminal primes. However, the disillusion with visible primes is primarily a correction for memory priming.
Email: David Huber, dhuber@ucsd.edu

8:40-8:55 (3)
Putting Retrieval-Induced Forgetting in Context. TANYA R. JONKER, COLIN M. MACLEOD and PAUL SELI, *University of Waterloo* (read by Colin M. MacLeod)—Practicing retrieval aids later recall of practiced information but can impair recall of related material, a phenomenon called retrieval-induced forgetting (RIF). RIF has been explained as the product of inhibition, whereby unpracticed related material is inhibited during practice to facilitate the retrieval of practiced material. This inhibition persists, reducing subsequent memory for the inhibited material. We propose an alternative account emphasizing the role of context. In Experiment 1, RIF occurred in the extra study variant of the RIF paradigm when context change was implemented between study and practice. In Experiment 2, RIF occurred following retrieval practice only when the practice context was available; no RIF occurred when the study context was reinstated. Thus, we argue that RIF occurs only when two conditions are met: (1) there is a context change between study and practice, and (2) the practice context remains present at test.
Email: Tanya Jonker, trjonker@uwaterloo.ca

9:00-9:15 (4)
Dual Processes in Recall. C. J. BRAINERD, CARLOS F. A. GOMES and V. F. REYNA, *Cornell University*—Current methods of separating recollective from nonrecollective retrieval rely on meta-cognitive judgments (remember/know, confidence, inclusion/exclusion) about old/new recognition. Those methods have been widely implemented, but they have been vigorously criticized on validity grounds. Recall supplies an attractive alternative approach that avoids such criticisms. Measurements of two retrieval operations (recollection and reconstruction) and a slave familiarity judgment operation can be extracted directly from recall performance, with a simple model. Another attractive feature of the recall approach is that measurements are made with low-burden designs in which subjects perform no more than three recall tests on a target list. We discuss the theoretical underpinnings of this approach and summarize results from several low-burden experiments. We stress results that bear on whether recollective and nonrecollective retrieval are being validly measured and whether these processes can be reliably measured in subjects with episodic memory deficits (young children, older adults with neurocognitive impairments).
Email: charles brainerd, cb299@cornell.edu

9:20-9:35 (5)
Recurrent Interaction of Episodic Memories Supports Generalization in The Hippocampal System. DHARSHAN KUMARAN, *University College London,* JAMES L. MCCLELLAND, *Stanford University* (read by James L. McClelland)—We present a perspective on the role of the hippocampal system in generalization, instantiated in a computational model called REMERGE (Recurrency and Episodic Memory Results in Generalization), which expands the generalization capacities of classical exemplar models of memory (e.g. the Generalized Context Model). We expose a fundamental, but neglected, tension between prevailing computational perspectives of hippocampal function and empirical and theoretical support for its role in generalization and flexible relational memory. Our account provides a means by which to resolve this conflict, by demonstrating that the basic representational scheme proposed by Complementary

Learning Systems theory, relying on sparse conjunctive codes in the hippocampus, can support efficient generalization, as long as there is recurrence rather than a unidirectional flow of activation. This recurrence allows the hippocampus to support efficient generalization through recurrent similarity computation, a process That involves the interaction of related episodic experiences within a dynamically created memory space.
Email: James McClelland, mcclelland@stanford.edu

Reasoning and Problem Solving
Salon C, Friday Morning, 8:00-9:20
Chaired by Richard Catrambone, Georgia Institute of Technology

8:00-8:15 (6)
Can Students Learn a Principled Approach to Solving Problems in an Introductory Physics Course? KEITH R. BUJAK and RICHARD CATRAMBONE, *Georgia Institute of Technology,* MARCOS D. CABALLERO, *University of Colorado, Boulder,* MICHAEL F. SCHATZ and MARCUS J. MARR, Georgia *Institute of Technology* (read by Richard Catrambone)—For seven years Georgia Tech has offered sections of introductory physics that use the "Matter and Interactions" (M&I) curriculum. M&I emphasizes analyzing problems starting from three fundamental mechanical principles (e.g., momentum) while "traditional" course students often learn to use special case formulas (e.g. constant acceleration kinematics equations). The expectation has been that M&I students would learn to approach problems from first principles; however, our prior work did not find this. In the present study a talk aloud session was followed by a structured interview to probe student knowledge more deeply. Although students showed little evidence of first principle reasoning when thinking aloud, they answered probes using the language from their respective courses. While this suggests the courses have some impact, the impact does not appear to extend to solution procedures. This has implications for claims that courses created around core concepts can successfully lead learners to reason in domain-appropriate ways.
Email: Richard Catrambone, rc7@prism.gatech.edu

8:20-8:35 (7)
Memory Indexing of Symptom Processing in Diagnostic Reasoning. GEORG JAHN and JANINA BRAATZ, *University of Greifswald*—Explaining symptoms by the most likely cause is a process during which hypotheses are activated and updated in memory. By letting participants learn about causes and symptoms in a spatial array, we could apply eye tracking during diagnostic reasoning to trace the activation level of hypotheses across a sequence of symptoms. Fixation proportions on former locations of possible causes reflected the causal strength of initial symptoms, a bias towards focal hypotheses, and the final diagnosis. Looking-at-nothing revealing memory activation consistent with process models of diagnostic reasoning was stable even after one week.
Email: Georg Jahn, georg.jahn@uni-greifswald.de

8:40-8:55 (8)
Evaluating Measures of Belief and Logic Effects in Syllogistic Reasoning. CAREN M. ROTELLO, *University of Massachusetts,* EVAN HEIT, *University of California, Merced*—Three difference scores measures of performance are traditionally reported in belief bias tasks: 1) the logic index, which measures positive responses to valid v. invalid problems; 2) the belief index, which reflects positive responses to believable v. unbelievable problems; and 3) the interaction index, which measures the difference in correct and error response rates to believable and unbelievable problems. Dube, Rotello, & Heit (2010, 2011) argued that the interaction index tacitly assumes a threshold model which implies a linear ROC that is not observed empirically. They used a signal detection model to conclude that the belief bias effect is a simple response bias shift: subjects are more likely to accept believable than unbelievable conclusions. We evaluate the behavior of all 3 indices under the assumption that belief affects either reasoning accuracy (Klauer et al., 2000) or response bias (Dube et al., 2010, 2011). Traditional difference score measures are shown to conflate reasoning and guessing parameters under either assumption, even if a threshold model is appropriate for the data. Data from 2 new experiments support the signal detection model and the conclusion that response bias drives the belief bias effect.
Email: Caren Rotello, caren@psych.umass.edu

9:00-9:15 (9)
Consideration of Alternative Causes Moderates Effects of Belief on Evidence Weighting and Choice of Evidence. KELLY M. GOEDERT, *Seton Hall University,* MICHELLE R. ELLEFSON, *Cambridge University*—Individuals have difficulty changing their causal beliefs in light of contradictory evidence. We hypothesized that this occurs because people think of more alternative causes when faced with causal relations contradicting their beliefs. Across two experiments subjects learned of believable or unbelievable causes of outcomes (e.g., severed brakes or leather seats causing car accidents). Subjects either saw complete frequency information (Exp. 1) or had a choice of what information they would like to see (Exp. 2). Subsequently, subjects listed all possible causes they could think of for the outcomes. Subjects given unbelievable causes were more likely to choose, and gave more weight to, disconfirming evidence. They also made more accurate causal judgments. These effects were moderated by the number of causes subjects listed: As subjects who were given unbelievable causes listed more alternatives, they placed less weight on confirming evidence and more frequently chose to see disconfirming evidence.
Email: Kelly Goedert, kelly.goedert@shu.edu

Letters and Word Processing I
Salon E, Friday Morning, 8:00-10:00
Chaired by Emmanuel Keuleers, Ghent University

8:00-8:15 (10)
Monkeys and Metrics: Using String Distance Measures to Investigate Orthographic Processing. EMMANUEL KEULEERS and MARC BRYSBAERT, *Ghent University*—

In a recent experiment, Grainger et al. (2012) showed that baboons learn to distinguish four-letter words from nonwords with an accuracy of about 75%. Whereas the authors defined orthographic processing as "the computation of letter identities and their relative positions," the representations and positional information required for this task remain unclear. We investigate the required level of orthographic processing in a lexical decision task using a nearest neighbor decision model (Keuleers & Brysbaert, 2011) extended with a Jaccard distance metric which can be made (in)sensitive to letter order and letter clusters. Simulations on the baboon data show that a non-positional single letter metric shows performance similar to that of baboons and that using bigrams and trigrams decreases performance, casting doubt on claims of advanced orthographic processing in baboons.
Email: Emmanuel Keuleers, emmanuel.keuleers@ugent.be

8:20-8:35 (11)

Monkeys Pass Cambridge University Test. JOHANNES C. ZIEGLER, THOMAS HANNAGAN, STÉPHANE DUFAU, MARIE MONTANT, JOËL FAGOT and JONATHAN GRAINGER, *Aix-Marseille University* (read by Jonathan Grainger)—Our capacity to read words that contain letter transpositions, as illustrated in the email about research at Cambridge University, is a hallmark of flexible orthographic processing. We show that baboons, previously trained to discriminate words from nonwords, pass the Cambridge University test, that is, they make more false positive errors on nonwords created by transposing two letters of a word they know compared with nonwords created by substituting two letters of the same word with different letters. In order to shed light on the underlying mechanisms, we trained artificial neural networks to classify the same words and nonwords as the baboons. Networks were given pixels, single letters, or letter combinations as input. All networks learned to discriminate words from nonwords, but only the letter combination model simulated the transposed-letter effect. Our results suggest that baboons discriminate words from nonwords using flexible orthographic codes based on letter combinations.
Email: Jonathan Grainger, jonathan.grainger@univ-amu.fr

8:40-8:55 (12)

There is Only One Orthographic Code: Letter Transposition Effects With Pseudohomophones. SACHIKO KINOSHITA, *Macquarie University,* DENNIS NORRIS, *MRC Cognition and Brain Sciences Unit*—Grainger and Ziegler (2011) proposed that there is both a coarse- and a fine-grained orthographic code. The fine-grained code is required to derive phonology. A key prediction of this hypothesis is that transposing two letters in a pseudohomophone makes it completely dissimilar to the baseword. We tested this in a masked priming lexical decision task. Contrary to this prediction, Experiment 1 showed robust priming effects for pseudohomophone primes containing letter transposition (e.g., arkobat-ACROBAT). In contrast, in Experiment 2 using the primes used in Experiment 1 as nonword targets, the pseudohomophone-transposed-letter nonwords were rejected as readily as two-letter-substitution controls (e.g., admobat); however, this experiment showed no evidence for the involvement of sublexical phonology. The results provide little support for the dual orthographic code hypothesis. The results are instead better interpreted in terms of a single orthographic code in which letter order and letter identity become more precise over time.
Email: Sachiko Kinoshita, sachiko.kinoshita@mq.edu.au

9:00-9:15 (13)

Is Masked Morphological Priming Stronger for Transparent than Opaque Words? SALLY ANDREWS and STESON LO, *University of Sydney*—We used the masked priming lexical decision task to address previous contradictory evidence about the relative strength of morphological priming for Transparent pairs (e.g., worker WORK), Opaque pairs (e.g., corner CORN) and Form pairs (e.g., turnip TURN). Average data for 92 university students showed a graded morphological effect - stronger priming effects for Transparent than Opaque or Form pairs - which gradually increased across the reaction time (RT) distribution. However, these average effects were significantly modulated by individual differences in spelling and vocabulary. Higher vocabulary than spelling was associated with increasing priming for Transparent pairs as RT increased but minimal priming for Opaque or Form pairs. In complete contrast, higher spelling than vocabulary showed increasing priming for Opaque pairs across the RT distribution while priming for Transparent and Opaque pairs decreased. These systematic individual differences amongst skilled readers have important implications for models of morphological priming and visual word recognition.
Email: Sally Andrews, sally.andrews@sydney.edu.au

9:20-9:35 (14)

Attention, Competition, and Lexicality in the Same-Different Matching Task. ALISON L. MORRIS, *Iowa State University,* MARY L. STILL, *Missouri Western State University*—Reversed-anagram masked primes (e.g., rulb-BLUR) produce interference for words in the lexical-decision task, but facilitation for both words and nonwords in the same-different task (Morris & Still, 2011). What accounts for these different outcomes? The tasks differ in the type of decision required, the presence of the reference stimulus in the same-different task, and the premask duration (typically longer in the same-different task). Each of these variables can potentially alter the competitive interactions affecting target processing. In two experiments using the same-different task, we manipulated inter-item competition by varying premask duration. We presented participants with a reference (1000 ms), followed immediately by the premask (500 or 1000 ms) and then the prime (48 ms) and target. Word and nonword targets were presented in separate blocks. Priming effects for words and nonwords interacted with block order and premask duration: For the 1000-ms premask duration, priming was found in both blocks, but for the 500-ms duration, priming was found only in the second block. These results are consistent with a theoretical framework involving attention, competition, and top-down activation from lexical representations.
Email: Alison Morris, almorris@iastate.edu

9:40-9:55 (15)

Auditory and Visual Processing of Pseudowords are Affected by Their Connotations of Danger and Usefulness. LEE H. WURM, *Wayne State University*—Several word recognition studies have revealed an interaction between danger and usefulness. For words rated low on usefulness, increasing danger is associated with faster RTs. For words rated high on usefulness, increasing danger is associated with slower RTs. In the current study the stimuli of interest were spoken and printed pseudowords. Participants rated the pseudowords on danger, rated them on usefulness, or responded to them in an auditory or visual lexical decision task. Lexical decision times showed the same danger x usefulness interaction that has been observed for real words. Follow-up analyses revealed that for a subset of the spoken items, the interaction arises from partial activation of similar real words. For the other spoken items, and for all of the printed items, the interaction does not seem to arise from such partial activation. It instead implicates rapid automatic evaluation of novel verbal stimuli on danger and usefulness.
Email: Lee Wurm, lee.wurm@wayne.edu

Cognitive Control

Salon D, Friday Morning, 8:00-10:00

Chaired by Michael J. Wenger, The University of Oklahoma

8:00-8:15 (16)

Advance Re-Orientation and Attentional Inertia in Task-Switching: An Eyetracking Study. CAI LONGMAN, STEPHEN MONSELL and AURELIU LAVRIC, *University of Exeter* (read by Aureliu Lavric)—We used eyetracking to examine the dynamics of spatial attention in a task-cuing paradigm. Digits were presented simultaneously at three locations. A cue preceded this stimulus by a variable interval, instructing the participant to perform one of three classification tasks, each consistently associated with a location, so that task preparation could be tracked via fixation of the task-relevant location. Task-switches delayed selection of the relevant location and there was a tendency to mis-allocate attention to the previously relevant location. These effects predicted RT switch costs within and over participants. The attentional 'pull' of the previously relevant location was reduced but not eliminated by extending the preparation interval, suggesting that 'attentional inertia' contributes even to the 'residual' switch cost. A control experiment, using identical displays but only one task, showed that these effects could not be attributed to delays or inertia in shifting attention between locations independently of a task change.
Email: Stephen Monsell, s.monsell@exeter.ac.uk

8:20-8:35 (17)

Stroop, Stopping, Switching, and Reverse Facilitation. AVISHAI HENIK and EYAL KALANTHROFF, *Ben-Gurion University of the Negev*—Many studies use the Stroop task to examine failures in selective attention and cognitive control. The Stroop effect is reflected in large interference (incongruent condition, e.g., red in blue, is faster than neutral, e.g., xxxx in blue) and small facilitation (congruent, e.g., blue in blue, is faster than neutral). Interestingly, fMRI experiments show a reverse facilitation (congruent trials produce larger activation in the anterior cingulate cortex, than neutral trials do). Accordingly, we suggest that performance reflects not only an informational conflict (between the word and ink color) but also a task conflict (between relevant color naming and irrelevant word reading). Task conflict appears when task control fails or is difficult to operate. We test this under various situations and show that task conflict appears when stopping fails and when an impending task switch is immediate. Moreover, we suggest that Stroop facilitation might be related to individual differences in task control.
Email: Avishai Henik, henik@bgu.ac.il

8:40-8:55 (18)

Brain Energy Expenditure as a Function of Cognitive Workload and Body Iron Status. MICHAEL J. WENGER, *The University of Oklahoma,* LAURA E. MURRAY-KOLB, *The Pennsylvania State University,* JERE D. HAAS, *Cornell University*—Iron deficiency (ID) is a highly prevalent micronutrient deficiency, affecting individuals in both developing and developed countries. ID with and without anemia has been shown to have deleterious effects on physical performance, worker productivity, and performance on perceptual and cognitive tasks. The present effort considers the effects of ID on energy use and energetic efficiency in the performance of mental work. ID women and age-, education- and activity-level-matched controls completed a working memory task and performed a visual Sternberg task with a concurrent mental math task. While performing the visual Sternberg task, participants' brain and metabolic states were measured using eletroencephelography (EEG) and energy expenditure from indirect calorimetry based on volume of concentrations of O2 and CO2 in expired air, respiratory rate, and heart rate. We show reliable relationships among behavioral, EEG, and metabolic measures, all as a function of variations in task difficulty and iron status.
Email: Michael Wenger, michael.j.wenger@ou.edu

9:00-9:15 (19)

The Boundaries of Sequential Modulations: Evidence for Set-Level Control. ERIC H. SCHUMACHER, HILLARY SCHWARB, SAVANNAH L. COOKSON and ERIN MCPHERSON, *Georgia Institute of Technology,* ELIOT HAZELTINE, *University of Iowa*—It is uncertain how cognitive control produces sequential modulation (conflict adaptation) effects. To investigate this issue we examined the sequential modulation of congruency effects using a modified flanker task, in which the target and flanker stimuli differed in time rather than space, making it accessible for both visual and auditory stimuli. Across a series of experiments we found larger congruency effects after congruent than incongruent trials (i.e., sequential modulations) as in the traditional flanker task. Moreover, we found that sequential modulations were observed within a stimulus modality but not between stimulus modalities. Sequential modulations were observed across two sets of visual stimuli, even though the two sets involved distinct stimulus dimensions, but only when the response sets overlapped. Critically, sequential modulations

crossed both set and modality boundaries when two stimulus sets were presented along two stimulus modalities. These results suggest that control processes obey flexible boundaries defined by task constraints.
Email: Eric Schumacher, eschu@gatech.edu

9:20-9:35 (20)

Do Salience and Relevance Have Multiplicative Effects on the Capture of Spatial Attention? MEI-CHING LIEN, *Oregon State University,* ERIC RUTHRUFF and NICK GASPELIN, *University of New Mexico*—Many previous studies have suggested that salient-but-irrelevant objects cannot capture spatial attention if we are looking for something else. We examined whether salience might nevertheless enhance attention capture by relevant objects. Participants searched target displays for a colored letter and indicated its identity. The target display was preceded by a non-informative cue display containing (a) only a relevant feature, (b) only a salient-but-irrelevant feature, or (c) a combination of salience and relevance. The cue appeared in the same location as the target (valid trials) or different (invalid trials). Results from all the experiments indicated that salient-but-irrelevant cues (abrupt onsets and color singletons) were unable to capture attention, by themselves. However, abrupt onsets, but not color singletons, were sometimes able to enhance capture by a relevant cue. These findings suggest that some previous instances of capture by abrupt onsets might reflect an enhancement of capture by relevance, not purely stimulus-driven capture.
Email: Mei-Ching Lien, mei.lien@oregonstate.edu

9:40-9:55 (21)

Affective Conflict Disrupts Counting. CHRISTOPHER A. STEVENS and RICHARD A. CARLSON, *The Pennsylvania State University* (read by Richard A. Carlson)—The present studies examined the impact of conflicting affective signals on control in event counting. On each trial, participants saw a series of words with emotional content and counted the number of positive and negative words presented. While doing so, participants used a mouse to move the words in directions that were either affectively congruent (e.g. positive-toward) or incongruent (positive-away) with the words. Counting accuracy was better when word and direction affect were congruent than when they were incongruent. Additionally, in congruent conditions, positive words were counted more accurately. Changing the description of the movement from "toward-away" to "down-up" eliminated the congruency effect. Further, when a similar procedure was used with non-affective stimuli and judgments, conflict did not disrupt counting performance. The results suggest that affect may serve important control functions in goal management and working memory updating in multiple-step tasks and that affective conflict disrupts this mechanism.
Email: Richard Carlson, racarlson@psu.edu

Perpetual Organization
Marquette VIII, Friday Morning, 8:00-10:00
Chaired by Cathleen Moore, University of Iowa

8:00-8:15 (22)

The Role of Object Representations in Visual Crowding. CATHLEEN M. MOORE and ANTHONY CHUNG, *University of Iowa*—Visual crowding is characterized by an inability to identify visual stimuli when they are presented in the context of visual clutter. Critical spacing, defined as the minimal distance by which stimuli must be separated to prevent crowding, increases with increasing eccentricity. It is thought that crowding is caused by fixed integration fields that increase in area with increasing eccentricity; features from stimuli that fall within a single integration field cannot be separately integrated, thereby preventing individual stimuli from being identified. It has been shown, however, that when a target stimulus is distinguished from flanking stimuli by, for example, contrast polarity, crowding is substantially reduced. This finding presents a challenge to a simple fixed integration-field understanding of crowding and has suggested that representing targets as distinct objects can protect the target from crowding. We pursue this hypothesis by asking whether the object history of stimuli can similarly protect a target from crowding. If so, a fixed integration field cannot fully account for crowding.
Email: Cathleen Moore, cathleen-moore@uiowa.edu

8:20-8:35 (23)

Familiarity of Parts Versus Wholes: The Role of the Perirhinal Cortex. MARY A. PETERSON and LAURA CACCIAMANI, *University of Arizona,* MORGAN D. BARENSE, *University of Toronto,* PAIGE E. SCALF, *University of Arizona*—Recent research implicates the perirhinal cortex (PRC) in complex configuration discrimination. Barense et al. (2011) proposed that it does so partly by modulating part familiarity responses in visual areas. Using fMRI we measured PRC and V2 activation in response to Familiar Configurations that portrayed portions of real-world objects; Part-Rearranged Novel Configurations created by spatially rearranging the parts of the familiar configurations; and Control Novel Configurations (novel configurations composed of novel parts). Stimuli were presented in the left or right visual field. For RVF presentation, BOLD responses in bilateral PRC were highest for Familiar Configurations, next highest for Control Novel Configurations, and lowest for Part-Rearranged Novel Configurations. Left hemisphere V2 mimicked PRC activation, and was significantly higher for Familiar Configurations than for Part-Rearranged Novel Configurations. We attribute V2 activation to feedback from the PRC because receptive fields in V2 encompass parts but not configurations. Thus the PRC (1) is sensitive to the congruency between the familiarity of object configurations and the parts comprising them and (2) likely modulates familiarity responses in visual area V2.
Email: Mary A. Peterson, mapeters@u.arizona.edu

8:40-8:55 (24)

A New Parallel-Channels General Recognition Theory, Which Predicts Both Response Times and Accuracy. JAMES T. TOWNSEND and JOSEPH W. HOUPT, *Indiana University*, NOAH SILBERT, *University of Maryland*—We present a new non-parametric General Recognition Theory which is time dynamic. It assumes a parallel architecture and can accommodate arbitrary stopping rules. This class of models encompasses most, if not all, quantitatively specified parallel markets in the literature. These include random walk, diffusion, accumulator and race models. Stochastic versions of perceptual independence, perceptual separability and decisional separability are established. Theorems establishing predictions of new parameter free statistics analogous to the static sampling independence and marginal response invariance are proven. Illustrative data and simulations are discussed.
Email: James T. Townsend, jtownsen@indiana.edu

9:00-9:15 (25)

Semantic Fit Dominates Default Aesthetic Preferences for Color and Spatial Composition. STEPHEN E. PALMER and KAREN B. SCHLOSS, *University of California, Berkeley,* JONATHAN SAMMARTINO, *University of California, San Diego*—Previous research on people's default aesthetic preferences for spatial composition showed strong biases for a focal object to be near the frame's center and facing into the frame (Palmer et al., 2008). Default preferences for colors and color pairs showed a strong bias toward harmonious color combinations (Schloss & Palmer, 2011). Here we investigated whether such strong default preferences can be influenced by goodness of fit within different semantic contexts. Participants in the spatial composition study were given standard or non-standard titles that fit well (or poorly) with standard or non-standard compositions. Participants in the color study were instructed to imagine giving advice to pop bands on which color pairs they preferred for album covers. In both cases, people's contextual preferences were almost completely dominated by the fit between the relevant feature and the intended meaning of the image within the context provided.
Email: Stephen Palmer, sepalmer@gmail.com

9:20-9:35 (26)

The Utility of an Intermediate Representation of Feature Space: Lessons From Fingerprint Examiners. TOM BUSEY, CHEN YU, FRANCISCO PARADA and BRANDI EMERICK, *Indiana University*, JOHN VANDERKOLK, *Indiana State Police Laboratory, Fort Wayne*—Latent print examinations require experts to match features from two prints to determine if they came from the same source. The challenge comes in determining which features are most diagnostic, because individual features in prints may not confer specificity if candidate matching prints are recovered from large databases. All of this assumes that we know the feature set that experts use (a challenge that is certainly not unique to fingerprints). To address these issues, we construct an intermediate representation using independent components analysis derived from image patches selected from eyetracking data from experts. We use this representation to provide automatic region assignment and feature diagnostically. We find that this approach gives some success, but fails to account for what is likely integration across scales. We then explore extensions that may better account for the search process observed in experts as they determine whether the same person made the two impressions. Although our examples come from fingerprints, the methods are applicable to a wide range of object recognition and scene processing tasks.
Email: Tom Busey, busey@indiana.edu

9:40-9:55 (27)

Computing Subjective Temporal Distances From Audiovisual Simultaneity Judgments. HANS COLONIUS, *Carl von Ossietzky Universität Oldenburg*—We propose a new method to gauge the effect of near-simultaneous auditory events on the position of a visual event on the subjective time axis and vice versa. It is based on the theory of Discrete Fechnerian Scaling (Dzhafarov & Colonius, Psychometrika, 2006). If certain empirical conditions are satisfied, the method allows estimating the subjective temporal distances between visual (or auditory) events in a crossmodal context. Several applications of this approach to different multisensory phenomena will be outlined.
Email: Hans Colonius, hans.colonius@uni-oldenburg.de

Bilingualism I

Marquette II, Friday Morning, 8:00-10:00

Chaired by Debra Titone, McGill University

8:00-8:15 (28)

Linking Inhibitory Capacity to Eye Movement Measures of Bilingual Production and Comprehension. DEBRA A. TITONE, IRINA PIVNEVA and JULIE MERCIER, *McGill University*—Recent work suggests that the repeated experience of resolving cross-language competition leads to bilingual advantages in cognitive control. If true, cognitive control capacity should relate to reduced linguistic competition among bilinguals after controlling for L2 proficiency. We test this idea in two eye movement studies. In E1, 48 bilinguals (English L1 & French L1) produced short L1 or L2 sentences for a picture array (e.g., The hose and the stove are above the bridge). In E2, 50 bilinguals (all French L1) read English sentences containing interlingual homographs (e.g., CHAT: talk in English, cat in French) or cognates (e.g., PIANO). All participants completed L2 ability and non-linguistic inhibitory control batteries. LME models showed that increased inhibitory capacity predicted lower L2 costs (in gaze-speech latency & accuracy) during production, and less homograph interference (in total reading time) during reading, after statistically controlling for L2 proficiency. These data suggest a strong coupling between inhibitory capacity and the resolution of cross-language competition during bilingual production and comprehension, consistent with the hypothesized mechanism of bilingual advantages in cognitive control.
Email: Debra Titone, dtitone@psych.mcgill.ca

8:20-8:35 (29)

Bilinguals Show No Enhanced Executive Control for Linguistic Processing Involving Conflict. KENNETH R. PAAP, ZACHARY I. GREENBERG and YUNYUN LIU, *San Francisco State University*—The homograph interference task requires participants to judge if a target (ACE) is related to the overall meaning of a sentence (He dug with a spade). Failure to inhibit the context-inappropriate meaning of the homograph causes interference. Gernsbacher reported that less- and more-skilled comprehenders show comparable amounts of interference when the target appears immediately after the sentence, but that the interference dissipates quickly for those more-skilled. The advantage was attributed to a general ability to enhance "the activation of relevant information while suppressing the activation of less relevant information." If there is a bilingual advantage in executive attention then bilinguals should show less interference. However, even when the groups are matched on overall accuracy, there is a bilingual disadvantage (+119 vs. +51 ms) in the delayed condition. The results contradict Moreno et al. (2010) who, on the basis of the results from two other linguistic tasks, concluded "that bilinguals use their enhanced executive control for linguistic processing involving conflict" The contradiction is resolved by a reinterpretation of their ERP and behavioral results.
Email: Kenneth Paap, kenp@sfsu.edu

8:40-8:55 (30)

Multilingualism and Cognitive Control: Simon and Flanker Task Performance in Monolingual and Multilingual Young Adults. APRIL D. HUMPHREY and VIRGINIA V. VALIAN, *Hunter College, CUNY*—Lifelong, balanced bilinguals (LBB) are reported to exhibit greater cognitive control than monolinguals, but little is known about different subgroups of bilinguals or trilinguals. We administered the Simon and Flanker tasks to 266 young adults who were monolingual, bilingual (including 5 subgroups) or trilingual. English proficiency, English word-naming ability, age, sex, computer use, and socio-economic status served as control variables. When compared to all bilinguals (the 5 bilingual subgroups combined), monolinguals tended to have a larger Simon reaction time (RT) cost (difference between incongruent and congruent trials) but showed no Flanker effects. When subgroups were compared to monolinguals, however, no subgroup, including LBBs, differed in overall RT or RT cost for either task. A comparison between trilinguals and monolinguals showed that trilinguals displayed a larger Flanker RT, contrary to expectations. Contrary to some reports, then, our large sample suggests that being bilingual does not provide young adults advantages in cognitive processing and that being trilingual results in lower, rather than greater, cognitive control. We discuss the possible reasons for discrepant findings.
Email: April Humphrey, little.linguist@hunter.cuny.edu

9:00-9:15 (31)

Picture Naming in Mandarin-English Bilinguals: A Test of Bilingual Dual Coding Theory. DEBRA JARED, ALLAN PAIVIO and REBECCA POH, *University of Western Ontario*—This study examined the nature of bilinguals' conceptual representations and the links from these representations to words in L1 and L2. Specifically, we tested an assumption of the Bilingual Dual-Coding theory that conceptual representations include image representations, and that learning two languages in separate contexts can result in differences in referential images for L1 and L2. Mandarin-English bilinguals were asked to name pictures presented on a computer screen in both Mandarin (L1) and English (L2). Critical pictures were chosen in pairs. Both members of a pair had the same name (e.g., mask), but one picture came from Chinese culture and one from Canadian culture. An equal number of unbiased pictures were included as fillers. Culturally biased images were named significantly faster in the culturally congruent language than in the incongruent language. These findings indicate that some image representations are more strongly connected to one language than the other, providing support for the Bilingual Dual-Coding theory.
Email: Debra Jared, djjared@uwo.ca

9:20-9:35 (32)

Bilingual Proficiency Effects in Conceptual and Perceptual Implicit Memory. WENDY S. FRANCIS, ELVA N. STROBACH, RENEE PENALVER, BETSABEE LARA and YOLANDA OCHOA, *University of Texas at El Paso*—In an ongoing effort to understand the effects of bilingual proficiency on memory processes, we explored the effects of bilingual proficiency and word frequency on implicit memory tasks. In Experiment 1, bilingual speakers of English and Spanish completed a conceptual implicit memory task. In the encoding phase and the test phase, participants made semantic decisions about words. This was done in both the more fluent and the less fluent languages, and priming effects were stronger in the less fluent language. In Experiment 2, bilinguals completed two perceptual implicit memory tasks. In the encoding phase, participants made lexical decisions. In the test phase, lexical decisions were made for half of the encoded items and perceptual identifications were made for the other half. Again, the tasks were performed in both languages. Proficiency effects in the two experiments are discussed in relation to word frequency and association strength.
Email: Wendy Francis, wfrancis@utep.edu

9:40-9:55 (33)

Solving the Mystery of a Lost Mother Tongue. LUDMILA ISURIN, *The Ohio State University*—The goal of the present study was to solve the mystery of a lost childhood language in a 33-year-old adoptee whose linguistic background upon her adoption at the age of three was unknown. Partially recovered lexical forms and the results of pre-tests pinpointed Russian or Ukrainian as possible languages in question. The savings paradigm was used and the savings effect was found for recognition in delayed tests: the lexicon that a 3-year-old child supposedly knew was retained better than words that are usually acquired later. In combination with the results of pre-tests, the findings suggest that a lost language was indeed Russian or Ukrainian. The present study has expanded the possibility of using the savings technique beyond the L2 loss/

relearning and demonstrated a way of employing it in order to solve complex and unusual cases of pervasive first language loss in adoptees.
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SYMPOSIUM I: Motivations, Emotions, and Cognition: What Am I Afraid of, and Why Does it Matter?
Salon C, Friday Morning, 9:50-12:00
Chaired by Thomas H. Carr, Michigan State University

9:50-9:55 (34)
Introduction. THOMAS H. CARR, *Michigan State University*

9:55-10:15 (35)
Math Anxiety, Attitudes, Beliefs, and Performance. MARK H. ASHCRAFT, ALEX M. MOORE and NATHAN O. RUDIG, *University of Nevada, Las Vegas*—For many college students, it's math they're afraid of – they try to avoid it, they do poorly at it, they develop math anxiety, and they adopt attitudes and beliefs about math that maintain their deficiencies. Among other things, we know that math anxiety consumes some of the working memory resources necessary for problem solving. Today we present further work related to the avoidance characteristics of math anxiety, as well as the consequences of two patterns of beliefs about math, the fixed vs. malleable beliefs (entity vs. incremental), roughly "I was born this way" vs. "Practice make you better." We tested people on a novel, challenging math task, then gave them the opportunity to switch to a more familiar form of math, measuring accuracy and latencies throughout. The results indicate how cognitive processing can be influenced by emotional and motivational factors.
Email: Mark H. Ashcraft, mark.ashcraft@unlv.edu

10:20-10:40 (36)
Academic Performance Under Stress: At the Intersection of Emotion and Cognitive Control. *SIAN BEILOCK, *The University of Chicago*—For many people, the desire to perform their best in academics is high. Consequences for poor performance, especially in examinations, include poor evaluations by mentors, teachers, and peers; lost scholarships; and relinquished educational opportunities. But, why do poor performances occur in those very situations where students are set on doing their best? What cognitive and neural processes drive less-than-optimal outcomes when the pressure is high? And, can we use knowledge about how cognitive control is altered under stress to help everyone show what they know on important tests? In this talk, I will discuss behavioral and brain imaging work examining how students' knowledge and general cognitive abilities interact with social and emotional factors (e.g., a student's fear of test taking) to impact performance in academic arenas such as math. These findings are used to motivate simple test-taking interventions aimed at alleviating the negative impact of high-stakes situations on academic performance.
Email: Sian Beilock , beilock@uchicago.edu

10:45-11:05 (37)
Motivation and Decision-Making: What Matters Changes With Age. DARRELL WORTHY, *Texas A&M University, W.* TODD MADDOX and ARTHUR MARKMAN, *University of Texas*—Our research explores the cognitive consequences of motivational factors like social pressure. We find that pressure improves performance in a simple two-choice dynamic decision-making task, but impairs performance in a complex four-choice task. Building on previous theories of choking under pressure we propose that pressure causes a "double-whammy" effect whereby it leads to an increase in explicit monitoring of performance, but with reduced, or distracted, executive resources. Pressure helps on relatively easy tasks, but leads to a "crunch" point when tasks become too complex. We relate this view to the neural scaffolding theory, prominent in the aging literature, which posits frontal compensation in both younger and older adults as a result of increased cognitive demand. Aging and pressure are proposed to additively increase cognitive demand. We find a cross-over interaction between age and pressure with an age-related advantage emerging under no pressure conditions, but an age-related deficit emerging under pressure.
Email: Darrell Worthy, worthyda@tamu.ed

11:10-11:30 (38)
Race, Threat, and the Decision to Shoot. JOSHUA CORRELL and BERND WITTENBRINK, *The University of Chicago*—We examine the impact of race on participants' decisions to shoot using a first-person-shooter computer task presenting Black and White targets either armed or unarmed. Typically, participants show racial bias, setting more lenient criteria to shoot when the target is Black. This bias reflects the operation of stereotypes that link Blacks with danger and crime. On a hopeful note, practice reduces bias. Police officers and "experts" (college students receiving practice in the lab) make fewer stereotypic errors. However, bias-attenuating practice effects depend on executive function. When experts perform a demanding concurrent task, bias remerges and practice benefits disappear. Because police shootings are inherently stressful and fear-arousing, they likely compromise executive function. Therefore our data suggest that benefits from practice may fail in precisely those situations in which they are most needed.
Email: Joshua Correll, jcorrell@uchicago.edu

11:35-11:45 (39)
Organizer's Comments. THOMAS H. CARR, *Michigan State University*

11:45-12:00 (40)
Audience Discussion. THOMAS H. CARR, *Michigan State University*

Concepts and Categories I
Salon D, Friday Morning, 10:20-12:00
Chaired by Edward Vul, University of California, San Diego

10:20-10:35 (41)
Mapping the Number Sense Onto Numbers. EDWARD VUL, JESS SULLIVAN and DAVE BARNER, *University of California, San Diego*—Number estimation tasks require that people map an analog, implicit estimate of numerosity onto their count list, or explicit number line. Since the first subitizing paper, explicit estimates of number have seemed to follow a peculiar pattern: estimates are unbiased for quantities below about 10, but they tend to show underestimation for larger quantities, suggesting that the mapping from internal magnitude estimates to numbers is quite precise for common, small, numbers, but not larger numbers. Here we investigate numerosity to number mapping as an implicit function learning problem. We show that there is consistent across-person variation in the mapping of large numerosities onto numbers. Moreover, within individuals, this mapping appears to be adjusted and learned online, as evidenced by slow-moving autocorrelations in proportional errors (but not responses or stimuli). We propose a model of the mapping between numerosity and number as a non-parametric function that is constantly being revised and reconsidered by participants such that mapping between small numerosities and the corresponding items in a count list is learned nearly perfectly but considerable uncertainty remains about how to map larger numerosities onto the number line.
Email: Edward Vul, evul@ucsd.edu

10:40-10:55 (42)
How Numbers Mean. DALE J. COHEN, *University of North Carolina at Wilmington,* PHILIP QUINLAN, *University of York*—There are several contrasting models of how numbers are represented internally. Controversies likely arise in the numerical cognition literature because researchers rely on poorly specified models that make imprecise predictions. To properly adjudicate between the different models, it is critical to instantiate these models in computational terms that demonstrate the functional properties of the models. Here, we instantiate these models in computer simulations and demonstrate that no model can account for the data as a whole. It is only after we introduce encoding errors that our simulations result in superior fits with the data. Our data reveal (1) that quantities are represented as perceptual distributions that are equally spaced and have equal variance, (2) that the perceptual system repeatedly samples the stimulus, and (3) that the recovery of number meaning begins quickly and continues simultaneously with encoding.
Email: Dale Cohen, cohend@uncw.edu

11:00-11:15 (43)
Moving on Down the (Mental Number) Line. DAVID LANDY, ZACHARY J. DAVIS, BRIAN M. GUAY, MEGAN L. DELAUNAY and ARTHUR CHARLESWORTH, *University of Richmond,* NOAH SILBERT, *University of Maryland*—Numbers ranging from one million to one trillion are notoriously difficult to understand, yet play an important role in public discourse. We investigate large-number understanding in adult Americans on a number line estimation task and when qualitatively evaluating descriptions of geopolitical scenarios. Prior work with small numbers suggests that individuals may shift from a compressed to a linear scale when estimating numbers (Siegler & Opfer, 2003, Barth & Paladino, 2011). This pattern has been attributed to an early-developing approximate magnitude system. With large numbers, very few adults are well-captured by smooth compressive functions: the majority place numbers linearly; a large minority roughly uniformly space thousand, million, and billion and estimate intermediate values linearly. We report sex differences in strategy use, and the interaction between line estimation and political responses. Results indicate that the surface structure of the numerals better match large number interpretation than does an approximate magnitude system.
Email: David Landy, dhlandy@gmail.com

11:20-11:35 (44)
The Role of Linguistic Labels in Infants' Category Learning. VLADIMIR SLOUTSKY and SOPHIA (WEI) DENG, *The Ohio State University*—How do words affect category learning? According to some accounts, even early in development, labels are category markers that attract attention to within-category commonalities. Alternatively, early in development, labels are part of the input and because they are presented in different modality, they may interfere with early category learning. The current study addressed this issue by examining the effects of labels on learning of probabilistic categories in 8- to 12- month infants. Learning was administered under one of the three conditions: (1) all members of the category were accompanied by the same label; (2) all members of the category were exhibited the same pattern of motion; or (3) items were presented without label or motion (Control). Participants were then tested and their eye movements were recorded during learning and testing. Participants exhibited better category learning and more disturbed pattern of attention in the motion than in the label condition, with control being in-between. Eye tracking results suggest important differences in infants' allocation of attention across the three conditions.
Email: Vladimir Sloutsky, sloutsky.1@osu.edu

11:40-11:55 (45)
Influence of Music on Men's Perceptions of Women's Dating-Relevant Cues. TERESA A. TREAT, *University of Iowa,* COREEN A. FARRIS, *RAND,* JODI R. SMITH, *University of Iowa,* RICHARD J. VIKEN, *Indiana University*—The present study evaluates the impact of degrading and non-degrading rap and hip-hop music on undergraduate men's sensitivities to and biases for undergraduate women's expressions of sexual interest, friendliness, sadness, and rejection in full-body photos. Self-reported exposure to such music, as well as endorsement of rape-supportive attitudes, also were assessed. 354 undergraduate males completed the study. Manipulated exposure to rap and hip-hop music exerted minimal effects, which is inconsistent with theoretical models specifying deleterious effects of aggression-glorifying media on sexually relevant attitudes and behavior, either

normatively or for vulnerable individuals (e.g., Anderson et al., 2003; Fischer et al., 2011). In contrast, self-reported naturally occurring exposure to rap and hip-hop music interacted with endorsement of rape-supportive attitudes and the provocativeness of women's clothing to predict men's tendency to perceive women as relatively more sexually interested than friendly. Overall, this work contributes to efforts to define the constellation of person-specific, stimulus-specific, and context-specific characteristics that influence men's sexual perceptions.
Email: Teresa Treat, teresa-treat@uiowa.edu

Attentional Processes
Salon G, Friday Morning, 10:00-12:00
Chaired by Jeremy Wolfe, Brigham & Women's Hospital / Harvard Medical School

10:00-10:15 (46)
Extending "Hybrid" Visual X Memory Search to Very Large Memory Sets and to Category Search. CORBIN A. CUNNINGHAM, *The Johns Hopkins University,* JEREMY M. WOLFE, *Brigham & Women's Hospital / Harvard Medical School* (read by Jeremy M. Wolfe)—"Hybrid search" is a combination of visual search and memory search. Observers search for any of M items in a Memory Set among the V items in the Visual Set. Using photorealistic objects, we find that RT is linear with visual set size and linear with log(memory set size). (Wolfe, Psych Sci, 2012). In a new task, Os identified a novel item on each trial. That novel item became part of the ever-growing memory set on the next trial. This allowed us to grow the memory set size to over 500 items. RTs continued to rise linearly with log (memory set). Next, suppose that the Memory set consists of a set of categories (animal, vehicle, etc.) and Os search for any instance from any of these categories in the visual array. For memory set sizes of 1-8 categories, we again find that RT is a linear function of log (memory set).
Email: Jeremy Wolfe, wolfe@search.bwh.harvard.edu

10:20-10:35 (47)
Event-Related Potentials Show Early Top-Down Modulation of Word Processing During Visual Search. JULIEN DAMPURÉ, ABDEL BENRAISS, JEAN-FRANÇOIS ROUET and NICOLAS VIBERT, *University of Poitiers* (read by Nicolas Vibert)—Visual search for a target word involves both perceptive and semantic word processing pathways. Previous eyetracking experiments showed that the two pathways are differentially sensitized according to search task requirements. ERP recordings were used to analyze top-down modulation of word processing during visual search and understand whether the sensitization occurs at earlier or later stages of word analysis. Participants had to identify a target word either known in advance (literal task) or defined by a semantic clue (categorical task) during serial, foveal presentations of neutral, semantically related or orthographically related distractor words. Orthographic distractors were rejected more slowly than neutral ones during both tasks, whereas the impact of semantic distractors was restricted to the categorical task. ERP analysis indicated early (about 150 ms) top-down modulation of word processing according to the words distractor status and task requirements. Data are interpreted in the frame of the attentional sensitization model (Kiefer & Martens, 2010).
Email: Nicolas Vibert, nicolas.vibert@univ-poitiers.fr

10:40-10:55 (48)
Visual Marking Across Eye Blinks. DAVID E. IRWIN, *University of Illinois,* GLYN W. HUMPHREYS, *University of Oxford*—Visual search for a conjunction target can be made efficient by presenting one initial set of distractors as a preview, prior to the onset of the other items in the search display (Watson & Humphreys, 1997, Psychological Review, 104, 90-122). This 'preview advantage' is lost if the initial items are offset for a brief period before onsetting again with the search display (Kunar, Humphreys & Smith, 2003, Psychological Science, 14, 181-185). In this study we assess whether an eye blink acts in the same manner as an external blink (i.e., offsetting and then onsetting the preview). Participants searched feature, conjunction and preview displays after being cued to blink their eyes. The search displays were presented during the eye blink and so were immediately available (without abrupt onsets) once participants opened their eyes. Whereas imposing an external blink disrupted preview search, having participants make an eye blink had no effect on search slopes. Efficient preview search occurred when the search items had no abrupt onsets, demonstrating that onsets of new search items are not critical to the preview benefit.
Email: David Irwin, irwin@illinois.edu

11:00-11:15 (49)
In Search of Experience Effects: How TSA Officers Differ From Undergraduates on Visual Search Tasks. STEPHEN R. MITROFF, ADAM T. BIGGS, MATTHEW S. CAIN, ELISE F. DARLING, KAIT CLARK, STEPHEN H. ADAMO and EMMA W. DOWD, *Duke University*—Visual search is a routine activity that people perform countless times each day. Search is also crucial for certain professions (e.g., airport security, radiology), and here we examine how the extensive practice gained through these careers alters search abilities. By comparing undergraduate participants from Duke University and Transportation Security Administration (TSA) officers at Raleigh-Durham Airport, we examine the effects of experience on visual search performance. In a laboratory we established at the airport, TSA officers completed search tasks and individual differences assessments during their normal work hours. Results from several search tasks demonstrated both similarities and differences in performance between the undergraduates and TSA officers; for example, the officers were more diligent searchers in a single-target search, but both populations showed performance decrements in multiple-target searches. By manipulating search parameters and experimental conditions (e.g., explicit instructions, time constraints), we reveal nuanced effects gained through visual search experience.
Email: Stephen Mitroff, mitroff@duke.edu

11:20-11:35 (50)

Separate Activations vs. Coactivation Revisited: Tests of the Third Channel Hypothesis. J. TOBY MORDKOFF and ANDREW KENNING, *University of Iowa*—Previous work has produced strong evidence of coactivation when the redundant target features are aspects of a single perceptual object (e.g., when a single item contains both the target color and the target shape). Other work has shown that color/shape conjunctions are available without the need for visual attention. The latter finding suggests an alternative explanation for the evidence of coactivation: that it is due to a race that occurs between three channels (instead of only two channels): one for the target color, one for the target shape, and one for the conjunction of target color and target shape. We developed several methods of testing this "third-channel model," but found little to no evidence in its favor. Thus, we conclude that coactivation really does occur when redundant targets are aspects of a single perceptual object.
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11:40-11:55 (51)

Divided Attention for Shape Perception: Limited by Objects and Locations? JOHN PALMER, *University of Washington,* ALEC SCHARFF, *University of Texas at Austin,* CATHLEEN M. MOORE, *University of Iowa*—In recent studies using the simultaneous-sequential paradigm, we compared the effects of divided attention on perception for simple features and objects. Varying the number of simultaneous stimuli had no effect on feature search but it affected search for object shape as much as is predicted by serial processing. In this study, we asked whether the divided attention effect on the perception of object shape depends on the number of locations in which the objects appear, on the number of objects themselves, or both. Two critical questions are considered: a) If the number of relevant locations is constant, is there an effect of the number of simultaneous objects? b) If the number of relevant objects is constant, is there an effect of the number of simultaneous locations?
Email: John Palmer, jpalmer@uw.edu

Metamemory
Salon E, Friday Morning, 10:20-12:00
Chaired by Yana Weinstein, Washington University in St. Louis

10:20-10:35 (52)

Test Expectancy Reduces the Buildup of Proactive Interference in Long-Term Memory. YANA WEINSTEIN, KATHLEEN B. MCDERMOTT and ADRIAN W. GILMORE, *Washington University in St. Louis,* KARL K. SZPUNAR, *Harvard University*—We examined the hypothesis that interpolated testing in a multiple list learning paradigm protects against proactive interference by sustaining test expectancy. In Experiments 1 and 2, recall on the last of five lists of words was compared between a tested group (tested on all previous lists), an untested group (not tested on previous lists), and a warned group (not tested on previous lists, but warned about the upcoming test prior to study of the fifth list). In both experiments, the number of correctly recalled words and prior-list intrusions in the warned group approached those of the tested group. In Experiment 3, we verified that reduction in test expectancy occurred in the untested group compared to the tested group by asking participants to indicate the perceived likelihood of receiving a test on each studied list. These findings suggest that testing protects against proactive interference in part via maintaining attention during encoding.
Email: Yana Weinstein, y.weinstein@wustl.edu

10:40-10:55 (53)

The Role of Expectation on the Attribution of Perceptual and Conceptual Fluency. MEREDITH LANSKA and DEANNE L. WESTERMAN, *Binghamton University, SUNY* (read by Deanne L. Westerman)—In general, stimuli that are processed fluently are more likely to be classified as "old" on a recognition memory test. However, the impact of fluency has been found to depend on whether fluency is considered diagnostic of recognition. The current study examined the role of expectations on the attribution of perceptual and conceptual fluency. A counterfeit study phase was presented under the guise of an experiment on subliminal perception. Participants were later asked to recognize the "subliminally-presented" targets or synonyms of targets. The results showed an interaction between the type of fluency that was enhanced (perceptual vs. conceptual) and the test instructions (verbatim vs. synonym recognition), with the effect of perceptual fluency greater for verbatim recognition and the effect of conceptual fluency greater for synonym recognition. The results support the view that the role of fluency in recognition depends on the degree to which it is perceived to be diagnostic of past experience with a stimulus.
Email: Deanne Westerman, wester@binghamton.edu

11:00-11:15 (54)

More Known Unknowns: Familiarity and Memorability Moderate the Rumsfeld Effect. JAMES A. HAMPTON and JURI MORANDI, *City University London*—When categorizing borderline cases (e.g. "a tomato is a fruit"), people who are told to respond True or False only when they are 100% certain, are no more consistent at retest than those simply deciding True or False (Hampton et al. 2012). However for general knowledge tasks, responding only when certain does lead to greater consistency. We report new factors that moderate this effect. Unfamiliar borderline category members led to improved consistency with 100% certain responses, whereas familiar items did not, while for memories for autobiographical events, unmemorable events showed better consistency for 100% certain responses, whereas more memorable events did not. The results support the interpretation of the effect in terms of known unknowns. For unfamiliar/ unmemorable items it is easier to be confident that one doesn't know the item than that one knows it.
Email: James Hampton, hampton@city.ac.uk

11:20-11:35 (55)

The Underconfidence-with-Practice Effect is Unique to Percentage-Likelihood JOL Scales. MACIEJ HANCZAKOWSKI, *Cardiff University,* KATARZYNA ZAWADZKA and PHIL HIGHAM, *University of Southampton*

(read by Phil Higham)—When repeatedly studying a list of cue-target pairs and asked to provide judgments of learning (JOLs), people tend to be slightly overconfident when the list is first presented, but underconfident when it is repeated: the underconfidence-with-practice (UWP) effect. We present evidence that the UWP effect is unique to percentage-likelihood JOL scales. If, instead, participants are asked to make binary JOLs ("Will you remember the target later [yes/no]?") or a binary betting decision ("Will you bet that you will remember the target later [yes/no]?"), then the effect disappears. The results are explained by our "recalibration hypothesis": With practice and when making percentage-scale JOLs (but not binary JOLs) the highest JOLs are reserved for recalls that are particularly strong and/or rich in remembered details. The JOL scale is then recalibrated such that lower JOLs are assigned to items without those retrieval characteristics but which are still successfully recalled, producing the observed underconfidence.
Email: Phil Higham, higham@soton.ac.uk

11:40-11:55 (56)

The Self-Consistency Model of Subjective Confidence: Implications for Group Decisions. ASHER KORIAT, *University of Haifa*—Studies indicated that dyads perform better than independent individuals. Capitalizing on recent work on subjective confidence (Koriat, 2012), I replicated the dyadic advantage in the absence of interaction between the members by selecting on each trial the decision of the more confident member of a virtual dyad. However, because subjective confidence monitors the consensuality rather than the accuracy of a decision, when most participants were in error, reliance on the more confident member yielded worse decisions than those of the worst individual. Assuming that group decisions are dominated by the more confident members, these results help specify when groups will be more accurate or less accurate than individuals.
Email: Asher Koriat, akoriat@research.haifa.ac.il

Statistics and Methodology
Marquette VIII, Friday Morning, 10:20-12:00
Chaired by Gregory Francis, Purdue University

10:20-10:35 (57)

Replication in Psychology and the Psychology of Replication. GREGORY FRANCIS, *Purdue University*—Scientists have been taught that the best way to demonstrate the validity of an empirical finding is through repeated successful replications. For a field that demonstrates effects with statistics, this training is wrong. Even true effects can only replicate a finding at a rate that reflects statistical power, which is the probability of rejecting the null hypothesis when it really is false. Given the relatively low power of most experiments in psychology, even true effects should often produce a failure to replicate. Indeed, it is possible to have too much replication success. If the frequency of rejecting the null hypothesis is substantially larger than the power of reported experiments, then there is some type of publication bias. Such biased sets of experiments must be considered non-scientific. I will demonstrate how to test for too much successful replication. Although the test is very conservative, I will provide examples of how publication bias contaminates important findings in experimental psychology. I will also outline data analysis methods that avoid some of the temptations to introduce publication bias.
Email: Gregory Francis, gfrancis@purdue.edu

10:40-10:55 (58)

Bayesian Estimation Supersedes the t Test. JOHN K. KRUSCHKE, *Indiana University, Bloomington*—Bayesian estimation for two groups provides complete distributions of credible values for the effect size, group means and their difference, standard deviations and their difference, and the normality of the data. The method handles outliers. The decision rule can accept the null value. The method also yields precise estimates of statistical power for various research goals. Examples show the rich information revealed by Bayesian estimation, and the relative poverty and fickleness of information from the traditional t test. The software and programs are free, and run on Macintosh, Windows, and Linux platforms. An article describing this work is in press at the Journal of Experimental Psychology: General.
Email: John Kruschke, kruschke@indiana.edu

11:00-11:15 (59)

Good Experiments Do Not Require Reliable Dependent Measures: A Graphical Argument. RICHARD B. ANDERSON, *Bowling Green State University*—Test reliability (Lord & Novick, 1968) is fundamental to research that measures individual differences and correlates such differences with other variables. But with regard to experiments, Nicewander and Price (1978, 1983) demonstrated, mathematically, that a dependent variable's reliability does not contribute to the size or power of an experimental effect. The argument, however, has had little impact on the persisting belief that good experiments require reliable dependent measures. In an effort to broaden the accessibility of, and appreciation for the argument, the present research advances a graphical form of the argument, built on a Monte Carlo simulation that manipulated the split-half reliability within a data set, without adding random error. The results demonstrated that reductions in reliability did not attenuate the size, significance, or power of the experimental effect. Thus in the context of an experiment, reliability as commonly defined is distinct and separate from the experimental outcome.
Email: Richard Anderson, randers@bgsu.edu

11:20-11:35 (60)

Did Your Subjects Eat Breakfast? Individual and Uncontrolled Variables Can Affect Performance. JOHN PAUL MINDA, SARAH J. MILES, RUBY T. NADLER and RACHEL R. RABI, *University of Western Ontario*—Many experiments rely on a fairly homogeneous sample of university students. Random assignment is supposed minimize the effect of subject variance. However, subjects participate in experiments in different states and at different times. These variables could affect performance on the tasks being studied, and this could lead to erroneous conclusions. We devised a questionnaire that covered many demographic

and situational variables. We asked subjects how busy they were, when they last ate, how much exercise they typically got, etc. We gave this questionnaire to several hundred subjects throughout the course of a single academic year (September-May) and examined the relationship between several clusters of factors and performance on a category-learning task. The results provide a detailed picture of the state of the standard subject pool and as predicted, many factors correlated with performance. Factors dealing with health, hunger, and satiation were most strongly correlated with performance, possibly because subjects who had just eaten were less able to engage in active processing. We argue that researchers should begin tracking and recording these variables, because they could change the outcome of a carefully designed experiment.
Email: John Paul Minda, jpminda@uwo.ca

11:40-11:55 (61)

Box Plots Outperform Bar Charts. DAVID V. BUDESCU, HAN HUI POR, JAMES MARCUS and ALEXANDRA MACLEAN, *Fordham University*—Despite repeated admonitions regarding the shortcomings of bar charts to represent quantitative variables many researchers continue to use them, possibly because they are default options in popular software packages. We present results from several empirical studies involving both between- and within-subjects designs with almost 400 subjects. Subjects were presented with bar charts or box plots of the same data and asked to interpret the results and to make inferences regarding future observations from the same sources. We find that people answer more questions correctly and make more accurate predictions after examining boxplots. Paradoxically most people express a preference for the bar charts despite their objective inferiority. We find evidence that people learn to favor box plots after exposure and feedback.
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Motion Perception

Marquette II, Friday Morning, 10:20-12:00

Chaired by Timothy Hubbard, Texas Christian University

10:20-10:35 (62)

Ratings of Causality and Force in Launching and Shattering. TIMOTHY L. HUBBARD, *Texas Christian University,* SUSAN E. RUPPEL, *University of South Carolina, Upstate*—Ratings of perceived causality and ratings of perceived force were collected for launcher and target stimuli in (a) launching effect displays, (b) modified launching effect displays in which the launcher or target shattered upon contact, and (c) modified launching effect displays in which the target remained stationary after contact. Launchers were rated as more causal in launching effect and target-shatter displays, and targets were rated as more causal in stationary and launcher-shatter displays. Launchers were rated as exerting more force in launching effect and target-shatter displays, but targets were rated as exerting more force in the launcher-shatter display. These patterns are not consistent with White's (2011) suggestions that the most active object in an interaction is always assigned the causal role and is perceived as exerting more force. Implications for causal asymmetry and force asymmetry, the relationship of perceived causality and perceived force, and phenomenal causality are considered.
Email: Timothy Hubbard, timothyleehubbard@gmail.com

10:40-10:55 (63)

A Peripherally Viewed Barber Pole Illusion Reveals a New Motion-Perception Mechanism. GEORGE SPERLING, PENG SUN and CHARLES CHUBB, *University of California, Irvine*—A diagonal sinusoidal carrier grating with bars drifting up to the left, windowed by a raised, vertical, sideways-drifting sinusoid, is a row of barber poles with blurred edges moving either to the right or to the left on a gray background. The diagonal stripes inside the poles move either up, down, or not at all, depending on the relative speeds of the carrier and windowing gratings. Foveally, this stimulus is perceived as sideways-moving barber poles. Viewed peripherally at high temporal frequencies (where the first-order motion system dominates), with the diagonal bars inside the barber poles moving up, the whole stimulus appears to move consistently up. This vertical perceived direction of movement is not consistent with the diagonal direction of rigid motion of the stimulus as a whole (feature tracking, third-order motion) nor with vector combinations of Fourier components of the stimulus. Instead, we infer that the perceived motion direction is determined by a stream-detection process sensitive to the orientation of contrast-defined stream-beds within which pattern motion is constrained to flow. The periphery, unlike the fovea, computes only the streaming motion within the barber poles, not their lateral motion.
Email: George Sperling, sperling@uci.edu

11:00-11:15 (64)

Motion Integration in Dynamic Scenes: Evidence From Multiple Object Tracking. MARKUS HUFF and FRANK PAPENMEIER, *University of Tübingen*—In multiple-object tracking, participants track several moving objects among identical distractors. Recently, it was shown that the human visual system uses motion information to keep track of targets. Texture on the surface of an object that moved in the opposite direction to the object itself impaired tracking performance. In this study, we examined the temporal interval at which motion is integrated in dynamic scenes. In three experiments, we manipulated the texture motion on the objects: The texture either moved in the same direction as the objects, in the opposite direction, or alternated between the same and opposite direction. By manipulating the interval lengths of same/opposite motion in the alternating texture motion conditions we show that motion integration can take place at intervals as short as 100 ms. Further, there was a linear relationship between the proportion of opposite texture motion and tracking performance in the alternate conditions, thus rejecting the alternative hypothesis that no motion integration takes place with alternating texture motion.
Email: Markus Huff, markus.huff@uni-tuebingen.de

11:20-11:35 (65)

Interpreting Differences in Slope and Intercept in Visual Search: The Puzzle of Looming Motion. PAUL A. SKARRATT, *University of Hull,* ANGUS RH GELLATLY,

Oxford Brookes University, GEOFF G. COLE, *University of Essex*—In visual search, a stimulus is said to capture attention when it yields a shallower search function than that of a competing stimulus. On that basis, we (Skarratt, Cole, & Gellatly, 2009) reported that targets that loom toward or recede away from the observer attract attention equally, but that looming targets receive consistently faster responses overall. We attributed this intercept difference, termed the looming advantage, as looming motion priming the motor system. This hypothesis was tested using a perceptual measure of performance, on the basis that any motoric contribution to the looming advantage would be absent when measuring accuracy. However, participants showed greater accuracy for looming targets, indicating that the looming advantage has a perceptual basis. These findings suggest that attentional primacy can manifest as a difference in intercept, even when search slopes remain parallel.
Email: Paul Skarratt, p.skarratt@hull.ac.uk

11:40-11:55 (66)

Up-Down but Not High-Low Sounds Drive Visual Motion Perception. SOUTA HIDAKA, *Rikkyo University,* WATARU TERAMOTO, *Muroran Institute of Technology,* MIRJAM KEETELS and JEAN VROOMEN, *Tilburg University* (read by Jean Vroomen)—Studies using speeded classification have reported that high-pitched sounds tend to be matched to the upper visual space. We examined whether this correspondence in auditory pitch-space is manifest at a perceptual or cognitive level using an indirect perceptual task. In speeded classification, we indeed found that sounds with higher/lower pitch or upper/lower location were classified faster with a congruent response-key assignment (i.e., the upper response key for higher-pitch or upper-location sounds) than an incongruent assignment. In contrast, while alternating sounds of upper and lower locations induced illusory vertical motion of a static visual stimulus, alternating higher and lower pitch sounds did not induce such an illusion and did not even modulate vertical visual motion perception. These findings indicate that, at a perceptual level, there are limits on the equivalence of auditory pitch and space.
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Concepts and Categories II
Salon G, Friday Afternoon, 1:30-3:30
Chaired by Matt Jones, University of Colorado

1:30-1:45 (67)

A Form of Strong Selective Attention With Integral Dimensions. MATT JONES, *University of Colorado*—Similarity among stimuli varying along perceptually separable dimensions is highly flexible, with the weight given to each dimension depending on attention and task-relevance. Experiment 1 showed this flexibility can also arise from manipulations of stimulus range. Subjects were given an incidental task with stimuli varying factorially on two dimensions (X & Y), with range varied between subjects (wide X, narrow Y; or narrow X, wide Y). Responses on a subsequent similarity-triads task gave greater weight to the narrower dimension, consistent with subjects' implicitly equating the total variation present on the two dimensions. Experiment 2 repeated this design with integral dimensions, and found exactly the opposite result: The dimension with the greater range had a much greater effect on similarity. This finding goes against a large body of work showing similarity and attention are inflexible with integral dimensions. Both experiments also implicate an important role of constructing a stimulus space to impose structure on the task at hand. With separable dimensions, the challenge is to convert the dimensions to a common currency. With integral dimensions, the challenge is to identify how the stimuli vary to begin with.
Email: Matt jones, mcj@colorado.edu

1:50-2:05 (68)

Integral and Separable Dimensions in Perceptual Categorization. DANIEL R. LITTLE, *University of Melbourne*—A fundamental question in the study of perception and decision making is how information from multiple stimulus dimensions is processed in basic tasks such as detection, visual search, recognition and categorization. Recent work suggests that when dimensions are separable, the processing of each dimension occurs in its own processing channel (Fifić, Little & Nosofsky, 2010; Little, Nosofsky & Denton, 2011). By contrast, the separate dimensions of integral stimuli, such as colors varying in brightness and saturation, which are processed holistically, are pooled into a single, common coactive processing channel (Little, Nosofsky, Donkin & Denton, 2012). This talk addresses how this information processing distinction is related to other operations, which distinguish between separable and integral stimuli (e.g., Garner's, 1974, facilitation and interference effects and Shepard's, 1987, derivation of city-block and Euclidean distance metrics).
Email: Daniel Little, daniel.little@unimelb.edu.au

2:10-2:25 (69)

A Neurocomputational Model of Criterion Learning in Rule-Based Categorization. SEBASTIEN HELIE, *Purdue University,* SHAWN W. ELL, *University of Maine,* J. VINCENT FILOTEO, *University of California, San Diego,* BRIAN D. GLASS, *Queen Mary University of London,* W. W. TODD MADDOX, *University of Texas at Austin*—Rule-guided behavior is essential in adapting to an ever changing environment. Rule learning involves at least two different cognitive operations, namely rule selection and criterion learning. Criterion learning consists of selecting a grouping criterion (e.g., if the selected rule is 'long' vs. 'short', define 'long'). Very little is known about the neuroscience of rule learning. Here we propose a biologically realistic model of criterion learning and apply the model to category-learning data. The new model implements rule in lateral prefrontal cortex using pre-synaptic inhibition (Helie & Ashby, 2009). Criterion learning is implemented using a new type of heterosynaptic error-driven Hebbian learning at GABAergic (i.e., inhibitory) synapses. The model is used to account for categorization data showing that participants are more impaired by a shift in the rule-relevant dimension than when both the relevant and irrelevant dimensions are changed. Additional results and predictions made by the neurocomputational model will also be discussed.
Email: Sebastien Helie, sebastien.helie@psych.ucsb.edu

2:30-2:45 (70)

Characterizing Rule-Based Categorization Impairments in Individuals With Parkinson's Disease. SHAWN W. ELL, *University of Maine*—Individuals with Parkinson's disease (PD) are impaired on rule-based categorization tasks, where learning entails the use of an explicit, hypothesis-guided strategy. The most consistent findings come from categorization tasks with selective attention demand (i.e., categorizing based upon relevant information while ignoring irrelevant information). The present experiments investigate the hypothesis that this impairment may be related to a more general deficit in decision criterion learning. In Experiment 1, PD patients were able to learn a decision criterion in the absence of irrelevant information, but were impaired following an intra-dimensional shift in the optimal criterion. In Experiment 2, pre-training PD patients on the optimal criterion in the absence of irrelevant information shielded the patients from impairment once irrelevant information was introduced. These data suggest that PD patients may have a limited criterion learning impairment on rule-based tasks, but importantly, this impairment may not be inevitable.
Email: Shawn Ell, shawn.ell@umit.maine.edu

2:50-3:05 (71)

Learning Categories With and Without Labels. JOHN V. MCDONNELL and TODD M. GURECKIS, *New York University* (read by Todd M. Gureckis)—Studies of human category learning typically focus on situations where explicit category labels accompany each example (supervised learning) or on situations were people must infer category structure entirely from the distribution of unlabeled examples (unsupervised learning). However, real-world category learning likely involves a mixture of both types of learning (semi-supervised learning). Surprisingly, a number of recent findings suggest that people have difficulty learning in semi-supervised tasks. To further explore this issue, we devised a category learning task in which the distribution of labeled and unlabeled items suggested alternative organizations of a category. This design allowed us to determine whether

learners combined information from both types of episodes via their patterns of generalization at test. We find that a variety of factors influence people's tendency to generalize appropriately, including presentation order, number of labeled items, and response mode during training. Our results provide challenges to existing models of human category learning.
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3:10-3:25 (72)

Leading a Horse to the Water: On Erroneous Conclusions From Verbal Fluency Tests in Neuropsychology. GERT STORMS, *University of Leuven,* JULIA LONGENECKER, *Johns Hopkins University,* WOUTER VOORSPOELS and STEVEN VERHEYEN, *University of Leuven,* BRITA ELVEVAG, *National Institute of Mental Health*—In the past decades, a huge number of neuropsychological studies compared semantic data of healthy control participants with that of different patient groups (like patients with Alzheimer's disease or with schizophrenia). Different techniques (such as priming, scaling and clustering) have been used to demonstrate semantic deficits in the patient groups. A considerable number of studies compared similarity data of a patient and a healthy control group, using multidimensional scaling, clustering, or other similarity analysis techniques. The similarity data were often derived from category fluency tasks, a standard task in neuropsychological test batteries. We gathered such data from over 200 control subjects and over 200 patients with schizophrenia. We replicate the finding of different maps in both groups based on average sample sizes used in the literature, but we show that such differences are not reliable. Next, we show that with increasing sample size and – consequently – with increasing reliability of the input data, the differences between the maps of both groups decrease. Finally, we demonstrate that, after controlling for the unreliability inherently present even in very large data sets, the semantic maps of both groups are virtually identical.
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Testing Effects in Memory
Salon D, Friday Afternoon, 1:30-3:10
Chaired by Hal Pashler, University of California, San Diego

1:30-1:45 (73)

Instructional Strategies: Does Effective Mean Dispreferred? HAL PASHLER, *University of California, San Diego,* SEAN KANG, *Dartmouth College*—Review via testing ("retrieval practice") is often found to produce more efficient learning per unit time than rereading or other more passive modes of studying. However, retrieval practice is often effortful, and may thus be subjectively unpleasant for many learners, representing an important tradeoff. Thus far, motivational issues of this kind have generally been ignored in research on learning effectiveness. To shed new light on the topic, we carried out web studies in which subjects learned materials, reviewed for a fixed period of time (with subjects randomly assigned to different review conditions including testing with feedback, rereading, and open-book testing), and then were given a final test after a 1-week delay. Attrition during the review phase was used as a behavioral measure of subjective tolerability. The results show that effectiveness and subjective desirability do not always trade off.
Email: Hal Pashler, hpashler@gmail.com

1:50-2:05 (74)

Experiencing Test-Enhanced Learning Influences Subsequent Encoding and Retrieval Processes in Three Domains: Verbal, Mathematical, and Visuo-Spatial. THOMAS H. CARR, JOHN A. DEWEY and MURA DOMINKO, *Michigan State University,* ROBERT BATSELL and AUTUMN B. HOSTETTER, *Kalamazoo College*—After initial study (IS), taking a practice test (PT) improves performance on a final test (FT) more than does repeating the IS. An important feature of such "test-enhanced learning" (TEL) is transfer: PT's impact can extend beyond PT material to facilitate remembering material that was initially studied but not queried during PT, or queried during PT but not successfully remembered. Because this material was apparently encoded and stored during IS but not retrieved during PT, this impact of TEL might be called "within-study-representation transfer" between PT and FT. What else might PT affect? We report enhanced performance in a new IS-FT sequence with new material and no intervening test-preparation activity at all, immediately following a TEL experience in the same kind of task. This improvement of new encoding and retrieval might be called "altered-processing transfer", and was observed in verbal memory and mathematical problem solving. Visuo-spatial memory might behave differently.
Email: Thomas Carr, carrt@msu.edu

2:10-2:25 (75)

Guided Retrieval Practice of Educational Materials With Automated Scoring. JEFFREY D. KARPICKE and PHILLIP J. GRIMALDI, *Purdue University*—Although retrieval practice is an effective strategy for promoting learning, many students do not engage in retrieval as often as they should. We have developed and tested a computer-based approach that uses a natural language scoring algorithm, which we call QuickScore, to score students responses and guide students to practice retrieval of complex materials. Students learned concepts about science topics by studying and recalling the concepts in a multitrial learning procedure (study, recall, study, recall, etc.; Karpicke & Roediger, 2008). Once students correctly recalled concepts, as determined by QuickScore, the concepts were repeatedly retrieved, repeatedly studied, or removed from practice. Repeated retrieval with automated scoring consistently produced the best long-term retention and transfer on delayed tests. When students scored themselves during learning, they exhibited overconfidence and often awarded themselves full credit for partially correct responses. Guided retrieval practice represents a promising approach to circumventing metacognitive biases and improving learning.
Email: Jeffrey Karpicke, karpicke@purdue.edu

2:30-2:45 (76)

A Short-Term Testing Effect in Cross-Language Recognition. PETER P.J.L. VERKOEIJEN, SAMANTHA BOUWMEESTER and GINO CAMP, *Erasmus University Rotterdam*—Taking a memory test after an initial study

phase produces better long-term retention than restudying, a phenomenon known as the testing effect. We propose that this effect emerges because testing strengthens semantic item features, whereas restudying strengthens surface features. This novel testing account predicts that a testing effect should be observed after a short retention interval when a language switch occurs between the learning phase and the test phase. In the present study, we assessed this prediction with Dutch-English bilinguals who learned Dutch DRM lists through restudying or through retrieval practice. Five minutes after the learning phase, they took a recognition test in Dutch (within-language condition) or in English (across-language condition). We observed a testing effect in the across-language condition, but not in the within-language condition. These findings corroborate our novel testing account.
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2:50-3:05 (77)

The Pretesting Effect: Interference as Well as Facilitation From Initial Errors. WILLIAM B. LANDON and DANIEL R. KIMBALL, *University of Oklahoma* (read by Daniel R. Kimball)—The pretesting effect refers to improved memory for correct items that follow generated errors versus those that do not. We included a condition in which errors were initially read rather than generated, to determine whether effects of generating errors are distinguishable from effects of processing errors without generation. In Experiment 1, compared to initially correct items, memory was enhanced for correct items that followed initially read errors and even more enhanced for those that followed initially generated errors. In Experiment 2, we addressed the possibility that participants benefited from foreknowledge that an item was always correct if it followed an error, unlike an item that did not. Using catch trials that eliminated such foreknowledge, we again observed the error generation advantage, but initially read errors now proactively interfered with memory for corrections. These results suggest that pretesting effects reflect both a benefit due to error generation and a detriment due to proactive interference from error processing.
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Judgment and Decision Making I
Salon E, Friday Afternoon, 1:30-3:30
Chaired by Jonathan D. Nelson, Max Planck Institute for Human Development

1:30-1:45 (78)

Heuristics, Optimality and Children's Sequential Information Search. JONATHAN D. NELSON, *Max Planck Institute for Human Development,* BOJANA DIVJAK, *Ludwigsburg University of Education,* GUDNY GUDMUNDSDOTTIR, *Max Planck Institute for Human Development,* LAURA F. MARTIGNON, *Ludwigsburg University of Education,* BJÖRN MEDER, *Max Planck Institute for Human Development*—Consider a game of guessing which person has been chosen at random from among several people. The task is to identify the person with the smallest number of yes-or-no questions. (The questions are from a list of specific features that some people have, e.g., "Is the person wearing earrings?") It is impractical to check which of all possible sequences of questions is most efficient. Are any heuristic or stepwise-optimal strategies effective? We considered two different environments, a Representative Environment (with similar numbers of male and female people) and a Nonrepresentative Environment (with almost all male people). A simple heuristic strategy-- asking about the feature possessed by closest to half of the possible individuals—identifies the optimal sequence of questions in both environments. We tested 4th-grade children's questions in this game. They preferentially asked the best first question in each environment, especially in the Representative Environment.
Email: Jonathan D. Nelson, jonathan.d.nelson@gmail.com

1:50-2:05 (79)

A Game of Hide and Seek: Expectations of Clumpy Resources Influence Hiding and Searching Patterns in a Sequential Multi-Person Game. ANDREAS WILKE and STEVEN MINICH, *Clarkson University,* MEGANE PANIS, *University of Lyon,* TOM LANGEN, *Clarkson University,* PETER M. TODD, *Indiana University*—Animals use hoarding as a long-term strategy to ensure a food supply in times of shortage. But how do they promote the likelihood that they will be able to find those resources again, while minimizing the chance that others will find them? To reduce food cache loss from pilferage, scatter-hoarder bird species hyper-disperse multiple seed caches, positioning them further apart from each other than expected by chance. Here, we systematically look at human hiding and search patterns emerging from multiple goals. Subjects had to hide resources that other players would then seek (either in ways that would make the seeking easy or difficult), search for resources that others hid from them, and later relocate their own earlier hiding places. Results supported our predictions that subjects hide resources in clumpy resource patterns when they are collaborating with other players, but disperse resources when in competition.
Email: Andreas Wilke, awilke@clarkson.edu

2:10-2:25 (80)

Response Dynamics Reveal Evidence Accumulation in Decision Making. JOSEPH G. JOHNSON and GREGORY J. KOOP, *Miami University*—Decision research has shifted from utility-based models focused on outcomes to computational models that make specific predictions about underlying cognitive processes. Unfortunately, the methods for discriminating among these models have not advanced at the same pace. Specifically, although response time analyses and information search data have complemented analysis of choice patterns, experimental tasks still only collect discrete choice responses. In contrast, we have developed a unique paradigm to collect continuous, dynamic preference data in decision tasks, drawing from successful application in other cognitive domains. Specifically, we analyze the response dynamics associated with a choice by simply tracking the real-time spatial coordinates of the response device (e.g. computer mouse). In application to three studies, we show how this paradigm produces novel, meaningful, interpretable information about the decision process, such as "online

preference reversals." We discuss these results in terms of their support for various formal decision models. Finally, in one study, we pair response dynamics with eye-tracking of information acquisition to formalize and evaluate an evidence accumulation model of decision making.
Email: Joseph Johnson, johnsojg@muohio.edu

2:30-2:45 (81)

Modeling the Cognitive Processes underlying Intuition: A Parallel Constraint Satisfaction Approach to Decision Making. ANDREAS GLOECKNER, *Max Planck Institute for Research on Collective Goods*—It has been shown that powerful automatic processes allow people to integrate tremendous amounts of information rather quickly and with little cognitive effort. They often result in 'intuitions', that is, feeling how to decide without exactly knowing why. Two major shortcomings of intuition research in the field of Judgment and Decision Making have been that the processes underlying intuition have not been sufficiently well specified and that models often have not been sufficiently related to formal models for perception and memory. I present a parallel constraint satisfaction (PCS) model that describes (one kind of) these intuitive processes relying on Gestalt-structuring similar to perception. The PCS model applies the computational principles of the classic Interactive Activation Model for perception (McClelland & Rumelhart, 1981) to Judgment and Decision Making. I review recent studies testing the core predictions of PCS against predictions from other approaches such as non-compensatory heuristics and decision field theory using critical property testing, eye-tracking technology and physiological measures.
Email: Andreas Gloeckner, gloeckner@coll.mpg.de

2:50-3:05 (82)

Blood Glucose as a Signal in Regulating Intertemporal Choice for Resource Acquisition. X.T. WANG, *University of South Dakota*—When making intertemporal choices, people discount the future as they prefer a smaller and sooner (SS) reward to a larger but later (LL) reward. In a recent study (Wang & Dvorak, 2010) we found that a sugar drink reduced delay discounting, making the LL options more attractive. We propose that fluctuating blood glucose (BG), serving as a signal about body condition, regulates choice behaviors in resource acquisition. Study 1 examined the effects of varying BG levels in natural conditions measured by subjectively rated hunger and actual temporal distance from the last meal. The temporal distance but not subjective hunger perception was significantly and positively correlated with delay discounting. In a second study, participants with lower BG levels were less likely to prefer long-term to short-term savings in a hypothetical investment choice task, and showed a greater mating interest, suggesting that lower BG levels prompt resource acquisition for both mating opportunities and monetary gains. Ongoing studies compare the effects of glucose and another form of sugar (xylitol) on delay discounting to better understand the metabolic signaling pathway of delay-discounting regulation.
Email: X.T. Wang, xtwang@usd.edu

3:10-3:25 (83)

Explaining the Interrelated Evaluation of Choice Options With a Sequential Sampling Model. NICOLAS BERKOWITSCH, BENJAMIN SCHEIBEHENNE and JÖRG RIESKAMP, *University of Basel* (read by Jörg Rieskamp)—Standard economic theories of decision making assume that people evaluate choice options independently of each other. However, past work illustrates that evaluations of choice options often dependent on the set of available options. In particular, the similarity, compromise, and attraction effect represent prominent demonstrations of how people's preferences depend on the available choice set. These effects represent violations of the principle of independence from irrelevant alternatives and the regularity principle. The present work makes the novel contribution of illustrating that all three effects can occur simultaneously in a within-subject experiment. To explain the effects we show that a generalized version of decision field theory (Roe, Busemeyer, & Townsend, 2001, Psychological Review) is able to explain all three effects simultaneously with a fixed set of parameters. Furthermore, we show that the sequential sampling model outperforms standard economic random utility models in predicting the people's preferences. In sum, the cognitive modeling approach provides a better understanding of the cognitive processes underlying human decision making.
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Spatial Cognition

Marquette II, Friday Afternoon, 1:30-3:10

Chaired by Ranxiao Frances Wang, University of Illinois at Urbana Champaign

1:30-1:45 (84)

Orientation Advantages in the JRD Task: Representations or Transformations? WHITNEY STREET and RANXIAO FRANCES WANG, *University of Illinois at Urbana-Champaign* (read by Ranxiao Frances Wang)—Studies using the Judgment of Relative Directions paradigm generally interpreted better performance for certain imagined orientations as evidence of reference direction selection. Alternatively, the orientation advantages can also result from the relative ease in certain transformations/rotations. The present study examined different types of errors and RT in a JRD task to distinguish between these two theories. Participants memorized a regular target array from an aligned orientation (0 degree) while standing at an oblique direction. Then they performed JRD tasks on randomly selected target triplets. Their RTs and absolute errors showed the standard advantages at 0, 90 and 180 degree directions. In contrast, they showed systematic biases toward the 0 degree but not the other directions. These results suggest that only one orientation is represented in memory, while the advantages of other orthogonal orientations are due to transformations.
Email: Ranxiao Frances Wang, francesw@cyrus.psych.illinois.edu

1:50-2:05 (85)

Domestic Dogs Show Primacy Effects Using A Radial Arm Maze. MELISSA R. SHYAN-NORWALT, *Martin University & Companion Animal Problem Solvers, Inc.,* MARLISE CRAIG, JACQUIE RAND and RITA MESCH, *University of Queensland,* JOHN MORTON, *Jemora Pty Ltd,* ELIZABETH FLICKINGER, *Proctor & Gamble Pet Care*—This study investigated spatial memory in domestic dogs (Canis familiaris) using an eight-arm radial maze. Experiment 1 (free choice) tested the ability of the dogs to remember previously unentered (or entered) arms. Experiment 2 (1st four forced; 2nd four free) tested the ability of dogs to use cognitive rather than positional strategies. Experiment 3 (7 choices free, 8th choice binary) examined the serial position effect. Performance in all experiments (81%, 73%, 83% CR, respectively) was $p < .05$ or stronger, better than reported by MacPherson and Roberts (2010), who also used a radial arm maze with dogs. Serial Position results from our study agree with Tapp et al. (2003), who used a non-maze, nonmatching-to-sample task and found both primacy and recency effects in Beagles. Tapp et al., (2003) found a stronger recency and weaker primacy effect. We found a stronger primacy effect and almost no recency effect--possibly a result of the different methodologies used. Finding primacy effect in dogs is noteworthy because there is much less evidence for primacy, compared to recency, effects in mammals (Williams et al., 2000). Results support Wright's (2007) theory that serial list learning is affected by different sensory modalities.

Email: Melissa Shyan-Norwalt, mshyan@earthlink.net

2:10-2:25 (86)

Distinguishing Preference From Ability in Selecting Navigational Solutions. AMY L. SHELTON and ANDREW J. FURMAN, *Johns Hopkins University,* STEVEN A. MARCHETTE, *University of Pennsylvania,* MANUEL A. BROCKMAN, *Johns Hopkins University*—Individuals differ dramatically in both how well they navigate and in the solutions they report (routes, beaconing to landmarks, dead reckoning, mapping). Although our understanding of navigational styles has largely focused on self-reported preferences, empirical investigations of navigation allow us to disentangle people's preferences for navigational solutions from their capacity to use different solutions. In a series of studies, participants learned virtual environments using methods that allow at least two dominant strategies: mapping global structure and forming familiar routes. We then manipulated testing to investigate whether various instructions could alter the selection of solutions and reveal differences in capacity. The results suggest that individuals differ not only in their preferred solutions but also in the degree to which they can shift solutions to meet the navigational demands. We place this work in a framework where initial biases/preferences, spatial skills, and task demands combine to determine how navigational solutions are selected.

Email: Amy Shelton, ashelton@jhu.edu

2:30-2:45 (87)

Walking Through Doorways Causes Forgetting Even When You're Sitting Down. KYLE A. PETTIJOHN, ALEXIS N. THOMPSON and GABRIEL A. RADVANSKY, *University of Notre Dame* (read by Gabriel A. Radvansky)—Event boundaries impact the processing and storage of information in ways that can either facilitate or hinder memory. In one experiment, recognition memory for items was probed before or after a causal or spatial boundary; memory was worse for objects when there was an event shift. In a second experiment, subjects recalled as many details as possible from a text that contained zero, one, or two causal, temporal, activity, or spatial breaks. Memory improved with increasing number of breaks. The results suggest that event boundaries can create conditions in which there is interference among competing event models during retrieval, but which also help organize the storage of event attributes in memories across multiple events.

Email: Gabriel Radvansky, gradvans@nd.edu

2:50-3:05 (88)

Spatial Reference Frame for Implicitly Learned Attention. YUHONG V. JIANG and KHENA SWALLOW, *University of Minnesota*—Visual attention prioritizes information presented at particular spatial locations. These locations can be defined relative to reference frames based on the environment (allocentric) or the observer (egocentric). We investigated whether implicitly learned attention uses an allocentric or egocentric reference frame. Participants conducted visual search on a monitor laid flat on a tabletop. During training, the target was more likely to appear in a "rich" quadrant than in other "sparse" quadrants. Although they were unaware of this manipulation, participants found the target faster in the rich rather than in the sparse quadrants (probability cueing). In the subsequent testing phase, participants were reseated to change their viewpoint by 90° and the target became evenly distributed across quadrants. Spatial attention continued to be biased for several hundred trials. Critically, the preferred quadrant moved with the participant. Thus, implicit learning of a target's likely location led to a persistent, egocentric spatial bias.

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Multiple States of Working Memory: A New Era of Fractionation?

Marquette VIII, Friday Afternoon, 1:30-3:10

Chaired by Bradley Postle, University of Wisconsin

1:30-1:45 (89)

Information vs. Activation in Short-Term Memory. BRADLEY R. POSTLE, *University of Wisconsin, Madison*—Several models that explain working memory as "activated long-term memory" (e.g., Cowan, Oberauer) posit multiple states of activation, including, variously, a capacity-limited focus of attention, a region of direct access, and a broader pool of temporarily activated representations. This talk will consider these models in light of recent methodological advances in applying multivariate pattern classification (MVPC) analsyes to physiological signals, developments that have given rise to

several questions: What is the psychological and physiological reality, indeed, the utility, of categorical distinctions between iconic vs. short-term vs. working vs. long-term memory? How far can we push the overlap of the constructs of attention and working memory? Does the concept of 'activation' mean different things in a psychological vs. a computational vs. a physiological context? Answers to these questions will move us toward a coherent model of working memory that can accommodate and withstand further pressure toward functional fractionation.
Email: Bradley Postle, postle@wisc.edu

1:50-2:05 (90)

Feature Memory and the Guidance of Attention. CHRISTIAN N.L. OLIVERS, *VU University Amsterdam*—Many models of visual search assume that targets are prioritized on the basis of their match to a visual working memory representation. Experiments by myself and others converge on the idea that maintaining a visual feature in working memory can be, but is not always, sufficient for inducing an attentional bias towards that object. Nor is visual working memory necessary for such feature-based biases to occur: More implicit, episodic memories, as well as long-term feature associations induce very similar biases. Taken together, the evidence suggests that working memory tries to be as lazy as possible by specifying just the minimal task requirements, and letting the visual details be filled in on a "need-to-know" basis, either by the stimulus or by other memory systems. Only when a new attentional template is recruited is visual working memory involved, but this takes time, effort, and appears subject to a single item capacity limit.
Email: Christian Olivers, cnl.olivers@psy.vu.nl

2:10-2:25 (91)

Handing off Attentional Templates From Working Memory to Long-Term Memory. GEOFFREY F. WOODMAN and ROBERT M.G. REINHART, *Vanderbilt University,* NANCY B. CARLISLE, *University of California, Davis*—Theories of attention propose that target representations are stored in working memory to bias attention mechanisms to find critical items in cluttered scenes. However, theories of learning and automaticity suggest that working memory should only serve this function of controlling processing early in practice. Using electrophysiological methods, our research shows that when humans search complex visual scenes, a representation of the target is maintained in visual working memory, provided the identity of the searched-for item changes frequently across trials. However, when the target identity is stable across trials we can watch these working memory 'attentional templates' handed off to long-term memory. This talk concludes by discussing new questions we are addressing using these methods. Specifically, I will discuss recent work showing that reward effects attentional deployment by changing the source of the memory representations that control attention.
Email: Geoffrey Woodman, geoff.woodman@vanderbilt.edu

2:30-2:45 (92)

Delay-Period Activity Reflects the Internal Focus of Attention. JARROD A. LEWIS-PEACOCK, *Princeton University* (Sponsored by Bradley Postle)—It is widely assumed that the short-term retention of information is accomplished via an active trace. Thus, although models differ about the capacity of the internal "focus of attention" (e.g., 1 item (McElree, Oberauer) vs. a few (e.g., Cowan)), there is general agreement that it represents a subset of a broader pool of "activated" long-term memory representations. We present multivariate pattern analyses of fMRI and EEG data that generally support this framework, but challenge important details. First, our data indicate that two items can be held in the focus simultaneously. Perhaps more surprisingly, they also indicate that the active neural signature of an item that is removed from the focus drops quickly to baseline (NOT to an intermediate state), even though its neural signature can be just as quickly reactivated if it is needed later in the trial. Thus, short-term memory outside the focus of attention may not require activation.
Email: Jarrod Lewis-Peacock, jalewpea@princeton.edu

2:50-3:05 (93)

A Neurally Informed Taxonomy of Visual Short-Term Memory. ILJA G. SLIGTE, *University of Amsterdam* (Sponsored by Chris Olivers)—At the psychological level, visual short-term memory (VSTM) can be dissociated into iconic memory (brief, high-capacity) and visual working memory (sustained, limited-capacity). In addition, our recent work provides overwhelming evidence for an in-between stage with high capacity and long lifetime (Sligte, Scholte, & Lamme, 2008). While this new fragile VSTM stage can be dissociated from iconic memory and working memory, one can question the use of a taxonomy that fractionates VSTM into increasingly smaller subparts. Here, I propose a neural framework that brings everything together. By assuming that the contents of VSTM are continually refreshed by loops of brain activity, the behavioral characteristics of iconic memory, fragile VSTM, and working memory are natural consequences of the architecture of the system. As higher brain areas have increasingly complex tuning characteristics and larger receptive field sizes, the depth of neural processing will then determine capacity, duration, and fragility of individual VSTM traces.
Email: Ilja Sligte, i.g.sligte@uva.nl

SYMPOSIUM II: *The American Journal of Psychology*: Celebrating 125 Years of Contributions Shaping Contemporary Scientific Psychology
Salon C, Friday Afternoon, 1:30-3:30
Chaired by Robert Proctor, Purdue University

1:30-1:45 (94)

***The American Journal of Psychology*: Past, Present, and Future.** ROBERT PROCTOR, *Purdue University—The American Journal of Psychology* is a significant part of the legacy of scientific psychology in the U.S. The journal was established in the earliest days of the discipline and has published many influential articles during its storied past. This

talk will describe the journal's founding and the editors and contributors who have played significant roles in its success. A few of the most significant contributions will be highlighted, and the journal's current orientation and recent contents will be described. I will convey why it is important for scientific psychology to maintain a general journal that is steeped in tradition in an era in which prior research findings and theoretical views tend to be ignored in the name of novelty. The case will be made that Psychonomic Society members should support and strengthen this vital link between contemporary psychology and its past as a backbone of the field.
Email: Robert Proctor, proctor@psych.purdue.edu

1:50-2:05 (95)

Research on Mechanisms of Selective Attention in Vision. LISA R. FOURNIER, *Washington State University—The American Journal of Psychology* (AJP) has a relatively continuous record of publishing attention research. Several of the earliest articles published in AJP describe attention as intensifying consciousness to make objects as distinct as possible. Attention is either given to information, enhancing the clarity of this information, or is denied; suggesting that the mechanism of attention is signal enhancement. Articles published in the 1960s and 70s in AJP describe the mechanism of selection as a process of filtering out, attenuating or rejecting non-attended information. Evolving from these ideas, recent research provides behavioral and physiological evidence that both mechanisms (signal enhancement and inhibition of noise) play a role in selection. This talk will review some of the key research findings that led to this evolution and will highlight emerging ideas that are likely to shape the future directions of attention research.
Email: Lisa R. Fournier, lfournier@wsu.edu

2:10-2:25 (96)

Research in Visual Pattern Recognition: The Enduring Legacy of Studies From the 1960s. PAULA GOOLKASIAN, *University of North Carolina, Charlotte*—This talk highlights some research in visual pattern perception that was published in *The American Journal of Psychology* in the 1960s. Although visual perception research has changed substantially since then and the term visual pattern recognition is no longer in widespread use, the six research studies highlighted are some of the most influential of those published by the Journal in its long history. The research is described with an emphasis on how particular publications influenced others and the field in general. Current research differs from these earlier studies in the realization that behavioral observation alone is insufficient to address all of the issues involved in understanding visual perception. A much broader interdisciplinary approach is the hallmark of contemporary research.
Email: Paula Goolkasian, pagoolka@uncc.edu

2:30-2:45 (97)

Learning and Memory in *The American Journal of Psychology.* HENRY L. ROEDIGER III and KATHLEEN M. ARNOLD, *Washington University in St. Louis*—This presentation will list and briefly describe articles on learning and memory published in *The American Journal of Psychology* that were highly influential. These include papers in both animal learning and human learning and memory. We will consider in a bit more detail one contribution, Rock's (1957) experiments that initiated "the one-trial learning" controversy in human learning. The issue was declared dead less than a decade later, but a new look at the evidence suggests that it should be re-opened.
Email: Henry L. Roediger III, roediger@wustl.edu

2:50-3:05 (98)

Change and Continuity in the Study of Higher Mental Processes. RICHARD A. CARLSON, *The Pennsylvania State University*—Psychological perspectives on higher mental processes have changed dramatically over the history of The American Journal of Psychology. I trace these changes by focusing on two strands of research: decision under uncertainty, and chess-playing skill. Research on decision was shaped by the adoption of formal models of rationality, followed by repeated findings that individuals' actual decision making fails to conform to these models. The multiple steps in shifting to models that better reflect psychological reality, such as the adoption of methods to assess and model subjective probabilities and utilities, are well represented in the Journal. In the domain of chess skill, an early report by Cleveland (1907) strikingly anticipates modern theories of cognitive skill, while empirical research reported more recently captures major trends in the study of expertise. Taking a historical perspective through the pages of the Journal reveals both continuity and change in the study of higher mental processes.
Email: Richard A. Carlson, racarlson@psu.edu

3:10-3:25 (99)

Research on Emotion: From Introspection to Outward Perception. JEANETTE ALTARRIBA, *University at Albany, SUNY*—Early investigations of emotion and mood within *The American Journal of Psychology* tended to center on analyses of how emotional states affected facial expressions, laughter, use of humor, ratings of others' implicit and explicit behavior, and the like. Over the years, attention to the study of this topic within *AJP* has turned more towards capturing the automatic processing of emotion in terms of the roles of valence and arousal on responding to emotion word stimuli, pictures, and linguistic phrases. After a brief overview of the earlier, general categories of work, this talk will focus on how emotion word representation and processing came into its own, as an area of research interest within the study of human cognition and how timed paradigms and procedures (e.g., priming, emotional Stroop effects, dot probe tasks) have helped us to uncover the ways in which emotional stimuli seem to mediate attention, perception, and behavior.
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Selective Attention I
Marquette VIII, Friday Afternoon, 3:30-5:30
Chaired by Raymond Klein, Dalhousie University

3:30-3:45 (100)

On the Flavors of Inhibition of Return: Will the Real IOR Please Stand Up? RAYMOND M. KLEIN, MATTHEW D. HILCHEY and JASON SATEL, *Dalhousie University*—Using variants of the model task pioneered by Posner, Tracy Taylor (Taylor & Klein, 2000) discovered 2 distinct "flavors" of IOR: When saccadic responses were precluded, the effect of IOR was confined to the input pathway (attentional/perceptual favor); while, when saccadic responses were executed (either to the cue or target, or both) IOR was confined to the output pathway (decision/motor flavor). Using different methods for encouraging eye movements or encouraging inhibition of the reflexive oculomotor machinery presumed to play an important role in the generation of IOR our research validates this important distinction, explores its implications, and identifies the motor flavor as the type of IOR that has been hypothesized to be a novelty seeking foraging facilitator.
Email: Raymond Klein, ray.klein@dal.ca

3:50-4:05 (101)

The Application of Attention Research to the Design of More Effective Product Labels. MARK W. BECKER and LAURA BIX, *Michigan State University,* NORA M. BELLO, *Kansas State University,* RAGHAV SUNDAR, *Michigan State University*—Products labels often require information that is essential for the safe and effective use of certain products (e.g., drug labels and nutritional facts labels). Most research on effective labeling techniques has focused on text legibility and the comprehensibility of the message. However, that approach pre-supposes that people attend to the critical information. Attention is capacity limited and necessary for conscious processing, thus a label must attract attention before the comprehensibility of its message can impact effectiveness. We applied change detection and eye-tracking methods to evaluate how novel labeling techniques for presenting look-alike-sound-alike drug names and nutritional information impact attentional prioritization. These data suggest that failures to attend to critical label information are common and specific labeling techniques can minimize these failures. Overall, we argue that basic visual cognition research can be applied to the design and evaluation of more effective product labels with the potential to have substantial positive health consequences.
Email: Mark W. Becker, becker54@msu.edu

4:10-4:25 (102)

Selection in Visual Working Memory Does Not Require Sustained Visual Attention. ANDREW HOLLINGWORTH, *University of Iowa,* ASHLEIGH M. MAXCEY-RICHARD, *Manchester University*—What is the relationship between visual working memory (VWM) and visual attention? Retro-cuing studies (in which a spatial cue supports selective VWM retention) suggest that selection in VWM depends on directing visual attention to particular object representations, and researchers have proposed that attention and VWM reflect a common mechanism that differs only in whether it operates over currently visible objects or previously visible objects. We tested whether visual attention is required for the selective maintenance of objects in VWM. Participants performed a color change-detection task. During the retention interval, a valid cue indicated the to-be-tested item. Accuracy was higher in the valid-cue condition than in a neutral-cue control condition. To probe the role of attention in the retro-cuing effect, a difficult search task was inserted after the cue, precluding sustained attention on the cued item. The addition of the search task produced no observable decrement in the cuing effect. Moreover, search efficiency was unimpaired by simultaneously prioritizing an object for retention in VWM. Thus, selection in VWM can be dissociated from visual attention. VWM and attention interact, but they are distinct cognitive systems.
Email: Andrew Hollingworth,
andrew-hollingworth@uiowa.edu

4:30-4:45 (103)

Updating Spatial Working Memory During Object Movement. JAN THEEUWES, PAUL BOON and ARTEM V. BELOPOLSKY, *Vrije Universiteit Amsterdam*—Spatial working memory enables the temporary maintenance and manipulation of spatial information. There is a strong link between spatial working memory, attention and eye movements. Directing attention to a location as well as remembering a location generates activity in the oculomotor system (Theeuwes et al., 1995; Psy Sci). In the current study we investigated how oculomotor activity representing memorized locations is updated during object movement. Participants had to remember a location on a moving object, and curvature of subsequent eye movements was used to measure oculomotor activity at both the original, retinotopic location and the updated, frame-centered location. The results showed that working memory is rapidly remapped from the retinotopic to the object-centered location. Shortly after object movement activity was present at both locations. However, within the next 200 ms, the activity at the retinotopic location decayed, and activity at the frame-centered location became dominant. We suggest that in addition to maintaining memory representations, the oculomotor system is also involved in updating these representations during object movement.
Email: Jan Theeuwes, j.theeuwes@psy.vu.nl

4:50-5:05 (104)

Implicit Sequence Learning Within and Across Modalities. ARIT GLICKSOHN and ASHER COHEN, *The Hebrew University* (read by Asher Cohen)—Two well known paradigms that explore implicit sequence learning are artificial grammar learning (AGL) and statistical learning (SL). One central question in these domains is whether learning is done separately within modalities (e.g., vision, audition) or whether learning is insensitive to input modality. Previous studies largely supported separable within-modality learning mechanisms. We further explored this question in both SL and AGL. A series of experiments in each of the two paradigms converge on the same conclusion: Implicit sequence learning is amodal. That is, implicit sequence learning is not sensitive

to the input modality; sequence learning is roughly similar for single modality and cross modal input. Finally, we shall explain why previous studies appeared to (wrongly) indicate separable within-modality learning.
Email: Asher Cohen, msasher@mscc.huji.ac.il

5:10-5:25 (105)

Testing Models of the Attentional Blink: Does Masking Increase Processing Duration in RSVP? BRAD WYBLE, *The Pennsylvania State University,* FLORIAN SENSE and MARK NIEUWENSTEIN, *University of Groningen*—Theories of the attentional blink (AB) – an impairment in perceiving the second of two targets shown within less than 500 ms of each other – generally assume that this effect reflects the time required to consolidate the first target in memory. In this view, the fact that the AB is strongly increased when the first target is masked suggests that masking prolongs the time needed for first-target consolidation. It is also possible, however, that the presence of a mask could elicit additional processing mechanisms that cause an increased blink without prolonging the duration of T1 processing. To answer this question, we examined reaction times for masked and unmasked targets embedded in rapid serial visual presentation. The results showed an increase in median reaction times for targets followed by immediate or delayed masks relative to targets followed by blanks. This was true for both target detection (spot any letter among numbers) and target discrimination (2AFC vowel vs consonant) tasks. These results corroborate theories of the AB in which the depth of the AB is related to the duration of T1 processing (Bowman & Wyble 2007; Wyble, Bowman & Nieuwenstein 2009).
Email: Brad Wyble, bwyble@gmail.com

Special Session: Improving the Quality of Psychological Science
Salon D, Friday Afternoon, 3:30-5:30
Chaired by Stephen Lindsay, University of Victoria

3:30-3:45 (106)

Do We Have a Replicability Crisis, and if so, What Should We Do About It? HAROLD PASHLER, *University of California, San Diego*—Concerns about replicability appear to be at an all-time high in many fields of research. Most of the underlying reasons for worry (especially the File Drawer Problem) have been around for decades, so it is perfectly sensible to wonder: Has anything really gotten worse? Relying on both subjective and objective indicators, I suggest the problem has likely worsened to some extent in recent years. I also consider and rebut several commonly raised arguments for complacency, such as the notion that even if direct replications are scarce, conceptual replications are plentiful and offer a good substitute--and the view that science is sure to be slowly self-correcting if we would just show a bit of patience. I review the various ideas that have been suggested to help promote and reward replications and replicability, and argue that a few should be adopted immediately, while the rest are promising enough to deserve experimentation.
Email: Harold Pashler , hpashler@gmail.com

3:50-4:05 (107)

We're All Doing It Wrong: Replication and Data Analysis in Psychological Science. GREGORY FRANCIS, *Purdue University*—We have been taught that replication is the gold standard of science and that multiple successful replications provide strong evidence for an effect. Because psychological science uses statistics, this view is wrong. When findings are based on statistics, the outcomes occur with predictable probabilities, and for hypothesis testing the reported successful replication rate must reflect experimental power. Not recognizing this fundamental property of hypothesis testing causes many problems in how we design experiments and interpret experimental findings. Thus, making a scientific argument across a set of experiments requires reporting both significant and non-significant findings. A set of experiments with relatively low power that almost always reject the null hypothesis should be interpreted as biased and thereby unscientific. To make convincing scientific arguments, more emphasis needs to be placed on effect sizes and measurement precision rather than hypothesis testing. Bayesian data analysis methods are especially well suited for these investigations.
Email: Gregory Francis, gfrancis@psych.purdue.edu]

4:10-4:25 (108)

Reporting Beyond Significance. CATHERINE O. FRITZ and PETER E. MORRIS, *Lancaster University*—Reports of experimental psychology are often incomplete in important ways, which can limit the usefulness of the research. Problems identified in the literature include failures to describe the data distributions, to fully report the results of analyses, to describe and reflect upon the size of observed effects, and to describe the variability of point estimates using standard errors or other confidence intervals. The effect size statistics selected should be appropriate rather than merely convenient and should play an important role in interpreting the results. These issues are addressed in the context of factorial and difference-based designs. For research to be cumulative, reports must include sufficient information not only to support their immediate interpretation but also to enable interpretation beyond the intended focus of the author(s). Complete descriptions of data and effect sizes are necessary to support planning of related research and for cross-study comparisons including meta-analyses.
Email: Catherine O. Fritz, c.fritz99@gmail.com

4:30-4:45 (109)

Why We Should Revile p-Values. GEOFFREY R. LOFTUS, *University of Washington,* MICHAEL E. J. MASSON, *University of Victoria*—Despite their continuing pervasiveness, p-values may be the worst mathematical application ever invented. We describe the top three reasons why. First, a null hypothesis is almost never literally true, thereby rendering irrelevant the probability of computing any probability that presupposes it. Second, putting aside this first reason, a p-value, being the probability of data given a null hypothesis, is only vaguely relevant to the real question, namely, how likely is it that a null hypothesis is true or false. Third, p-values, having attained such a central role in whether an article is publishable, have shifted

researchers' emphases away from what is fundamentally interesting in science. We suspect, for example, that chasing a significant p-value may contribute to the recently identified problem of shrinking effect sizes. "Revile"? Too strong a term? We think not. Researchers' slavish devotion to p-values have set Psychology back at least a half-century (and counting).
Email: Geoffrey R. Loftus, gloftus@u.washington.edu

4:50-5:05 (110)

Bayesian Methods Interpret Data Better. JOHN K. KRUSCHKE, *Indiana University*—Bayesian analysis can ameliorate many problems in data interpretation. This talk focuses on inflated false alarm rates in sequential testing and multiple comparisons, illustrated by examples. Researchers might test their data during collection, stopping only when statistical significance has been achieved. Intuition suggests this is okay because any datum is independent of other data. Nevertheless, in null hypothesis significance testing (NHST), sequential testing yields 100% probability of rejecting the null. By contrast, Bayesian methods have a much lower probability of false alarms. Researchers might test multiple comparisons. Under NHST, the threshold for declaring significance must be raised merely because of the intention to make other tests. Consequently, analysts might feign interest in only a few comparisons. By contrast, Bayesian methods make it easy to construct hierarchical models that mitigate false alarms. Bayesian decisions are not affected by multiple comparisons.
Email: John K. Kruschke , johnkruschke@gmail.com

5:10-5:25 (111)

Panel Discussion. STEPHEN LINDSAY, *University of Victoria*—This 15-minute time slot will give audience members an opportunity to follow up on the speakers' presentations and to broach other, related issues.

Judgment and Decision Making II
Marquette II, Friday Afternoon, 3:30-5:30
Chaired by Michael Young, Kansas State University

3:30-3:45 (112)

Order Effects in Impulsive Choice. MICHAEL E. YOUNG, *Kansas State University,* TARA L. WEBB, JILLIAN M. RUNG and ERIC A. JACOBS, *Southern Illinois University at Carbondale*—Recently, we have used a video game preparation to study the tradeoff between responding quickly in order to produce smaller rewards versus responding more slowly in order to produce larger rewards (Young, Webb, & Jacobs, 2011). In the present study, we leveraged this task to study behavioral dynamics when the contingencies for this tradeoff changed over time. Using an escalating interest task in which reward gradually increased over a 10-second period, the rate of increase was systematically altered across four experimental phases with the order of the rates counterbalanced between subjects. Not surprisingly, behavioral preferences changed in response to changes in the rate, but persistent effects of prior experience were evidenced especially in the presence of weak preference contingencies. The escalating interest video game task allowed for the study of the dynamics of choice without concerns about satiation.
Email: Michael Young, michaelyoung@ksu.edu

3:50-4:05 (113)

Remembering Peaks and Ends: Memory Biases in Experience-Based Risky Decisions. ELLIOT A. LUDVIG, *Princeton University,* CHRISTOPHER R. MADAN and MARCIA L. SPETCH, *University of Alberta*—When retrospectively evaluating past experiences, such as the overall pain of a medical procedure, people often display a peak-end heuristic. Their subjective valuation is mostly determined by the maximal (peak) and final intensities (end). In three experiments, we show that people exhibit similar biases in experience-based risky decisions. In the main task, people selected between pairs of doors. One door always led to a fixed amount (gain or loss), and a second, risky door led equiprobably to double-or-nothing that same amount. People were risk seeking when choosing between relative gains but risk averse when choosing between relative losses, contrary to the usual findings with description-based choice. This pattern of risk sensitivity only emerged when the risky option occasionally led to the largest or smallest reward experienced. In addition, people were sensitive to recent outcomes: they gambled more often after winning on a risky option and gambled less often after losing.
Email: Elliot Ludvig, eludvig@princeton.edu

4:10-4:25 (114)

Gist Numeracy: A Fuzzy-Trace Theory Approach. VALERIE F. REYNA, PRISCILA G. BRUST-RENCK, ALLISON PORTENOY, MARGARET GICHANE and EVAN WILHELMS, *Cornell University*—Numeracy (ability to understand and use numbers) has been linked to cognitive biases, health behaviors, and medical outcomes. Although numeracy scales have proliferated, they lack theoretical justification. Indeed, some anomalous results have been consistently obtained that challenge conceptions of numeracy. For example, people high in numeracy sometimes prefer numerically inferior options to superior options or base judgments on ratios or proportions even when correct answers require absolute numbers. Recent psychometric research suggests that objective numeracy scales tap both gist (simple categorical or ordinal relations) and verbatim (exact or rote) conceptions of number (Liberali, Reyna et al., 2011). Therefore, we constructed an alternative gist numeracy scale that captures categorical and ordinal gist, tested its psychometric properties in a sample of 438 subjects, and related it to a number of decision quality and medication adherence measures. Among other results, the gist numeracy scale predicted medication adherence better than standard objective numeracy.
Email: Valerie Reyna, vr53@cornell.edu

4:30-4:45 (115)

The Role of Number of Choices and Outcomes in Experience-Based Decisions. ADRIAN R. CAMILLERI, *Duke University,* BEN R. NEWELL, *University of New South Wales*—The "description-experience gap" is the observation

that preferences tend to deviate depending on whether outcomes and probabilities are stated explicitly or are learned from a sampling process over time. In the current study we assessed the extent to which differences in the weighting of rare events—a factor commonly implicated in the choice gap—are produced by differences in the number of choices and number of outcomes associated with the choice problem. We ran an online experiment in which participants made both description- and experience-based choices to a systematic set of 32 binary choice problems that crossed domain, probability of the rare event, favorability of the rare event, and maximizing option. In the experience condition we observed that underweighting of rare events (and hence, the choice gap) was reduced when there was just one choice ("multi play") compared to when there were many choices ("repeated play"), and also when a single choice produced many outcomes ("multi play") compared to a single outcome ("single play"). We conclude that underweighting of rare events in the experience-condition is partly due to a myopia associated with short-run horizons.
Email: Adrian Camilleri, adrian.camilleri@duke.edu

4:50-5:05 (116)

The Effect of Context on the Temporal Discounting of Sequential Losses. MARY KAY STEVENSON, DANIELLE LAVERE and JACOB GOMEZ, *California State University, East Bay*—Context describes time frame manipulations or variations in the sample of delayed gains or losses. This series of studies describes four manipulations that focus on the impact of context demonstrating its importance for temporal discounting. Three judgment studies describe the differences in temporal discounting for single and sequential outcomes as a function of the contextual manipulations. The last study uses a preferences task for a direct comparison of single payments and payment schedules presented in a sequential context manipulation of payment magnitude. Participants evaluate the sequences by comparing them to lump sums that vary in their due date. The results describe the impact of context and the loss magnitudes on the preference for lump sums and payment sequences. These results are related to a general theory of temporal discounting.
Email: Mary Kay Stevenson, marykayste@gmail.com

5:10-5:25 (117)

Bias in Simple Decisions. COREY N. WHITE and RUSSELL A. POLDRACK, *University of Texas at Austin*—Adjustments in decision bias allow for great behavioral flexibility. Choice response time (RT) models like the drift-diffusion model (DDM) assume that bias can be induced by adjusting stimulus evaluation, which produces changes in the value of decision evidence, or by adjusting response expectations, which produce changes in how much evidence is needed for each response. These biases are predicted to produce different effects on the distributions of RTs. We manipulated both types of bias independently in perceptual and recognition memory tasks to assess their behavioral effects across different decisions. As predicted, the bias manipulations had different effects over time: expectancy manipulations were most effective for fast responses, whereas evaluation manipulations were effective across different response speeds. There was also some evidence for a dynamic biasing signal for expectancy manipulations that increases over time, but mainly when stimulus information was poor and responses were rushed. DDM fits to the behavioral data separated these biases into distinct parameters, offering a promising methodological approach to interpreting decision bias. Implications for the interpretation of decision bias are discussed.
Email: Corey White, white.1198@mail.utexas.edu

Working Memory I

Salon E, Friday Afternoon, 3:50-5:30

Chaired by Valerie Camos, Universite de Fribourg

3:50-4:05 (118)

Phonological Similarity Effect in Complex Span Task. VALERIE CAMOS, *Universite de Fribourg,* GEROME MORA, *Universite de Bourgogne,* PIERRE BARROUILLET, *Universite de Geneve*—Our study aimed at evaluating phonological similarity effect (PSE) in complex span tasks. PSE was largely investigated with immediate serial recall tasks that show better recall performance for lists of phonologically dissimilar memory items compared with lists of similar items. By contrast, the few studies in complex span paradigm led to a mixed picture with all the possible patterns of results reported. An analysis of these studies points towards two factors that could be responsible for the observed variations in PSE, i.e., the attentional demand of the concurrent task and its verbal or non-verbal nature. In three experiments, we manipulated orthogonally these two factors in complex span tasks in which adults had to maintain words while performing concurrent tasks. First, this study confirmed the previous works that observed PSE in complex span tasks. Moreover, although both the attentional demand and the nature of the concurrent task affected recall performance, only the induction of an articulatory suppression during maintenance made the PSE disappear. These results suggest that the emergence of PSE in complex span tasks relies on the maintenance of a phonological representation of memory items through subvocal rehearsal.
Email: Valerie Camos, valerie.camos@unifr.ch

4:10-4:25 (119)

Chunking Memory Span of Categorizable Stimuli Varying in Number, Order and Compressibility. FABIEN MATHY and MUSTAPHA CHEKAF, *Université de Franche-Comté*—We aim to evaluate the capacity of working memory while measuring the compressibility of information likely to allow the formation of chunks. It is hypothesized that the average working memory capacity (4 +/-1 chunks) allows the span to vary depending on the sum of information compressed within each chunk. We constructed a task of immediate serial report in which the participants had to memorize and recall sequences of categorizable stimuli, that is, objects with possible associations between them. The logical complexity of Feldman's (2000) rules of classification was used to measure the compressibility of each sequence of stimuli. To favor the extraction of informational regularities by participants, a second manipulation of the sequences concerned the presentation order. The results showed a span of about 4

objects, with a variability, which depended on both the complexity of the sequences and their presentation order. The amount of information retained in working memory was maximal for the most compressible sequences and for the presentation orders that facilitated the abstraction of rules. The role of working memory in the formation of chunks is discussed.
Email: Fabien Mathy, fabien.mathy@univ-fcomte.fr

4:30-4:45 (120)

No Decay in Verbal Working Memory. KLAUS OBERAUER, *University of Zurich,* STEPHAN LEWANDOWSKY, *University of Western Australia*—Two experiments with a complex-span task tested whether forgetting in working memory is caused by time-based decay. Encoding of letter lists for serial recall alternated with processing periods comprising four trials of difficult visual search. Search time, during which memory could decay, was manipulated via search set size. Free time between search trials, during which memory could be restored, was also manipulated. Despite nearly doubling the retention interval, the manipulation of search time failed to affect memory. This result held with and without articulatory suppression. Two further experiments with a PRP paradigm confirmed that the visual search task required central attention. Thus, even when maintenance by central attention and by sub-vocal articulation was prevented, a large delay had no effect on memory, contrary to the notion of decay.
Email: Klaus Oberauer, k.oberauer@psychologie.uzh.ch

4:50-5:05 (121)

Working Memory: Competing Theories, or Different Research Questions? ROBERT H. LOGIE and JASON M. DOHERTY, *University of Edinburgh*—We address three accounts for working memory. One is focused on individual differences in maximum working memory performance and maximum performance on other tasks. A second examines effects of altering overall cognitive load. Both assume a general purpose, limited capacity attentional control system. A third notes that most everyday cognition does not require maximum performance levels, and assumes a collection of different cognitive resources that can be applied in different combinations depending on the nature of the task and the capacity of each resource. This collective operation would generate data patterns consistent with a single, general purpose attention system. We present experimental evidence demonstrating that when task loads are adjusted to the function-specific capacities of each experimental participant, then the impact of cognitive load is strikingly different from when cognitive loads exceed the overall capacity of cognitive functions acting in concert. Implications for the three accounts will be discussed.
Email: Robert Logie, rlogie@staffmail.ed.ac.uk

5:10-5:25 (122)

Spared and Impaired Encoding Categories in Memory and Language: H.M. Revisited. DON G. MACKAY and LAURA W. JOHNSON, *University of California, Los Angeles*—In two studies, amnesic HM encoded some categories of episodic and syntactic information without deficit relative to memory-normal controls. Spared were topics of conversation in episodic memory and proper names in sentence production. For example, when describing pictures of unfamiliar people on the Test of Language Competence (TLC), HM used proper names (e.g., Melanie) without gender-inappropriate errors, but he produced many gender-inappropriate errors using the three other ways to describe people: pronouns (e.g., she), common nouns (e.g., woman) and noun phrases (NPs, e.g., this woman). These results helped explain a puzzling result in three earlier studies: HM's greater-than-normal use of proper names in spoken and written discourse relative to NPs, pronouns, and common nouns. HM was apparently using his intact mechanisms for encoding proper names to compensate for his impaired mechanisms for encoding functionally equivalent structures, yielding overuse of proper names relative to pronouns, common nouns, and NPs.
Email: Don MacKay, mackay@ucla.edu

Motor Processes
Salon G, Friday Afternoon, 3:50-5:10
Chaired by Gordon Logan, Vanderbilt University

3:50-4:05 (123)

Prevention or Cure? Error Detection and Correction in Skilled Typists. GORDON D. LOGAN, *Vanderbilt University,* MATTHEW J. C. CRUMP, *Brooklyn College, CUNY*—Error detection serves two different functions: prevention and cure. Prevention engages post-error slowing to reduce future errors. Cure engages processes that correct the error. Thus, prevention predicts post-error slowing and cure does not. Skilled typists prefer cure to prevention: In three experiments, we found post-error slowing only when correction was disallowed, and the slowing persisted only for a few keystrokes. Words that followed errors were typed as quickly as words that preceded errors. We found no post-error slowing when typists were allowed to correct errors. They corrected errors as soon as they detected them and then resumed typing at normal rates. Keystrokes that fell between the error and the error detection response were actually faster than keystrokes before the error, suggesting post-error speeding. These findings led us to propose the novel hypothesis that post-error slowing reflects the inhibition of pre-potent tendencies to correct mistakes.
Email: Gordon Logan, gordon.logan@vanderbilt.edu

4:10-4:25 (124)

Are Tool Characteristics Represented in Imagined Actions? MARTINA RIEGER, *University for Health Science, Medical Informatics & Technology,* CRISTINA MASSEN, *Leibniz-Institut für Arbeitsforschung*—We investigated whether tool characteristics (here: thickness of a felt pen) are represented during motor imagery. In Experiment 1 participants executed or imagined colouring rectangles with a thick and thin felt pen. To disentangle whether differences between execution and imagination are due to the lack of action and/ or due to the lack of effects in the environment, participants also executed drawing without an action effect in Experiment 2. In both experiments pen thickness influenced drawing durations in executed as well as imagined actions, showing that tool characteristics are represented during motor imagery.

Imagination durations were shorter than execution durations. Executed drawing without an effect was even shorter than imagined drawing. Presumably, imagining the action itself is effortful, resulting in longer durations for imagination than for execution without effect. The lack of environmental effects during imagination seems to be responsible for differences between imagination and execution.
Email: Martina Rieger, martina.rieger@umit.at

4:30-4:45 (125)

Directive and Incentive Functions of Affective Action Effects. ANDREAS B. EDER, *University of Würzburg,* KLAUS ROTHERMUND, *University of Jena,* JAN DE HOUWER, *Ghent University,* BERNHARD HOMMEL, *University of Leiden*—Studies examined whether affective action effects become associated with the responses producing them, and how the resulting response-effect bindings influence action control. In a learning phase, one response produced pleasant and another response unpleasant visual effects. In a subsequent test phase, the same actions were carried out in response to a neutral feature of affective stimuli. Results showed that responses were faster when the irrelevant valence of the test stimulus matched the valence of the response effect, but only when the responses still produced effects. This confirms that affective action consequences have a directive function in that they facilitate the selection of the associated response over other responses. Results also showed that affective action consequences can have an incentive function in that responses with pleasant effects are generally facilitated. However, this incentive function was seen only in a free-choice test. Our results suggest that directive and incentive functions of affective action consequences are implemented by dissociable processes that have additive effects on action control.
Email: Andreas Eder,
andreas.eder@psychologie.uni-wuerzburg.de

4:50-5:05 (126)

After Effects of Action on Selection: Attentional Bias Towards an Acted Upon Object. SOWON HAHN and DANIEL R. BUTTACCIO, *University of Oklahoma*—In the present research we investigated the after-effects of action by fusing a go/no-go task with a visual search task. In Experiment 1 participants responded to a colored shape (prime) when it matched a preceding color name cue (go) did not respond when the two mismatched (no-go). In Experiment 2 participants were given the reverse response instructions. Following the go/no-go task, the prime was either present or absent in the search array and its presence resulted in slowed RTs on go trials relative to its absence, with no such difference for no-go trials. Relatedly, the prime was fixated more often on go trials relative to no-go trials. However, this attentional bias was eliminated when the prime was acted upon because it mismatched the cue. The authors suggest that by acting on an object because it contains a specific feature creates a strong trace in memory which influences subsequent selection processes.
Email: Sowon Hahn, sowon@ou.edu

Explicit Memory II

Salon C, Friday Afternoon, 3:50-5:30

Chaired by Bridgid Finn, Washington University in St. Louis

3:50-4:05 (128)

Reconsolidation From Negative Emotional Pictures: Is Successful Retrieval Required? BRIDGID FINN and HENRY L. ROEDIGER, *Washington University in St. Louis*—When a negative picture is presented immediately after a successful retrieval, later recall is enhanced as compared to when a neutral picture or a blank screen is shown (Finn & Roediger, 2011). This finding implicates the period immediately following retrieval as important in boosting later retention via reconsolidation. Experiments investigating whether successful retrieval is required to show this enhancing effect will be presented. Participants studied Swahili-English vocabulary pairs, took an intervening cued-recall test, and then a final cued-recall test. We tested whether enhancement occurred when a negative picture followed an unsuccessful retrieval attempt with feedback; we found a larger enhancing effect after errors of commission than errors of omission. Results point to effort during retrieval as critical to reconsolidation via negative pictures. The results provide support for semantic enrichment as a key element in the enhancing effect of negative pictures presented after a retrieval attempt.
Email: Bridgid Finn, bridgid.finn@wustl.edu

4:10-4:25 (129)

Does Reconsolidation Happen for Episodic Memory in Humans? JASON C.K. CHAN and JESSICA A. LAPAGLIA, *Iowa State University*—Hundreds of studies on memory reconsolidation have populated the literature over the past decade, but only a handful involved human subjects. To date, no study has demonstrated reconsolidation-dependent amnesia in human episodic memory. Here, using a retrieval-relearning technique, we show that selective impairment in episodic memory is possible due to reconsolidation disruption. Here we show that the memory impairment can be achieved long after formation of the original memory if (and only if) relearning occurred soon after retrieval, that the effect cannot be attributed to response competition or source confusions during memory testing, and that it is only attainable via specific, but not general, interference. Together, these results specified the conditions under which disruptions of reconsolidation might produce amnesiac effects on episodic memory in humans.
Email: Jason C.K. Chan, ckchan@iastate.edu

4:30-4:45 (130)

Updating Memory: Is Reconsolidation Involved? JANET METCALFE, MICHAEL A. SMITH and BARBIE J. HUELSER, *Columbia University*—Does retrieval of an error make that error stronger and hence make learning of a new correct response more difficult as interference/unlearning theory suggests? Or does retrieval of an error put it into a malleable state whereby it can be easily updated as reconsolidation theory proposes? This latter view suggests that generating an error may facilitate, rather than obstruct, memory for the correct response. In two experiments, we investigated the effect of

retrieving a newly learned but now erroneous response (B) on learning of a new correct response (C). In the error-generation condition the erroneous response was elicited before the correct information was provided; in the no-error condition, the correct response was provided without first eliciting the now incorrect response. Two experiments were conducted. In the first, the cue (A), the error (B), and the correct response (C) were semantically related. In the second experiment the cue, error and correct response were unrelated. In both cases, correct generation of the error was associated with enhanced rather than inhibited recall of the correct response. This finding of beneficial effects of error generation on updating is consistent with reconsolidation theory.
Email: Janet Metcalfe, jm348@columbia.edu

4:50-5:05 (131)

Temporal Context Cues Harm Recognition Memory, but Task Context Cues Do Not. JEFF ANNIS and KENNETH J. MALMBERG, *University of South Florida,* AMY H. CRISS, *Syracuse University,* RICHARD M. SHIFFRIN, *Indiana University* (read by Kenneth J. Malmberg)—Recognition memory accuracy is harmed by prior testing (a.k.a., output interference or OI; Tulving & Arbuckle, 1966). In several experiments, we interpolated various tasks between recognition test trials. The stimuli used to perform the tasks were more similar (lexical decision) or less similar (face judgments) to the stimuli used in recognition testing. Not only did the similarity between the interpolated stimuli and recognition stimuli not affect recognition accuracy, but performance of the interpolated task caused no interference with recognition testing whatsoever, even though it was harmed by prior recognition testing. When we presented LD trials or face judgment trials before the recognition test in a blocked fashion, OI was observed in the subsequent recognition tests. These results suggest a distinction between temporal context and task context, that recognition memory performance is determined by the salience of the context cues, and that the use of temporal context cues is associated with OI.
Email: Kenneth Malmberg, malmberg@usf.edu

5:10-5:25 (132)

Context Change, Event Segmentation, and Time Estimation. LILI SAHAKYAN and JAMES R. SMITH, *University of North Carolina at Greensboro*—Context plays a critical role in memory because it helps explain how we remember a single past occurrence of an event that may be encountered numerous times during life. The postulation of this theoretical construct is essential for building a coherent theory of episodic memory, yet the precise nature of context has remained elusive, and how it affects retrieval is inferred from memory performance itself. We conducted several experiments using different memory paradigms that are thought to be indicative of context-change to examine subjective estimates of the passage of time. Research suggests that retrospective estimates of time are influenced by what people remember from the time interval – specifically, by event segmentation and contextual changes that take place during the interval (e.g., Block & Reed, 1978; Poynter, 1983). Our investigation aimed to determine if subjective time estimates could serve as a marker of internal context-change, thereby providing an independent way of assessing context change induced by experimental manipulations.
Email: Lili Sahakyan, l_sahaky@uncg.edu

Embodied Cognition
Marquette II, Saturday Morning, 8:00-9:40
Chaired by Arthur Glenberg, Arizona State University

8:00-8:15 (133)
"Wherever This Flag is Flown/We Take Care of Our Own...". TAMER SOLIMAN, RYAN W. FERGUSON and ARTHUR M. GLENBERG, *Arizona State University* (read by Arthur M. Glenberg)—...sings Bruce Springsteen. But why do we take care of our own, and why don't we take care of others? We propose that cooperative activity makes partners "our own" by adjusting our own neural body schema. Research on tool use gave us a methodological tack: Extensively used tools get incorporated into the body schema such that locating tactile stimulation on the hand becomes harder when spatially incongruent stimuli at the tool's tip are simultaneously attended. In two experiments, participants completed a rhythmic sawing task with an active partner or individually (with the partner watching). As predicted, after sawing, participants were impaired in identifying the location at which their own hands were stimulated when spatially incongruent stimuli were simultaneously observed at the active partner's hand (but not the watching partner's hand). Thus, the active partner's hand was integrated into the participant's own spatial body representation so that a joint-body schema emerged!
Email: Arthur Glenberg, glenberg@asu.edu

8:20-8:35 (134)
Enhanced and Impaired Processing of Visual Stimuli Near the Hands. BLAIRE J. WEIDLER and RICHARD A. ABRAMS, *Washington University in St. Louis* (read by Richard A. Abrams)—It is known that stimuli near the hands receive preferential processing. In the present study we explored changes in early vision near the hands. Participants were more sensitive to low spatial frequency information and less sensitive to high spatial frequency information for stimuli presented close to the hands. This pattern suggests enhanced processing in the magnocellular visual pathway for such stimuli. Consistent with that possibility, we found that the benefit of hand proximity in several tasks was eliminated by illumination with red diffuse light—a manipulation known to impair magnocellular processing. The results help clarify how posture affects vision.
Email: Richard Abrams, rabrams@wustl.edu

8:40-8:55 (135)
Interaction Compresses Environmental Representations in Spatial Memory. CHRISTOPHER C. DAVOLI, *University of Notre Dame,* LAURA E. THOMAS, *North Dakota State University,* JAMES R. BROCKMOLE, *University of Notre Dame*—Evidence in favor of an action-specific account of perception has shown that observers represent objects they can interact with as being closer. However, demonstrations of this effect have been limited to scenarios in which a relatively stationary observer interacts with a single object. Here, we considered whether participants who maneuvered through multiple-object environments would represent compressed inter-object relationships following interaction, and whether compression would be applied to representations of an environment's global properties. Participants drew a scaled version of a learned multiple-object environment (Experiment 1) or reconstructed a full-sized replica of the environment and its boundaries (Experiment 2) from memory. Those who interacted with the objects reproduced more compact inter-object relationships and smaller environmental boundaries compared to those who only walked to and viewed the objects. Thus, action-based perceptual distortions appear to accumulate over a moving observer's multiple interactions, and are even applied to the untouched environmental boundaries.
Email: Christopher Davoli, chris.davoli@gmail.com

9:00-9:15 (136)
When Do Agents Influence Spatial Perspective Taking? SARAH H. CREEM-REGEHR, KYLE T. GAGNON and MARGARET R. TARAMPI, *University of Utah*—One function of spatial perspective taking (SPT) is to form a mutual understanding of space with another agent. However, we are also capable of SPT in the absence of an agent. Our studies ask to what extent viewers rely on another agent when performing SPT. Three experiments required spatial updating of a target array with respect to a new viewing location around a table. Participants were instructed to imagine the new viewing location, always facing towards the table, and indicate the spatial positions of objects with respect to the new viewpoint. The viewing location was cued with a spotlight highlighting a position to imagine standing around the table, and/or an avatar facing toward or away from the table. We show that viewers can override spontaneous SPT of the avatar, but only in experimental conditions that are predictable. The results are discussed with respect to flexibility and embodiment in SPT.
Email: Sarah Creem-Regehr, sarah.creem@psych.utah.edu

9:20-9:35 (137)
Embodiment of Intentions in Sentence Comprehension. MICHAEL E.J. MASSON, DANIEL N. BUB and HILLARY LAVELLE, *University of Victoria*—When listening to a sentence describing an interaction with a manipulable object, understanding the actor's intentions is shown to have a striking influence on action representations evoked during comprehension. Subjects performed a cued reach-and-grasp action while listening to a context sentence. Actions were completed faster when they were consistent with the proximal intention of an actor (e.g., lifting a cell-phone is the proximal goal for "John lifted the cell-phone to clear the shelf"), but this effect held only when sentences mentioned the proximal intention first. When the sentence structure was changed to mention the distal intention first ("To clear the shelf, John lifted the cell-phone"), priming effects favored actions pertaining to the function of the mentioned object (e.g., pressing buttons on a cell-phone). These results are not compatible with a straightforward mental-simulation account of sentence comprehension, but instead reflect a hierarchy of intentions distinguishing how and why actions are performed.
Email: Michael Masson, mmasson@uvic.ca

Working Memory II
Salon C, Saturday Morning, 8:00-9:20
Chaired by Margaret C. Jackson, University of Aberdeen

8:00-8:15 (138)

Emotional Expression Influences the Precision With Which Face Representations are Stored in Visual Working Memory. MARGARET C. JACKSON, *University of Aberdeen,* DAVID E.J. LINDEN, *Cardiff University,* JANE E. RAYMOND, *University of Birmingham*—Visual working memory (VWM) is enhanced for faces that portray a negative expression. Here we examined whether this emotion effect in VWM can be attributed to differences in the degree of precision with which emotional faces are represented. Borrowing the concept of a colour wheel, we created two 'face wheels' both comprised of the same three male face identities each morphed with one another to create a 24-face wheel. One wheel used angry faces and the other happy faces. Participants viewed a single face selected from one of the two wheels for 1000 ms. After a 1000 ms retention interval, the corresponding face wheel was presented and participants selected the face just previously seen. A Gaussian function fitted to the response data yielded a full-width half-maximum value that was greater for angry than happy faces, indicating that angry faces were represented in VWM with greater precision than happy faces.
Email: Margaret Jackson, madge1975@hotmail.com

8:20-8:35 (139)

Novelty Encoding Does Not Cause Forgetting From Working Memory. PIERRE BARROUILLET, *Universite de Geneve,* GAEN PLANCHER, *Universite de Lyon* (Sponsored by Valerie Camos)—Sources of forgetting in working memory remain the matter of intense debate. According to SOB model (Farrell & Lewandowsky, 2002), forgetting in complex span tasks does not result from temporal decay but from interference produced by the encoding of distractors that are superimposed over memory items onto a composite memory. The model assumes that encoding strength of a distractor is a function of its novelty, with novel distractors being encoded with a large encoding weight that interferes with other memories, whereas repeated distractors would result in negligible encoding weight and no further forgetting. Our study tested the two main predictions issuing from this model. First, recall performance should be better in complex span tasks in which distractors are repeated compared with tasks in which every distractor is novel. Second, increasing the number of novel distractors should lead to more interference and poorer recall. In 5 experiments in which we controlled for attentional demand and temporal factors, none of these predictions was verified, whereas a strong effect of the pace of distracting tasks testified that they involved forgetting. Contrary to SOB model, novelty of distractors plays no role in forgetting.
Email: Pierre Barrouillet, Pierre.Barrouillet@unige.ch

8:40-8:55 (140)

A Novel Methodology to Measure the Content of the Mind: Using Top-Down Capture to Investigate the Temporal Dynamics of Hypothesis Generation. NICHOLAS D. LANGE, *University of London, Birkbeck College,* RICK P. THOMAS and DANIEL R. BUTTACCIO, *University of Oklahoma,* EDDY J. DAVELAAR, *University of London, Birkbeck College*—Research investigating top-down capture has demonstrated a tight coupling of working memory content with attention and eye movements. By capitalizing on this relationship we have developed a novel methodology for measuring dynamic information use in high-level cognitive tasks (e.g., decision making, problem solving) for which existing methods are ill-suited. By briefly presenting visual arrays containing task relevant information at different points in a task and observing which items are visited we gain a measure of working memory content as the task evolves though time. Here we demonstrate the efficacy of this method by investigating the temporal dynamics of hypothesis generation and maintenance. Results from 2 experiments demonstrate that the methodology is able to discriminate the activation level of a hypothesis shortly after retrieval when it is very active (measured 450ms into the task) from a later maintenance period when the hypothesis possesses less activation in working memory (measured 1000ms into the task). As the logic underlying this methodology is domain general it has the potential to support inquiry concerning the temporal dynamics occurring in a wide host of domains.
Email: Nicholas Lange, ndlange@gmail.com

9:00-9:15 (141)

Active Processing of Cues in a Memory as Discrimination Paradigm. KIKI KOUTMERIDOU, *City University London,* ANNIE ROY-CHARLAND and ANDREANNE PLAMONDON, *Laurentian University Canada,* MARIE POIRIER, *City University London* (Sponsored by James Hampton)—The distinction between nominal cues (what the experimenter thinks is encoded) and functional cues (what the subject actually encoded) has long been established (Capaldi & Neath, 1995; Neath, 1998; Postman, Stark & Fraser, 1968). The original information can be distorted in a variety of ways (Neath & Surprenant, 2003). What is not yet systematically explored is what guides this transformation. Here, we examined the effect of a distinctive cue on memory performance. It was suggested that attention to the cues will differ based on their informative values. Information value was defined in relation to how a cue contributed to ease of retrieval. Eye-tracking results confirmed our hypothesis: participants spent more time processing cues with increased discriminative power. Reduction of cue overload appears to be one of the guiding forces in cue processing and in the transformation from nominal to functional cues.
Email: Kiki Koutmeridou, kikouki@gmail.com

Judgment and Decision Making III
Salon E, Saturday Morning, 8:00-10:00
Chaired by Eldad Yechiam, Technion - Israel Institute of Technology

8:00-8:15 (142)

A Dissociation Between Subjective Evaluations and Behavioral Decisions Concerning Losses. ELDAD YECHIAM, *Technion - Israel Institute of Technology,* GUY

HOCHMAN, *Duke University,* ARIEL TELPAZ, *Technion - Israel Institute of Technology*—There is an extensive literature demonstrating a negativity bias in people's evaluation of losses and gains, with penalties being associated with more extreme negative feelings than the positive feelings about gains. On the other hand, some recent studies have shown that in behavioral decisions from experience people do not exhibit increased weighting of losses compared to gains (i.e., loss aversion). In two experiments, we examined whether the evaluation of losses and the behavioral decisions contingent upon experiencing them could be the product of different processes. In Experiment 1 participants performed a decision from experience task and evaluated the (symmetric) loss and gain outcomes. Losses led to more negative feelings than the positive feelings reported for gains. However, at the same time participants were loss-neutral in their behavioral choices. In Experiment 2 increased frontal activation following losses (i.e., feedback-based Error-related negativity) was also observed simultaneously with loss neutrality in behavioral choices. These findings challenge the assumption of a robust linear correlation between evaluative processes and behavioral decisions. An attentional model is proposed to account for the discrepancy.
Email: Eldad Yechiam, yeldad@tx.technion.ac.il

8:20-8:35 (143)

Thinking in a Foreign Tongue Reduces Decision Biases. BOAZ KEYSAR, SAYURI L. HAYAKAWA and SUN GYU AN, *The University of Chicago*—Would you make the same decisions in a foreign language as you would in your native tongue? Using a foreign language is more difficult and cognitively taxing than a native language. As such, we might expect peoples' decisions to be less systematic or normative when using a foreign language. On the other hand, research demonstrates that foreign languages can be less emotional relative to a native tongue. We propose that because using a foreign language provides greater emotional and cognitive distance, it may lead to more systematic, normative decisions. Our findings indicate that using a foreign language can reduce emotionally driven decision biases. These findings have important theoretical implications regarding the relationship between language and thought, methodological implications regarding internet-based data collection, and practical implications for personal decisions regarding savings and investments.
Email: Boaz Keysar, boaz@uchicago.edu

8:40-8:55 (144)

Accounting for Working Memory and Attentional Processing in Decision Making. ANA M. FRANCO-WATKINS, *Auburn University,* JOSEPH G. JOHNSON, *Miami University*—Processing and maintaining information can be resource-intensive and cognitive demands tend to increase as the complexity of the task increases. To examine how cognitive demands affect decision making processes, we used a probabilistic inference task coupled with an eye-tracking paradigm (i.e., decision moving window). We measured individual differences in working memory and manipulated cognitive load by varying the complexity of attribute cue information (i.e., measurement scale). Our results suggest increasing cognitive demands tax working memory and affect attentional processing. Furthermore, individual differences in working memory partially cushioned individuals from the adverse effects of increasing information load. Additionally, we show how pupil dilation can be used as an index of mental effort in decision making. We propose that decision theories should account for both the global definition of attention, as well as individual differences in attentional control and processing (i.e., working memory) when attempting to understand the complexities of information processing.
Email: Ana Franco-Watkins, afrancowatkins@auburn.edu

9:00-9:15 (145)

Using a Response Time Model (without Response Times) as a Tool for Measuring Preference. *SCOTT D. BROWN and GUY E. HAWKINS, *The University of Newcastle,* A.A.J. MARLEY, *University of Victoria,* ANDREW HEATHCOTE, *The University of Newcastle,* JORDAN J. LOUVIERE and TERRY FLYNN, *The University of Technology, Sydney*—Best-worst scaling—selecting both the best and worst options from a set—is increasingly popular as it provides more efficient and valid measurement of attitudes or preferences than other methods (e.g., Likert scales). Best-worst scaling has traditionally been analyzed with random utility models that have good measurement properties, but which provide limited insight into cognitive processes. We extend an evidence accumulation model, which has successfully explained both choices and response times for simple decision tasks, to provide a process interpretation of the complex multi-attribute best-worst scaling. We show that the extended model has measurement properties analogous to random utility models in two data sets: one involving patient preferences for dermatology appointments, and another preference for attributes of mobile phones. We conclude that a variety of fields can benefit from best-worst scaling procedures, and psychometric analyses based on evidence accumulation models.
Email: Scott Brown, scott.brown@newcastle.edu.au

9:20-9:35 (146)

Good Inference by Lazy Cue Search. SHENGHUA LUAN, LAEL J. SCHOOLER and GERD GIGERENZER, *Max Planck Institute for Human Development* (read by Lael J. Schooler)—We investigate when, if ever, it is rational to use just one cue in a paired-comparison inference task. Central to our investigation is a lexicographic model named "TTBΔ," which stops cue search when the difference between the cue values of two options exceeds an aspiration level Δ. For the most part, search stops at the first cue when Δ is zero. In 766 simulated task environments, we found that the accuracy of TTBΔ peaks at a value of Δ that on average is small but not zero. However, for 39 real-world environments we examined Δ is zero. Furthermore, despite rarely searching more than one cue (mean=1.12), this version of TTBΔ achieves as high a level of prediction accuracy as linear regression in these real-world environments. Thus, when making inferences in the real world, it can pay to be lazy: there is little need to weight and add cue values or even bothering to find optimal aspiration levels.
Email: Lael Schooler, schooler@mpib-berlin.mpg.de

9:40-9:55 (147)

Observers Consistently Overestimate the Probability of Conjunction of Independent Events. LAURENCE T. MALONEY, JAMES TEE and HANG ZHANG, *New York University*—We examined how observers estimated the probability of conjunction of independent events. During each trial, a subject chose between a single roulette wheel with probability r of success and a pair of independent roulette wheels with probabilities p and q of success. The observer's estimates of p, q, and r were based on visual judgments of the fraction of each roulette wheel colored gold. The wheels were spun and the observer won a small monetary prize (i) if he chose the single wheel and it stopped in the gold, or (ii) chose the pair and both stopped in the gold. We used a staircase procedure to estimate the r for which the subject chose the pair as often as the single wheel: r~(p,q). Twelve conditions corresponded to twelve choices of (p,q), with p greater than or equal to q. They included four homogeneous groups of conditions of three pairs each, where p1q1 = p2q2 = p3q3. Ten naïve subjects participated. We fit the model a log(p) +b log(q) = log (r) where a=b=1 corresponds to normative use of probability. We rejected the normative model. All observers had r> pq for most of the conditions: they overestimated the conjunction probability. We tested the homogeneity of observers: were they consistent even though they assigned erroneous probabilities? 9/10 observers passed.
Email: Laurence Maloney, ltm1@nyu.edu

Explicit Memory III

Salon D, Saturday Morning, 8:00-10:00

Chaired by Daniel Bernstein, Kwantlen Polytechnic University

8:00-8:15 (148)

Puzzles Produce Strangers: Puzzling Data for Revelation-Effect Theories. ANDRE Aβfalg, *University of Mannheim,* DANIEL M. BERNSTEIN, *Kwantlen Polytechnic University* (read by Daniel M. Bernstein)—A person's activity just prior to recognition judgments affects whether that person judges a stimulus as familiar. Solving an anagram of the word BUTTERFLY, for example, will increase recognition claims for the word BUTTERFLY or even an unrelated word, like SUNRISE, compared to a control condition containing no anagram. This phenomenon, called the revelation effect, generalizes to face stimuli. In several experiments, we used a face puzzle task in which a face appeared scrambled and participants rearranged the pieces until the face appeared intact. Contradicting all extant revelation-effect theories, participants judged faces that appeared in the puzzle task as less familiar compared to faces in the control condition—a reversed revelation effect. We discuss the hypothesis that participants over-discounted the puzzle task's influence on the recognition judgment. Finally, we conclude that little is known about the mechanisms underlying the revelation effect and call for new theories.
Email: Daniel Bernstein, daniel.bernstein@kwantlen.ca

8:20-8:35 (149)

Consolidation Power of Money: Monetary Cues Enhance Long-Term Memory for Irrelevant Past Events. KOU MURAYAMA, *University of California, Los Angeles,* SHINJI KITAGAMI, *Nagoya University*—Recent research suggests that monetary reward promotes memory consolidation through dopaminergic modulation processes. However, no conclusive behavioral evidence exists given that the influence of monetary reward on attention and motivation during encoding and consolidation processes are inherently confounded. The present study provides the first unequivocal behavioral evidence that monetary incentives enhance human memory consolidation. Participants saw neutral pictures, followed by a monetary or control cue in an unrelated context. Our results demonstrated that the monetary cue predicted a retrograde enhancement of memory for the preceding neutral pictures. This retrograde effect was observed only after a delay, not immediately upon testing. We also observed that interindividual and intraindividual variability in memory performance is consistent with predictions derived from computational theories addressing dopaminergic activation in the reward system. These results provide strong support for the dopaminergic memory consolidation effect resulting from monetary reward.
Email: Kou Murayama, murakou@orion.ocn.ne.jp

8:40-8:55 (150)

Adaptive Memory: The Mnemonic Relevance of Animacy and Contamination. JAMES S. NAIRNE, JOSHUA E. VANARSDALL and MINDI COGDILL, *Purdue University,* JOSEFA N.S. PANDEIRADA, *University of Aveiro*—The functionalist agenda assumes that our memory systems evolved to solve specific problems, particularly fitness-related problems in our ancestral past. Here we explore two new fitness-relevant dimensions: animacy and contamination. In our first experiment, people were asked to remember a list of animate and inanimate items (e.g., BABY, VIOLIN); previously, the target items had been carefully matched along nine mnemonically relevant dimensions (e.g., frequency, concreteness). Substantially better free recall was found for the animate items, suggesting that animacy is an important dimension to be controlled in memory experiments. Next, nonwords were associated with either animate or inanimate properties during encoding. Processing nonwords as "animates" led to enhanced recognition memory. Finally, people were shown objects that had been "touched" by people with sick or healthy characteristics; a surprise recall test yielded enhanced memory for the contaminated items. These data support the idea that memory is selectively tuned to retain fitness-relevant information.
Email: James Nairne, nairne@psych.purdue.edu

9:00-9:15 (151)

Prospective Memory: Effects of a Familiar Context on Cost to the Ongoing Task. REBEKAH E. SMITH and AMY E. MURRAY, *University of Texas at San Antonio*—Participants viewed a series of photographs representing a walk through a familiar campus environment. The prospective memory (PM) task was to perform four errands on campus, modeled by pressing the 0 key when they arrived at an errand location and then typing in a description of the errand for that location. The ongoing task was to decide whether each photograph

contained 6 or more people. Importantly, photographs were shown in order (as if walking on campus) or randomly. A cost was found for both the ordered and random groups relative to a no-PM task control group, with a larger cost for the random group. The pattern of cost in the PM ordered condition mimicked the typical pattern of clock checking seen in time-based tasks, with increased cost when approaching a target location. Thus, participants were able to use contextual cues provided by a familiar environment to more efficiently allocate resources.
Email: Rebekah Smith, rebekah.smith@utsa.edu

9:20-9:35 (152)

Differential Processing of Ongoing Task Items for Non-Focal Event-Based Prospective Memory. SHAYNE D. LOFT, *University of Western Australia,* MICHAEL S. HUMPHREYS, *University of Queensland*—Remembering to perform deferred actions when events are encountered is referred to as event-based prospective memory. We argue that the recognition of non-targets previously presented in an ongoing task with prospective memory requirements can provide evidence for the differential processing of individual ongoing task items. Participants performed a lexical decision task, where some participants were required to make a prospective memory response to either a specific word (focal) or to category exemplars (non-focal). This task was followed by a surprise recognition memory test in which non-targets from the lexical decision task were intermixed with new words. The non-focal condition, but not the focal condition, was slower to make lexical decisions (costs) and had better discrimination on the recognition task, compared to controls. The non-focal condition mapped the semantic features of letter strings onto their prospective memory category, and this elaboration in processing increased incidental learning and produced the recognition benefit.
Email: Shayne Loft, Shayne.Loft@uwa.edu.au

9:40-9:55 (153)

Three More Semantic Serial Position Functions and a SIMPLE Explanation. MATTHEW R. KELLEY, *Lake Forest College,* IAN NEATH and AIMÉE M. SURPRENANT, *Memorial University of Newfoundland* (read by Ian Neath)—While there are innumerable demonstrations of serial position functions—with characteristic primacy and recency effects—in episodic tasks, there are only four such demonstrations in semantic memory tasks. Here, we provide three more examples: Recall of (1) cartoon theme song lyrics, (2) Harry Potter books, and (3) top-grossing movies from 2002-2010 all yielded standard-looking serial position functions. SIMPLE, a local distinctiveness model of memory that was designed to account for serial position effects in short- and long-term episodic memory, fit the data from all three demonstrations. According to SIMPLE, serial position functions, whether observed in episodic or semantic memory, reflect the relative distinctiveness principle (Surprenant & Neath, 2009): items will be well remembered to the extent that they are more distinct than competing items at the time of retrieval.
Email: Ian Neath, ineath@mun.ca

Timing and Sequencing

Salon G, Saturday Morning, 8:00-9:40

Chaired by Todd S. Horowitz, Massachusetts Institute of Technology

8:00-8:15 (154)

Counting the Clocks: Time Perception at Medium Durations. TODD S. HOROWITZ, STEVE M. MAHER, LAURA K. LEVIN-GLEBA and AUDE OLIVA, *Massachusetts Institute of Technology*—How does time perception depend on duration? A single universal clock for all durations should lead to a constant Weber fraction (WF). However, Grondin (2012) demonstrated that WFs for duration perception increase between 1 and 2 s. In two experiments, we presented a series of auditory standard intervals (Experiment 1:1 s, 1.3 s, 1.6 s, 1.9 s; Experiment 2: 1 s, 2, s, 10 s, 20 s, 40 s) followed by a series of comparison intervals, and asked observers to judge whether comparison intervals were longer or shorter than standard. We varied the comparison durations and derived a psychophysical function from which we could estimate the WF. We replicated and extended Grondin's findings, observer a significant increase in WF between 1 and 2 s, and again between 2 and 10 s. We suggest that durations on the order of 10s of seconds are measured by a different clock.
Email: Todd Horowitz, toddh@search.bwh.harvard.edu

8:20-8:35 (155)

Losing the Beat: Adaptation to Temporal Perturbations. CAROLINE PALMER and PASCALE LIDJI, *McGill University,* ISABELLE PERETZ, *University of Montreal*—Most people, with or without musical training, have a strong sense of pulse that underlies their ability to maintain a beat with temporally regular auditory events, such as clapping along with music. We investigate rare cases of individuals who cannot keep a beat by examining how beat-deaf individuals and control participants tap along with a regular auditory stimulus that introduces perturbations typical of those that occur in speech and music. Listeners tapped along with regular metronomic tone onsets that changed unpredictably in phase or period relative to the underlying beat. A dynamical systems model was applied to predict the tapping response to perturbations; the model indicated deficits in the beat-deaf individuals relative to the control subjects in their adaptation rate, their intrinsic frequency, or in both parameters. These findings support normal temporal adaptation as an entrainment of internal neural oscillations with external stimulus rhythms.
Email: Caroline Palmer, caroline.palmer@mcgill.ca

8:40-8:55 (156)

"It's Different Every Time": Stability of Expressive Timing in Repeated Music Performance. ROGER CHAFFIN and ALEXANDER DEMOS, *University of Connecticut,* VIVEK KANT, *University of Waterloo,* TANIA LISBOA, *Royal College of Music, London*—Performances by concert soloists must be both reliable (stable) and expressive (flexible), as predicted by the concept of motor synergies. We examined tempo and stability (tempo variability across performances) of polished performances of Bach's Italian Concerto (Presto) for piano and 6th Cello Suite (Prelude), by two concert soloists.

In previous studies we recorded their entire practice and public performances of these works. Here, we analyzed their performances: 8 for the Presto, 13 for the Prelude. Mixed effect models evaluated the effects of musical structure (musician-identified). For both pieces, there were tempo arches, similar to previous studies, but at multiple levels of hierarchical structure. There was less stability at beginnings/ends of phrases and more in the middle. The performances were more flexible (less stable) at expressively important locations, which were also the most heavily practiced. The synergies that stabilized performance and also provided expressive flexibility, emerged as a result of practice.
Email: Roger Chaffin, Roger.Chaffin@UConn.edu

9:00-9:15 (157)

Self-Imitation and the Role of Inverse Models in Poor-Pitch Singing. PETER Q. PFORDRESHER and JAMES T. MANTELL, *University at Buffalo, SUNY*—Vocal imitation of pitch during singing is challenging because one must reproduce laryngeal gestures that are usually unobservable. Accurate imitation thus may rely on an inverse internal model of auditory-vocal associations. Most individuals can match pitch while singing within a musical semitone. However, a minority exhibits poor-pitch singing. If poor-pitch singing results from a deficient inverse model it should be reduced for imitations of pitch sequences one has already produced, where imitation could rely on auditory-vocal associations that were experienced directly, rather than an internal model. Experiments reported here confirmed this prediction. Participants, both accurate and poor-pitch singers, were better able to imitate recordings of themselves through singing than recordings of other singers. However, this self-advantage was enhanced for poor-pitch singers. These effects are not specific to vocal timbre, self-recognition, or the absolute pitch of target recordings (i.e., the advantage remains when recordings are transposed). Results support the conceptualization of poor-pitch singing as an imitative deficit resulting from a deficient internal model of the auditory-vocal system with respect to pitch.
Email: Peter Pfordresher, pqp@buffalo.edu

9:20-9:35 (158)

Memory for Surface Features of Unfamiliar Melodies. E. GLENN SCHELLENBERG, STEPHANIE M. STALINSKI and BRADLEY M. MARKS, *University of Toronto*—A melody's identity is determined by relations in pitch and time. By contrast, the surface features are irrelevant. Although surface features of familiar recordings are encoded into memory, little is known about listeners' mental representations of melodies heard only once. Moreover, there is debate about whether musical pitch and time are processed and stored additively or jointly. In the present experiments, listeners heard a set of unfamiliar melodies in an initial exposure phase. In a subsequent test phase, they heard the same (old) melodies interspersed with new melodies. Some of the old melodies were shifted in pitch, tempo, or pitch and tempo. Listeners' task was to rate how well they recognized each melody from the exposure phase, while ignoring changes in pitch and tempo. Recognition ratings were lower for old melodies that were shifted in pitch or tempo compared to old melodies that stayed the same, and effects of pitch and tempo were additive in between-subjects (Experiment 1) and within-subjects (Experiment 2) designs. The results confirm that (1) surface features are stored automatically even when a melody is heard only once, and (2) pitch and tempo are processed and stored independently.
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Human Learning & Instruction I
Marquette VIII, Saturday Morning, 8:00-9:40
Chaired by Michael C. Mozer, University of Colorado

8:00-8:15 (159)

Discovering Optimal Training Policies: A New Experimental Paradigm. ROBERT V. LINDSEY and MICHAEL C. MOZER, *University of Colorado,* HAROLD PASHLER, *University of California, San Diego* (read by Michael C. Mozer)—Typical psychological studies compare two or a small number of conditions. For example, in the domain of concept learning, a study might compare whether individuals learn better when trained on only difficult-to-classify exemplars versus when the training sequence gradually progresses from easy exemplars to the more difficult (fading). Instead of comparing a small set of training policies selected based on the experimenter's intuition, suppose we could define a parameterized space of policies and search this space to identify the best policy. For example, in concept learning, policies might be described by a fading function that specifies exemplar difficulty over time. We propose an experimental technique for searching a low-dimensional policy space using Gaussian process surrogate-based optimization. Instead of running a large number of subjects in a small number of conditions, the technique runs a single subject in a large number of conditions. Even though individual subjects provide only a noisy estimate of the population mean, the optimization method allows us to determine the shape of the policy space and identify the global optimum, requiring not many more subjects than in a traditional study.
Email: Michael Mozer, mozer@colorado.edu

8:20-8:35 (160)

The Pen is Mightier than the Keyboard: Longhand and Laptop Note-Taking. DANIEL M. OPPENHEIMER and PAM A. MUELLER, *Princeton University*—Taking notes by typing on laptops rather than by writing them in longhand has become increasingly common. Many researchers (e.g. Hembrooke & Gay, 2003, Yamamoto, 2007, Fried, 2008) have suggested that laptop note-taking is less effective for learning. Prior studies have primarily focused on laptops' capacity for allowing multitasking and distraction; however, there is some suggestion that laptop note-taking could be affecting learning at the encoding stage. In both lab studies and actual classroom note-taking, we found that students who took notes on laptops performed worse. We show that this effect is related to laptop note-takers' tendency to transcribe a lecture verbatim rather than processing information and reframing it in their own words. Additionally, in comparison with laptop notes,

longhand notes display more of the characteristics identified by Pennebaker (2011) to be correlated with college success.
Email: Pam Mueller, pamuelle@princeton.edu

8:40-8:55 (161)

Relations of Symbolic and Non-symbolic Fraction and Whole Number Magnitude Representations to Each Other and to Mathematics Achievement. LISA K. FAZIO, *Carnegie Mellon University,* CLARISSA A. THOMPSON, *The University of Oklahoma,* ROBERT S. SIEGLER, *Carnegie Mellon University*—Both symbolic and non-symbolic numerical magnitudes are related to overall mathematics achievement. It is unclear, however, how symbolic whole number and fraction representations are related to each other, how symbolic and non-symbolic representations are related to each other, and whether each is uniquely related to mathematics achievement. Therefore, we examined 5th graders' symbolic and non-symbolic representations of whole number and fraction magnitudes with both number line estimation and magnitude comparison tasks. Individual differences on all four symbolic tasks were closely related. There was no relation, however, across the non-symbolic tasks or between them and the symbolic tasks. Mathematics achievement was uniquely related to symbolic magnitude knowledge, even after controlling for non-symbolic magnitude knowledge, but the opposite was not the case.
Email: Lisa Fazio, lkfazio@cmu.edu

9:00-9:15 (162)

Is the Benefit of Retrieval Practice Modulated by Motivation? SEAN H.K. KANG, *Dartmouth College,* HAL PASHLER, *University of California, San Diego*—Retrieval practice (RP) tends to produce better long-term learning than rereading, but studies have typically used arbitrary material that subjects may not care to learn. The observed advantage of RP may be exaggerated because low motivation may result in deficient processing during (usually passive) rereading. In other words, when subjects are motivated to learn the material, the type of study strategy (whether RP or rereading) may be less important. To test this hypothesis, we conducted 3 experiments in which we manipulated the incentives (using monetary bonuses or time savings) for learning Swahili-English word pairs. Items that had undergone RP were better recalled than reread items on a final test 2 days later, but this effect did not interact with incentive level. These results provide some reassurance that lab findings from the testing effects literature likely generalise to real-world situations in which motivation to learn may be greater.
Email: Sean Kang, seankang@wustl.edu

9:20-9:35 (163)

Stereotype Threat in Older Adults: The Key Role of Regulatory Fit. SARAH J. BARBER and MARA MATHER, *University of Southern California*—Older adults consistently perform worse on tests of memory abilities than younger adults, and this may be partially due to stereotype threat. Stereotype threat occurs when people fear that poor performance on their part will confirm a negative, self-relevant, stereotype. In response to this threat people underperform compared to their potential, thereby conforming to the stereotype. Although it is clear that stereotype threat effects occur, it is less clear why. To help clarify this, we examined the contributions of executive control interference and regulatory fit in modulating how stereotype threat affects memory in older adults. Across two experiments, older adults' memory for information that varied in value was tested while under stereotype threat about their memory or not. Our results were consistent with the regulatory fit hypothesis. Older adults under threat learned more information related to losses than gains, and adopted more conservative response criteria during a recognition test.
Email: Sarah Barber, barbersa@usc.edu

Cognitive Aging
Marquette VIII, Saturday Morning, 10:00-12:00
Chaired by Ayanna K. Thomas, Tufts University

10:00-10:15 (164)

The Disruptive Effects of Interference on Monitoring and Control. AYANNA K. THOMAS and MEEYEON LEE, *Tufts University,* JOHN B. BULEVICH, *Richard Stockton College of New Jersey*—Research suggests that a disruption in metamemorial monitoring plays a significant role in interference effects in memory (Bulevich & Thomas, 2012). The present study investigated whether repeated testing could benefit metamemorial processes in a retroactive interference paradigm. Younger and older adults were compared within the context of A-B/A-D paired associate learning. Critically, we manipulated testing before and after A-D learning. Testing of A-B pairs before learning of A-D pairs was designed to consolidate A-B pairs and reduce interference from A-D pairs. Results suggest that initial testing improved overall retention, reduced susceptibility to interference, and improved the relationship between confidence and memory on interference trials in both older and younger adults. Finally, young adults who received an initial test on A-B pairs were better able to withhold incorrect answers on interference trials than older adults. The present results have important implications for the relationship between monitoring and control.
Email: Ayanna Thomas, ayanna.thomas@tufts.edu

10:20-10:35 (165)

Strategy Repetition, RSI, and Aging. PATRICK LEMAIRE and MARIEL LECLERE, *Aix-Marseille Université & CNRS*—The role of response-stimulus-interval was investigated on participants' tendency to repeat the same strategy across consecutive trials. Young and older adults were asked to select the best of two strategies on each item of a computational estimation task. Participants could choose between rounding-down (e.g., do 40x60 to estimate a product for 42x67) or rounding- up (i.e., doing 50x70). RSI was either 300 ms or 1300 ms. Data revealed that (a) participants repeated the same strategy over consecutive problems more often than chance, (b) older adults repeated strategies more often than young adults, especially under short RSI condition, (c) both age groups repeated strategy less often under long RSI than under short RSI, and (d) age differences in strategy repetitions were no longer significant under long RSI condition. These findings have important implications regarding strategy selection

and aging effects. We discuss these implications regarding executive control and priming processes underlying strategy selection and age-related changes in these processes.
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10:40-10:55 (166)

How to Eliminate Forgetting in Older Adults. RENÉE K. BISS, KAREN L. CAMPBELL and W.K. JOAN NGO, *University of Toronto,* GILLIAN ROWE, *Baycrest Hospital,* LYNN HASHER, *University of Toronto* (read by Lynn Hasher)—We examined whether older adults' tendency to process distraction can be used to minimize widely-reported age-related differences in forgetting. Younger and older adults studied and recalled a list of words immediately and again following a 15 min delay. During the delay, half of the words were repeated as distraction in a 1-back task. Older adults were slower on 1-back task trials with these repeated items compared to trials with novel distractors. This greater distractibility benefited their memory: Older adults showed no forgetting across the delay for the words that repeated as distraction along with substantial forgetting of unrepeated words. In contrast, younger adults were not differentially distracted by previously studied items, and showed forgetting whether words repeated as distraction or not. This finding suggests that exposure to distraction may serve as a rehearsal episode for older adults, providing a method by which distractibility may be co-opted to boost memory.
Email: Lynn Hasher, hasher@psych.utoronto.ca

11:00-11:15 (167)

The Cross-Age Effect in Recognition Performance and Memory Monitoring for Faces. MARGARET S. BRYCE and CHAD S. DODSON, *University of Virginia* (read by Margaret S. Bryce)—The cross-age effect refers to the finding of better memory for own- than other-age faces. We examined three issues about this effect: (1) does it extend to the ability to monitor the likely accuracy of memory judgments for young and old faces; (2) does it apply to source information that is associated with young and old faces; and (3) what is a likely mechanism underlying the cross-age effect? We observed that young adults show a strong cross-age effect on recognition performance when younger and older faces are encountered mixed together, whereas older adults seem largely resistant to any age-of-face effects. Critically, this cross-age recognition effect disappears when young adults encounter either a pure list of young or old faces. The fact that encountering either a mixture or a pure list of faces can turn on and turn off the cross-age effect is consistent with ingroup/outgroup accounts of this phenomenon.
Email: Chad Dodson, cdodson@virginia.edu

11:20-11:35 (168)

Electrophysiological Evidence for Differential Age Differences in Emotion Perception. JOSHUA W. POLLOCK, *University of Akron,* NADIA KHOJA and MEI-CHING LIEN, *Oregon State University,* PHILIP A. ALLEN, *University of Akron* (read by Philip A. Allen)—We examined age differences in emotion perception using a psychological refractory period paradigm. Behavioral and event-related potential (P1 component) measures were used. Task 1 was tone discrimination (fuzzy vs. pure tones) and Task 2 was emotional facial discrimination ("happy" vs. "angry"). The stimulus onset asynchrony (SOA) between the two tasks was 100, 300, and 900 ms. Earlier studies observed age deficits in tasks associated with ventromedial prefrontal cortex function. Thus, we predicted that older adults would show decreased attentional efficiency in dual-task processing on the P1 component (linked to amygdalar processing). Both groups showed significantly higher P1 amplitudes at 100- and 300-ms SOAs than at the 900-ms SOA, suggesting that both age groups could process emotions without central attention. However, younger adults showed a higher-amplitude P1 for angry than for happy faces, but older adults showed no difference, reflecting an age difference in "angry bias" in emotion perception.
Email: Philip Allen, paallen@uakron.edu

11:40-11:55 (169)

Age-Related Changes in Flexible Listening: Studies on Meta-Audition and the False Hearing Effect. CHAD S. ROGERS, *Brandeis University,* LARRY L. JACOBY and MITCHELL S. SOMMERS, *Washington University in St. Louis,* ARTHUR WINGFIELD, *Brandeis University*—Rogers, Jacoby, and Sommers (2012) demonstrated that false hearing occurs when semantic context is misleading and as a byproduct of older adults' elevated use of context (Pichora-Fuller, Schneider, & Daneman, 1995). Their most dramatic age-group difference was in metacognition: when asked to explicitly rate the quality of their identifications, older adults subjectively "heard" words misleadingly predicted by context more often than young adults. We report results from three new experiments in which young and older adults listened to words from two speakers that varied in how often they validly used context (80% vs. 20% valid). The utility of feedback and warning procedures toward encouraging meta-auditory sensitivity and reducing false hearing was also examined. In each experiment we controlled for age-related changes in hearing by titrating the level of stimulus quality for each participant. Discussion relates to top-down semantic context and bottom-up sensory information serving as qualitatively different bases for hearing, with aging affecting the ability to listen flexibly across these different dimensions of information. We generalize also to false memory and false seeing (Jacoby, Rogers, Bishara, & Shimizu, 2012).
Email: Chad Rogers, rogers@brandeis.edu

Action and Perception I

Salon G, Saturday Morning, 10:00-12:00

Chaired by Michael McBeath, Arizona State University

10:00-10:15 (170)

Crying Babies Enhance Body Tilt Perception: Visual and Auditory Potency Diminish Illusion for both the Blind and Sighted. MICHAEL K. MCBEATH and YOKO NAYLOR, *Arizona State University*—Normal sighted people generally experience a body-tilt illusion of 45 degrees when tilted only 25-35. The illusion is larger when sensory deprived, decreasing with added spatial information from vision or

audition. Here we test if blind individuals exhibit a weaker body-tilt illusion (consistent with more accurate non-visual sensory processing), or a stronger illusion (consistent with enhanced sensory resolution). We also test if the tilt illusion systematically diminishes with increased potency of acoustic stimuli (e.g. crying babies). We used an Aerotrim body-tilt machine with 5 fully blind individuals and 13 sighted controls, each judging body-tilt with eyes open versus closed at four levels of auditory potency. Our findings confirm that the blind experience a significantly larger body-tilt illusion, that closing eyes only diminishes the illusion for the sighted, and that both the blind and sighted exhibit systematic decreases in illusory tilt as auditory stimuli climb in potency. The findings support an ecological interpretation in which perceived body-tilt systematically decreases with potency of both visual and acoustic stimuli, and the blind, with presumably enhanced non-visual senses, exhibit a stronger body-tilt illusion.
Email: Michael McBeath, michael.mcbeath@asu.edu

10:20-10:35 (171)

Effective Rotations: Action Effects Determine the Interplay of Mental and Manual Rotations. MARKUS JANCZYK and ROLAND PFISTER, *University of Würzburg,* MICHAEL A. CROGNALE, *University of Nevada, Reno,* WILFRIED KUNDE, *University of Würzburg* (Sponsored by Volker H. Franz)—Previous research has reported a facilitation of mental rotations by a preceding or concurrent unrelated manual rotation in the same direction. We extended this research in two fundamental ways: First, we show that not only manual rotations facilitate direction-congruent mental rotations, but that conversely, mental rotations have the power to facilitate subsequent manual rotations. Second, we addressed the underlying mechanisms of this interplay, and used salient visual effects rotating either in the same or the opposite direction as the manual rotation itself. With this manipulation we show that for the observed facilitation, the overlap between the cognitive process of mental rotation and the manual rotation's contingent effect is crucial – not the direction of the manual rotation per se. These findings highlight the importance of effect anticipation in action planning and support the contentions of ideomotor theory, while shedding new light on the cognitive source of the interplay of manual and mental rotations.
Email: Markus Janczyk, markus.janczyk@uni-wuerzburg.de

10:40-10:55 (172)

It's Not About the Items! Prosodic Factors Underlie Performance in Verbal Serial Recall. JOHN C. TAYLOR and WILLIAM J. MACKEN, *Cardiff University*—Models of STM for sequential information rely on item-level, feature-based descriptions to account for errors in serial recall. Transpositions in alternating similar/dissimilar sequences derive from interactions between overlapping features. However, we demonstrate that it's the characteristics of the sequence that determine the fate of nominal sequences items, rather than properties ascribed to the items themselves. Performance in alternating sequences is determined by the way sequences themselves induce particular prosodic rehearsal patterns and not the nature of the items per se. In a serial recall task, the shapes of the canonical 'sawtooth' serial position curves and error probabilities at successive input/output distances were modulated by grouping / rehearsal strategy, despite all item-based parameters being held constant. We replicated this finding using non-alternating lists, thus demonstrating that transpositions cannot be dependent on featural similarity. These data challenge the status of models that address themselves to item properties as determinants of STM performance.
Email: John Taylor, taylorj29@cardiff.ac.uk

11:00-11:15 (173)

Gestures Affect Thinking About Time. BARBARA TVERSKY, *Columbia University; Stanford University,* AZADEH JAMALIAN, *Columbia Teachers College*—In several experiments, participants heard the same verbal script accompanied by different gestures. Gestures altered thought about time from linear to cyclical, from sequential to simultaneous, from an ego- or time-moving perspective to a calendar perspective. Gestures can carry abstract semantic content that "listeners" seamlessly integrate.
Email: Barbara Tversky, btversky@stanford.edu

11:20-11:35 (174)

Segmenting the "Dance Stream"—Implications for Perception and Memory. RUTH S. DAY, *Duke University*—Audiences at modern dance concerts typically wonder how the dancers remember "all those steps." Meanwhile their own memory for performances is not very good. They don't recall much and/or report general features such as the number of dancers or the color of the costumes, rather than the nature of the movement performed. Although many factors can contribute to this poor memory for movement, the complex stream of movement that changes constantly is a large part of the problem. In a series of experiments, we examined the extent to which viewers segment the "dance stream" into chunks and whether this ability enhances memory. We also determined the types of cues that signal perceived chunks for dancers vs. nondancers. Chunking the dance stream in a brief laboratory experiment—without instructions about how to do so—had positive effects on both perception and memory.
Email: Ruth Day, ruthday@duke.edu

11:40-11:55 (175)

Recognition of Amodal and Modally Completed Shapes by a Grey Parrot. IRENE M. PEPPERBERG and KEN NAKAYAMA, *Harvard University*—A Grey parrot, Griffin, previously taught English labels for various colors and regular 3D polygons ("1-", "2-", "3-", "4-", "6-", "8-corner"), was tested on 2D modal and amodal completion figures. For amodal completion, portions of variously colored regular polygons were occluded by black circles or polygons. Controls were colored polygons missing pieces with black objects appropriately displaced. Kanizsa figures (modal completion) were constructed with black 'pac-men' forming regular polygons on colored paper. Controls involved placing additional circles or 'pac-men' near the Kanizsa figure so Griffin could not simply count black objects. Griffin was queried "What shape X?", X being the color of the polygon in

question; he provided a vocal English shape label. Responses were >75% accurate (chance was 0.20). Despite a somewhat different brain structure and considerably different visual system from that of humans, Griffin solved at least two of the same visual cognitive problems faced by humans.
Email: Irene Pepperberg, impepper@media.mit.edu

Implicit Learning and Memory
Marquette II, Saturday Morning, 10:00-12:00
Chaired by Andrew Heathcote, The University of Newcastle

10:00-10:15 (176)
Not so Primitive: Context Sensitive Meta-Learning About Unattended Sound Sequences. JUANITA TODD, ALEXANDER PROVOST, LISA WHITSON and ANDREW HEATHCOTE, *The University of Newcastle* (read by Andrew Heathcote)—Mismatch Negativity (MMN)—an evoked response potential elicited when a "deviant" sound violates a regularity in the auditory environment—is integral to auditory scene processing and has been used to demonstrate "primitive intelligence" in the auditory short-term memory. We show that MMN magnitude displays a context sensitive modulation depending on changes in the probability of a deviant at multiple temporal scales. Initially the modulation is limited to the duration that first acts as a deviant within a context (a primacy effect) that reverses in a second context, but in a final context both durations display modulation. These results show that learning how to learn about deviant probability (meta-learning) provides a context-sensitive modulation of the accessibility of predictive long-term memory representations that underpin the MMN.
Email: Andrew Heathcote,
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10:20-10:35 (177)
Phonotactic Constraint Learning in Speech Production: Can a Little Sleep Help? GARETH GASKELL, *University of York,* JILL WARKER, *University of Scranton,* REBECCA FROST, JAMES GUEST, REZA SNOWDEN and ABIGAIL STACKHOUSE, *University of York*—The composition of speech errors is malleable, suggesting that simple phonotactic constraints can be learned swiftly. However, second-order constraints tend to emerge more slowly. We addressed whether sleep affects this acquisition time-course. Participants produced target sequences in which two phonemes (/f/, /s/) were restricted to onset or coda position depending on the vowel. After 48 sequences, participants either had a 90-minute nap or remained awake. Participants then repeated 96 sequences to examine implicit phonotactic learning, and were tested for explicit generalization. The nap but not the wake group showed speech errors at test according with training constraints. Furthermore, only the nap group generalized this knowledge to new materials. Polysomnography data suggested that generalization was correlated with sleep spindle activity. These results show that sleep facilitates the abstraction and generalization of speech knowledge from a limited input dataset. We interpret these data in the context of systems consolidation models of sleep.
Email: Gareth Gaskell, g.gaskell@psych.york.ac.uk

10:40-10:55 (178)
A Novel Model for Separate Estimates for Explicit and Implicit Memory. RICHARD A. CHECHILE, LARA N. SLOBODA, ERIN L. WARREN and DANIEL H. BARCH, *Tufts University,* JESSICA R. CHAMBERLAND, *Unilever Research and Development*—The Implicit/Explicit Separation (IES) model is a new multinomial processing tree model for obtaining separate probability estimates for explicit storage, implicit storage, fractional storage, and non-storage. The IES model is based on a novel set of testing protocols, and, unlike the process dissociation task, the IES testing procedure does not rely on the use of inclusion versus exclusion instructions. The IES model is used in a number of experiments that build a case for the validity of the model. Rather than treating implicit and explicit memory as separate memory systems, the experimental results are consistent with the theoretical position that implicit memory is either (1) a faint residue of a target event that was once explicitly stored or (2) a surviving trace that was initially complete but a weak memory encoding.
Email: Richard Chechile, Richard.Chechile@tufts.edu

11:00-11:15 (179)
The Emergence of Explicit Knowledge From Implicit Learning. ANNABELLE GOUJON, *LPC-CNRS & Univeristé d'Aix-Marseille,* ANDRÉ DIDIERJEAN, *Université de Franche-Comté & Institut Universitaire de France* (Sponsored by Patrick Lemaire)—A staggering amount of recent evidence has highlighted the ability of observers to incidentally extract statistical contingencies present in visual environments. At the same time, a description of consciousness as a graded rather than an all-or-none phenomenon has received some attention. At the intersection between the areas of statistical learning and conscious cognition, this study examined whether knowledge that is fully accessible to explicit awareness can arise from unconscious learning. Using a "typical" contextual cuing procedure adapted to real-world scenes, we first observed that after extensive training in searching for a target within repeated scenes, knowledge about regularities was associated with conscious awareness (Experiment 1). However, both subjective and objective measures of consciousness revealed that in the early phase of training, learning of regular structures can first take place at an unconscious level (Experiment 2). These results are discussed in the light of the causal relationships between learning and consciousness.
Email: Annabelle Goujon,
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11:20-11:35 (180)
Contextual Expected Development Fraction Model: Framework for Asymmetry in Circle of Fifths Revealed by Time Estimations Relative to Modulating Music. JOSE LINO OLIVEIRA BUENO, *University of São Paulo,* EMMANUEL BIGAND, *Université de Bourgogne,* ERICO FIRMINO, *University of São Paulo* (Sponsored by Jose Aparecido da Silva)—Tonal modulations elicit time estimations in an inverse function of interkey distances with major impact of sudden ones. Distant reverse modulations shorten subjective time more than close ones. Each participant listened to one music excerpt, was instructed regarding time estimation,

and reproduced the duration. The proposed Expected Development Fraction Model (EDF Model) claims that, if an interkey distance is traversed, an expected development longer than perceived duration is evoked; such disproportion is applied to perceived duration, leading to shortening of time. The present study found shorter time estimations for counterclockwise modulations unfolding circle of fifths than for clockwise ones. This study also found shorter time estimations for minor key modulating route than for circle of fifth one. Contextual Development Fraction Model (C-EDF Model) was proposed in order to contemplate all musical keys and the asymmetry in circle of fifths through elaboration of semantic and working memory processors of EDF Model.
Email: Jose Lino Oliveira Bueno, jldobuen@ffclrp.usp.br

11:40-11:55 (181)

Parallels Between Perceptual Learning and Pavlovian Conditioning: Contrasting Conditioned Inhibition and Second-Order Conditioning. RALPH R. MILLER and CODY C. POLACK, *Binghamton University, SUNY*—Pavlovian conditioned inhibition (CI) treatment strongly resembles that of second-order conditioning (SOC); yet, the resulting behaviors are opposed. Prior research found a determinant of SOC or CI being observed in conventional conditioning is the number of nonreinforced training trials, rather than the different trials types being interspersed vs. phasic or the cues on nonreinforced trials being presented simultaneously vs. serially. In three conditioned suppression experiments with rats, we examined this relationship in perceptual learning. Using a variant of Espinet, Iraola, Bennett, and Mackintosh's (1995) procedure (i.e., XB / AB followed by pairing A with an unconditioned stimulus), we found that few training trials made X into a conditioned excitor, whereas many training trials made X into a conditioned inhibitor. Extinction of the mediating stimulus (B) eliminated X's excitatory value after few trials and X's inhibitory value after many trials. These results extend the known parallels between perceptual learning and conventional conditioning.
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Working Memory III
Salon D, Saturday Morning, 10:20-12:00
Chaired by Jane E. Raymond, University of Birmingham

10:20-10:35 (182)

Reward Associations Facilitate Visual Working Memory. JANE E. RAYMOND, *University of Birmingham,* PAUL THOMAS, *Bangor University*—Previous work has shown that when stimuli become associated with salient outcomes, such as winning or losing money, they become better at attracting attention than similarly familiar stimuli associated with no outcome. Interestingly, however, only reward-associated stimuli show reduced susceptibility to the attention blink, suggesting that reward, but not punishment associations might facilitate visual working memory. To test this possibility, we provided monetary outcomes in a simple choice task so that different colors (transparently overlaid on grayscale faces) could become associated with a rewarding, punishing, or null outcome. These compound stimuli (color+face) were then presented in a conventional visual working memory change detection task based on face identification. Performance was better when a stimulus with the reward-associated color was present (versus absent) in the to-be-remembered stimulus array. No such benefit of the punishment-associated color was observed. Reward but not punishment-associated stimuli appear to motivate visual working memory processes.
Email: Jane Raymond, j.raymond@bham.ac.uk

10:40-10:55 (183)

Large Capacity Temporary Visual Memory. ANSGAR D. ENDRESS and MARY C. POTTER, *Massachusetts Institute of Technology* (read by Mary C. Potter)—Visual working memory (WM) capacity is thought to be limited to three or four items, as measured by K. When new pictures of objects are used on every trial, capacity increases with no clear upper bound as more items are presented: K was 7 or 8 with trials of 21 pictures presented in an RSVP sequence at 4/s, and 30 with trials of 100 pictures. Remembered items were not stored in a temporally stable form of memory (LTM), but decayed almost completely after a few minutes. In contrast, when the pictures were drawn from a set of 22 objects reused across trials, performance stayed within the standard WM range. These results show that viewers can temporarily store many more items than past WM capacity limits suggest, and raise the question of whether everyday temporary memory is severely limited as in WM experiments, or has the much larger capacity found here.
Email: Mary C Potter, mpotter@mit.edu

11:00-11:15 (184)

Can Men Only Do One Thing at a Time? Gender Differences in Multiple Task Monitoring. TIMO MÄNTYLÄ, *Stockholm University*—Demands on scheduling and interleaving of multiple activities have become increasingly prevalent, especially in women's paid and unpaid work hours. Anecdotal evidence suggest that women are better multitaskers than men, but there are no scientific studies showing gender differences in multitasking. In two experiments, participants completed a multitasking session with four gender-fair monitoring tasks and separate tasks of executive functioning and spatial ability. In both experiments, males outperformed females in monitoring accuracy. Individual differences in executive functioning (working memory updating) and spatial ability (mental rotation) were independent predictors of monitoring accuracy, but only spatial ability mediated gender differences in multitasking. These findings suggest that multitasking involves spatiotemporal task coordination and that gender differences in multitasking reflect differences in spatial ability.
Email: Timo Mäntylä, timo.mantyla@psychology.su.se

11:20-11:35 (185)

Separate Capacity Limits for Objects and Their Attributes. NELSON COWAN, *University of Missouri,* CHRISTOPHER L. BLUME, *Georgia Southern University,* J. SCOTT SAULTS, *University of Missouri*—We examined arrays of simple objects with attention directed to their colors, to their shapes, to both, or to the specific color-shape combinations. There was a constant limit in how many objects were kept in working

memory in a form that included at least one attribute, color and/or shape (about 3 objects). Within this limited number of objects, there was another limit in the number of attributes. Specifically, fewer objects had color retained when attention was shared with shape, and fewer objects had shape retained when attention was shared with color. We present suggestions as to how these two different capacity limits come about.
Email: Nelson Cowan, cowann@missouri.edu

11:40-11:55 (186)

Does Working Memory Training Improve Working Memory Capacity? TYLER L. HARRISON, ZACH SHIPSTEAD and KENNY L. HICKS, *Georgia Institute of Technology,* THOMAS S. REDICK, *Indiana University-Purdue University, Columbus,* DAVID Z. HAMBRICK, *Michigan State University,* RANDALL W. ENGLE, *Georgia Institute of Technology* (read by Randall W. Engle)—Does training on a working memory (WM) task generalize to improved performance on other cognitive measures including tests of fluid intelligence? Some papers have reported generalized improvements following training but others have reported failure to replicate these findings (see Shipstead, et al., 2012). If WM training increases WM capacity generally, a logically prior question is whether training on a WM task leads to generalization to other WM tasks. Subjects completed one of three different cognitive training regimes for 20 days: complex spans, simple spans, or visual search. All subjects performed a battery of cognitive ability task before and after training. Training on complex span tasks improved performance relative to the visual search control group on other complex span tasks involving different processing and storage components. However, training on simple span tasks showed no improvement on other simple span tasks with memory items different than training relative to the control group.
Email: Randall Engle, randall.engle@gatech.edu

Psycholinguistics I
Salon E, Saturday Morning, 10:20-12:00
Chaired by Sara Finley, Waldorf College

10:20-10:35 (187)

Rapid Learning of Morphological Categories in Adult Artificial Grammar Learning. SARA R. FINLEY, *Waldorf College*—The present study tests the ability for adults to rapidly learn morphological information associated with gender and number categories. Using an artificial language learning paradigm, participants were exposed to picture-sound pairs in which pictures of animals varied by both number (singular, dual and plural) and gender (masculine, feminine and neuter). Auditory stimuli was presented in CVCVCV forms (e.g., [zovabu]) in which the first two syllables denoted the animal (e.g., [zova] for snail) and the final syllable denoted either gender (Experiment 1) or number (Experiment 2). For example, in Experiment 1 [bu] appeared in all pictures containing a masculine animal, and in Experiment 2, [bu] appeared in all pictures containing a single animal. Results revealed that participants were able to learn which category (gender or number) the suffix endings referred, based on a 2AFC generalization task . Implications for the learning of complex paradigms is discussed.
Email: Sara Finley, finleys@elmhurst.edu

10:40-10:55 (188)

Language Learning as Language Use: A Computational Model of Children's Comprehension and Production of Language. STEWART M. MCCAULEY and MORTEN H. CHRISTIANSEN, *Cornell University* (read by Morten H. Christiansen)—We present a usage-based computational model of language acquisition that learns in a purely incremental fashion, through on-line processing of simple statistics, and offers broad, cross-linguistic coverage while uniting comprehension and production within a single framework. The model's design reflects psycholinguistic evidence for children's storage of multi-word sequences and shallow language comprehension based on local information. It learns from corpora of child-directed speech, chunking incoming words together to incrementally build an item-based "shallow parse." When the model encounters an utterance made by the target child, it attempts to generate an identical utterance using chunks and statistics learned previously. The model achieves strong performance across over 200 single-child corpora representing 29 languages from the CHILDES database. It also accommodates a range of developmental psycholinguistic findings. Together, our modeling results suggest that much of children's early linguistic behavior can be accounted for by item-based learning from simple distributional cues.
Email: Morten Christiansen, christiansen@cornell.edu

11:00-11:15 (189)

Amodal Aspects of Linguistic Design. IRIS BERENT and AMANDA DUPUIS, *Northeastern University,* DIANE BRENTARI, *The University of Chicago*—Spoken languages include two levels of patterning. Words are constructed from meaningful units (morphemes), which, in turn, comprise of meaningless elements (syllables). Each such unit, moreover, is defined by different phonological principles. Syllables require a single energy peak, whereas morphemes are not so constrained. Here, we show that humans extend these principles across modalities. Deaf signers of American Sign Language (ASL) extract both syllables and morphemes from novel ASL signs. Remarkably, the principles that contrast signed syllables and morphemes are spontaneously available to English speakers as well. Despite no previous experience with sign languages, English speakers were sensitive to the number of signed syllables and morphemes. Moreover, given novel signs analogous to pens (one syllable, two morphemes), all participants shifted their response depending on the task—syllable- vs. morpheme count. These findings suggest that the design of the language system is partly amodal.
Email: Iris Berent, i.berent@neu.edu

11:20-11:35 (190)

Semantic Interference During Naming: Will It Stay or Will It Go? TATIANA SCHNUR, *Rice University*—Naming semantically related pictures (e.g., "goat" "cow" "mouse") becomes increasingly slower when repeatedly naming from

a semantic category even when several unrelated trials (lags) intervene (e.g., Howard, Nickels, Coltheart, & Cole-Virtue, 2006). Semantic interference is attributed to persistent changes in connection strength from semantic features (e.g., "four legs" "fur") to lexical representations (i.e., learning). The aim of this study was to test whether semantic interference is independent of time and lags between naming occurrences as predicted by learning accounts of interference. Increasing time between critical trials did not affect interference (750 vs. 5250 ms), but longer lags eliminated interference (e.g., lags 8, 10, 12, and 14) except when a short lag occurred within a sequence of critical trials (lags 2, 8, 10, and 12). These results show that semantic interference requires relatively closely-spaced critical trials suggesting that semantic interference in naming is not as automatic as previously assumed.
Email: Tatiana Schnur, ttschnur@rice.edu

11:40-11:55 (191)

From Gradient Activation to Gradient Articulations: Cascading Activation and Phonetic Processes in Production. MATTHEW GOLDRICK and KAREN CHU, *Northwestern University*—Recent studies have shown that sound-based speech errors do not involve categorical substitution of one sound for another. For example, Pouplier and Goldstein (2010) show that when "top" is misproduced as "cop," participants frequently produce a closure with both the tongue tip (consistent with the target "top") and, simultaneously, a closure with the tongue body (consistent with the error "cop"). We present simulation data suggesting these co-productions could arise due to cascading activation from co-activated phonological representations of the target and error (Goldrick & Blumstein, 2006). Using the Gradient Symbol Processing framework (Smolensky, Goldrick, & Mathis, in press), we show that in speech errors target and error phonological representations are gradiently co-activated. We then use a model of inter-articulator coordination (Nam, Goldstein, Saltzman, & Byrd, 2004) to show how cascading activation from these co-activated representations can give rise to the articulatory and acoustic patterns observed in speech errors.
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SYMPOSIUM III: The Adaptive Nature of Memory Illusions: Positive Consequences Can Arise from Illusory Memories

Salon C, Saturday Morning, 9:50-12:00

Chaired by Mark Howe, Lancaster University

9:50-9:55 (192)

Introduction. MARK L. HOWE, *Lancaster University*

9:55-10:15 (193)

Memory Illusions, Like Perceptual Illusions, Reflect Generally Adaptive Processes Employed in Contexts that Lead People Astray. HENRY L. ROEDIGER III, *Washington University in St. Louis*—Memory illusions seem bizarre—how could we remember events that never happened to us and do so with high confidence? However, the situation is less strange when placed in the context of other cognitive illusions, especially those of perception. As with the processes that give rise to perceptual illusions, those that give rise to memory illusions can also be adaptive. A review of the evidence shows that the same variables that encourage highly accurate memories are ones that can, under slightly different circumstances, lead to false memories. These factors include strong thematic organization (schemas), strong associations among concepts, repetition, imagery, and similarity among elements. The fact that memories are malleable has both positive and negative consequences. I will focus on the role of similarity as one variable that can have strong positive effects on recall and negative effects on recognition in both educational and legal contexts.
Email: Henry L. Roediger III, roediger@artsci.wustl.edu

10:15-10:35 (194)

Adaptive Constructive Processes and the Future of Memory. DANIEL L. SCHACTER, *Harvard University*—Memory serves critical functions in everyday life, but is also prone to error. This talk considers adaptive constructive processes, which play a functional role in memory and cognition but can also produce distortions, errors, or illusions. The talk will focus in particular on the process of imagining or simulating events that might occur in one's personal future. Simulating future events relies on many of the same cognitive and neural processes as remembering past events, which may help to explain why imagination and memory can be easily confused, sometimes resulting in such phenomena as imagination inflation. The talk will consider both pitfalls and adaptive aspects of future event simulation in the context of research on memory, planning, prediction, problem solving, mind-wandering, and the interconnected set of brain regions known as the default network.
Email: Daniel L. Schacter, dls@wjh.harvard.edu

10:35-10:55 (195)

Has a Few Coherence Memories and They Are Good! MARTIN A. CONWAY, *City University London*—One account of autobiographical memory proposes that memories can be viewed as arrayed on a correspondence-coherence dimension. High correspondence memories contain experience-near details, high coherence memories are closely linked into the self-system and some or all of their details may have a purely internal source. I consider various examples, from memories of politicians to false memories from childhood, and I explore their value to the self.
Email: Martin A. Conway, martinconway1@me.com

10:55-11:15 (196)

Colored by Intuition: How Gist-Based "False" Memories Support Adaptive Judgments and Decisions. VALERIE F. REYNA and CHARLES J. BRAINERD, *Cornell University*—Fuzzy-trace theory distinguishes verbatim (literal, exact memories) from gist representations (meaning-based memories), predicting that reliance on gist-based intuition increases with experience and expertise. Thus, when a task requires verbatim memory, net memory accuracy for highly meaningful content declines from childhood to adulthood. Similarly, many judgment-and-decision-making

biases increase during this period, such that cognition is colored by context in ways that violate logical coherence and probability theories. Nevertheless, this increase in gist-based intuition makes sense from an adaptive perspective because gist provides benefits for cognition: Gist is more stable, less subject to interference, and easier to manipulate compared to verbatim representations. Moreover, gist captures the functionally significant essence of information, generally supporting healthier and more robust decision processes. We describe predicted advantages for gist-based cognition in personal decisions about health and in experts' medical decision making. We also develop implications of this theory for typical and atypical neurodevelopment, such as autism.
Email: Valerie F. Reyna, vr53@cornell.edu

11:15-11:35 (197)

False Memories Trump True Ones as Problem-solving Primes after a Delay. MARK L. HOWE, SAMANTHA WILKINSON annd PADRAIC MONAGHAN, *Lancaster University*—We discuss how false memories prime problem solving and present a computational model that accounts for this phenomenon. We report new experiments comparing true and false memory priming of insight-based problems (remote associates task, RAT). DRM lists were selected whose critical lures (CLs) were also the solution to a subset of RATs. Participants were exposed to true (CLs included in the studied list) and false (CLs not studied) memory primes at study, test, or both. Some participants completed the RATs immediately while others completed them one-week later. We found that: primed problems were better solved than unprimed problems; priming during study was better than at test; and true and false memories were equally effective primes immediately, but false memories were better than true memories one-week later. These findings are consistent with false memory persistence effects, our model, and the growing consensus that memory illusions can have positive effects on cognition.
Email: Mark L. Howe, mark.howe@lancaster.ac.uk

11:35-11:50 (198)

Discussant. STEPHEN LINDSAY, *University of Victoria*

11:50-12:00 (199)

Audience Questions. MARK L. HOWE, *Lancaster University*

Action and Perception II
Salon G, Saturday Afternoon, 1:30-2:50
Chaired by Jodie M. Plumert, University of Iowa

1:30-1:45 (200)

How Does Manipulating Perception Versus Action Impact Recalibration? CHRISTINE J. ZIEMER, JODIE M. PLUMERT, BENJAMIN J. CHIHAK, JAMES F. CREMER and JOSEPH K. KEARNEY, *University of Iowa* (read by Jodie M. Plumert)—This talk focuses on how manipulating perception vs. action impacts recalibration processes. In all experiments, participants performed a distance estimation task both before and after an adaptation period that involved walking on a treadmill through an immersive virtual environment. We manipulated either the rate of visual motion or walking speed during adaptation. We probed perception-action recalibration using two types of distance estimation tasks (blindfolded or imagined walking) and two types of environments (real or virtual). With blindfolded walking, we found a recalibration effect when either the rate of visual motion or the walking speed was manipulated. With imagined walking in either the real or the virtual environment, we found a recalibration effect when the rate of visual motion was manipulated but not when the walking speed was manipulated. We explain these differences across blindfolded and imagined walking by discussing how spatial updating processes operate on perception, action, and representation.
Email: Jodie Plumert, jodie-plumert@uiowa.edu

1:50-2:05 (201)

Using Equiluminant Concurrent Visual Feedback to Explore the Initiation and Control of Corrective Submovements. CHARLES E. WRIGHT, SUSAN CARRIGAN, EDWARD MARTINEZ, EHLUM SHAMSHIRI and LISA YEE, *University of California, Irvine*—The Stochastic-Optimized Submovement Model (Meyer et al., 1988 & 1990) posits that Fitts's Law, the logarithmic relation of movement duration and movement difficulty, emerges when time-minimization movements are produced using a series of submovements: an initial submovement, which ends close to the target followed, if necessary, by one or more feedback-guided, corrective submovements. An open question is how concurrent visual feedback is used to guide the initial submovement and trigger subsequent ones. To explore these questions we report results from experiments that compare conditions in which the concurrent feedback is discriminable from the background by either luminance or color; the motion of equiluminant colored stimuli is not easily perceived. As expected, this manipulation substantially increases the slope in Fitts's law. Detailed analyses of movement trajectories provide insights into the role of concurrent visual feedback in these movements.
Email: Charles Wright, cewright@uci.edu

2:10-2:25 (202)

Response Method (Go/No-Go vs. Two-Choice) Interferes With Core Processes in Children. PABLO GOMEZ, *DePaul University,* MANUEL PEREA, *Universitat de Valencia*—Data from any laboratory experiment is the convolution of the task demands and the core process of interest. Examples of core processes are memory and object recognition; examples of task specific processes are speed accuracy trade-offs and response biases. We explore if a manipulation in experimental procedure affects the core process in a lexical decision task and in a perceptual task (numerosity judgement) in children (7-9 y.o.). Participants were instructed to respond to words and to "many" dots (go) and refrain from responding to nonwords and to "few" dots (no-go); thus simplifying an alleged "response selection" stage. The data from the go/no-go procedure was compared to data from the traditional two-choice task. The diffusion mode (Ratcliff, 1978) was used to account for the differences. We found that the GNG task produces a higher rate of information accumulation in children (but not in adults), particularly in a lexical decision task. We hypothesize that as executive control and reading skills develop, response selection requires fewer resources.
Email: Pablo Gomez, pgomez1dpu@gmail.com

2:30-2:45 (203)

Ballistic Tools Influence Perceived Speed: Evidence for Action-Specific Effects From Action-Based Measures. JESSICA K. WITT, *Colorado State University,* MILA SUGOVIC, *Purdue University*—According to the action-specific account of perception, people perceive the environment in terms of their ability to act. When abilities are modified via tool use, perception takes into account these modified abilities. This demonstrates that tools become incorporated into the body schema, and that perception is sensitive to tool-induced changes to the body. In the experiments, participants attempted to catch a virtual fish by releasing a virtual net. The net varied in size, making the task of catching the fish easier or harder. We measured net release time as an action-based measure of perceived speed. If participants perceived the fish to be moving slower, they should wait longer to release the net. We found that participants released the net later when playing with the big net, indicative that the fish looked to be moving slower when playing with this net compared with the small net. Explicit judgments of fish speed were also influenced by net size. These results provide converging evidence from judgment-based and action-based measures that a perceiver's ability to act influences speed perception.
Email: Jessica Witt, jkwitt@purdue.edu

Judgment and Decision Making IV
Salon E, Saturday Afternoon, 1:30-2:50
Chaired by Christopher Wolfe, Miami University

1:30-1:45 (204)

Individual Differences in Base Rate Neglect: A Fuzzy Processing Preference Index. CHRISTOPHER R. WOLFE and CHRISTOPHER R. FISHER, *Miami University*—Little is known about individual differences in weighing quantitative base-rates and qualitative information in making probability judgments. We conducted three web-based individual differences studies with the Fuzzy Processing Preference Index, (FPPI) an instrument grounded in Fuzzy-Trace Theory. The FPPI provides scores on a continuum from 0 to 1 representing preferences for gist (text-based) to

verbatim (numeric base-rate) information. Four "M-Scale" items distinguish between high verbatim scores and a simple matching strategy. In the first study we collected new item norms on an international platform. Applying these norms as FPPI parameters to previously collected data yielded negligible differences (0.0055), providing evidence of robustness. In Study 2 the FPPI predicted conjunction and disjunction fallacies, replicating earlier findings, and providing evidence for validity. The M-Scale items predicted an over matching strategy used by about 7% of participants. This finding was replicated in Study 3. Cronbach's Alpha (reliability) was above 0.9 in both studies.
Email: Christopher Wolfe, wolfecr@muohio.edu

1:50-2:05 (205)

The Chunking Model of Frequency and Probability Distortion. HANG ZHANG and LAURENCE T. MALONEY, *New York University*—Similar patterns of distortion of frequency/probability information have been found in visual frequency estimation, frequency estimation based on memory, signal detection theory, and in the use of probability information in decision making under risk. These distortions can be expressed as linear transformations of the log odds of frequency and/or probability (Zhang & Maloney, 2012, Frontiers in Neuroscience). Particularly, in a visual frequency estimation task, we found that the slope of frequency distortion decreases with the number of samples, a finding that could not be explained by existing theories or models. Here we develop a model based on Stevens' power law and binomial variation to account for the frequency/probability distortion. The model produces data that quantitatively replicate our earlier findings in the visual frequency task and qualitatively explains the effect of sample size in decision tasks. The model can serve as a common mechanism underlying human processing of frequency/probability information; it yields counter-intuitive predictions that are testable. Support: Grant EY019889 from the National Institutes of Health and the Humboldt Foundation.
Email: Hang Zhang, hang.zhang@nyu.edu

2:10-2:25 (206)

A Diffusion Model Analysis of Developmental Changes in Number Processing. ROGER RATCLIFF, *The Ohio State University,* CLARISSA A. THOMPSON, *University of Oklahoma,* GAIL MCKOON, *The Ohio State University*—The diffusion model for two-choice decisions was fit to accuracy and response time distribution data from college adults and first, second/third, fourth/fifth and seventh/eighth graders. Participants completed a numerosity discrimination task (was the displayed number of asterisks greater than 50?), a number discrimination task (was the displayed number greater than 50?), memory for two- and three-digit numbers (did the number appear on a just-presented list of numbers?), and arithmetic verification (Does 2+3=4?). Adult and children's drift rates, the quality of evidence extracted from the display, on the numerosity discrimination and number discrimination tasks were correlated as were adult drift rates on the two memory tasks. Children extracted lower quality evidence, set wider decision criteria, and took longer to encode and execute responses than adults. We also report relationships between IQ and achievement scores and diffusion model parameters.
Email: Roger Ratcliff, ratcliff.22@osu.edu

2:30-2:45 (207)

How Normative are Inferences on Causal Networks? REID HASTIE and BENJAMIN M. ROTTMAN, *The University of Chicago*—In the last decade, Bayesian Networks have become the normative standard for uncertain causal reasoning. There have been many empirical efforts aimed at understanding whether people's informal reasoning about causal systems aligns with that normative framework. First, we will discuss past research and our own empirical efforts to identify whether people follow the Markov Assumption, a critical simplifying assumption of Bayesian Networks. Second, we will discuss the empirical evidence for normative "discounting" of alternative causes that compete to explain the same effect. Third, we will discuss empirical evidence for neglect of base rates when reasoning about causal relationships. We conclude that informal reasoning about causal systems often follows the patterns implied by the normative framework, but there are some systematic qualitative and quantitative discrepancies.
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Bilingualism II

Marquette II, Saturday Afternoon, 1:30-2:50

Chaired by Catherine Caldwell-Harris, Boston University

1:30-1:45 (208)

Are Jokes Less Funny is a Foreign Language? CATHERINE L. CALDWELL-HARRIS, *Boston University,* AYSE AYCICEGI-DINN, *Istanbul University*—Appreciating humor in a non-native language is believed to require native-like ability. Foreign language stimuli are frequently judged less emotional and elicit reduced skin conductance responses. To determine if jokes presented in a second (foreign) language (L2) would have reduced emotional resonances, we presented L1 and L2 versions of the same jokes to Turks learning English as a foreign language (N=251). The more proficient English readers rated L2 jokes as slightly funnier (exoticism effect). However, skin conductance responses (SCRs) were linearly related to ease-of-understanding for both L1 and L2 jokes, suggesting that visceral aspects of joke processing are insensitive to L1/L2 status. We propose that the exoticism effect obtained with humor ratings draws on achievement accompanying successful joke interpretation in the less proficient language. Contrary to the conventional view, if language users are proficient enough to resolve a jokes' incongruity, humor will be experienced as funnier in a foreign language.
Email: Catherine Caldwell-Harris, charris@bu.edu

1:50-2:05 (209)

Does Bilingualism Twist Your Tongue? TAMAR H. GOLLAN, *University of California, San Diego,* MATTHEW GOLDRICK, *Northwestern University*—Bilingualism leads to disadvantages in lexical retrieval but advantages in the management of competition in both linguistic and non-linguistic tasks. The current study investigated whether bilingualism leads to disadvantages or advantages in the

retrieval and processing of sounds. Spanish-English, Mandarin-English, and English-only monolinguals repeated English tongue twisters. In addition to manipulating sound similarity to increase competition at a sublexical level, the twisters varied in whether lexical information did or did not support sound processing. Spanish-English bilinguals produced significantly more errors than monolinguals, particularly in the absence of lexical support. However, Spanish-English bilinguals exhibited a relative advantage in producing twisters composed of similar sounds (which increased errors in monolinguals more than in bilinguals). Mandarin-English bilinguals exhibited more consistent disadvantages across all twister types. These data reveal a bilingual disadvantage at a sublexical level, and suggest that the effects of overlapping representational structure can be modulated by individual differences in competition-management.
Email: Tamar Gollan, tgollan@ucsd.edu

2:10-2:25 (210)

A Bilingual Disadvantage in Linguistic Perspective Adjustment. RACHEL A. RYSKIN and SARAH BROWN-SCHMIDT, *University of Illinois* (read by Sarah Brown-Schmidt)—Previous research suggested bilinguals enjoy general cognitive benefits such as improved executive function, due to flexible language-switching. Yet, how such cognitive advantages interplay with known bilingual verbal disadvantages is poorly understood. We used eye-tracking to examine monolinguals' and bilinguals' performance in a lexical-remapping task, which relies both on executive control and linguistic abilities. Participants followed temporarily ambiguous spatial instructions (e.g. "go left to the pig"). Instructions were either given using the normal English mapping (e.g., "left"=left) or, in the remapping condition, the opposite mapping (e.g., "left"=right, as in face-to-face conversation). Bilinguals made fewer target fixations than monolinguals, regardless of mapping. Performance was predicted by individual measures of executive function. Our results suggest that despite their proposed executive function advantages, bilinguals are less able than monolinguals to switch flexibly between lexical mappings, perhaps due to interference from the other language, or overall less experience with even the dominant language.
Email: Sarah Brown-Schmidt, brownsch@illinois.edu

2:30-2:45 (211)

Cross-Language Non-Selective Activation Increases Within Language Homophone Competition. ANA I. SCHWARTZ and YU-CHENG LIN, *University of Texas at El Paso*—In two experiments the role of cross-language lexical activation in accessing homophone meanings was investigated. Highly proficient Spanish-English bilinguals either heard (Experiment 1) or read (Experiment 2) sentences ending in an English homophone. This homophone either had a cognate meaning with Spanish (e.g., alter/altar) or had no relationship with Spanish (e.g., bare/bear). Participants decided whether follow-up target words were related in meaning to the sentence presented. When target words were related to the contextually irrelevant competing homophone meaning ("These are the results I cannot alter. PRAY") inhibitory effects were observed only when the competitor was also a cognate meaning, and only in the auditory presentation modality. Results will be discussed in terms of an emerging model of bilingual access to homonym meanings, The Bilingual ReOrdered Access Model.
Email: Ana Schwartz, aischwartz@utep.edu

Automatic Processing

Marquette VIII, Saturday Afternoon, 1:30-2:50

Chaired by Terry Blumenthal, Wake Forest University

1:30-1:45 (212)

Acoustic Startle Stimuli Speed Reaction Time on the Attentional Networks Test. JOHN Z. REYNOLDS and TERRY D. BLUMENTHAL, *Wake Forest University* (read by Terry D. Blumenthal)—The startle response is believed to interrupt ongoing cognitive processing, and is used in research on failures of inhibition (e.g. schizophrenia, anxiety). This interruption assumption has been based on measures of startle response inhibition, but relevant measures of cognitive processing are rare. The present study involved presenting 100 dB startle stimuli 100 msec after cue onset in the Attentional Networks Test, a cued flanker paradigm used to evaluate alerting, orienting, and executive function. As the information content of the cue increases, reaction time should decrease as participants are better able to predict the timing and location of the subsequent target, and startle should interfere with this speeding. However, the presence of a startle stimulus speeded the reaction to the target compared to the trial without an accompanying startle stimulus. These findings support previous research showing that the startle stimulus speeds RT, but provide only weak evidence for startle interrupting cognition.
Email: Terry Blumenthal, blumen@wfu.edu

1:50-2:05 (213)

Masked Priming Mechanisms and Latency Distributions in Number Classification Tasks. JASON R. PERRY, STEPHEN J. LUPKER and ERIC STINCHCOMBE, *University of Western Ontario* (read by Stephen J. Lupker)—The nature of masked priming in a number classification task (i.e., is the presented number greater or less than 5?) was investigated in a set of experiments. Past research investigating the impact of both old set primes (i.e., primes that also appear as targets) and new set primes (i.e., primes that never appear as targets) has typically confounded the old-new manipulation with prime-target distance (i.e., congruent old set primes typically have a prime-target distance of 3 units). We examined priming effects after unconfounding these factors with a specific focus on the nature of the full latency distributions. Tasks of this sort produce an unusual distribution pattern, with the priming effect size decreasing in the longer quantiles. Implications of this pattern for the nature of the priming mechanisms (e.g., S-R associations, semantic activation, action triggers) in number classification and other similar tasks will be discussed.
Email: Steve Lupker, lupker@uwo.ca

2:10-2:25 (214)

Familiarity Effects in Visual-Spatial Attentional Capture and Disengagement. JAMES H. NEELY and MATTHEW A. THOMAS, *University at Albany, SUNY,* TODD A. KAHAN, *Bates College*—In two experiments, a target display contained a target letter and a distractor letter, one to the left and one to the right of fixation. In Experiment 1, an immediately preceding "cuing" display contained an icon (to the left or right of fixation) that had previously received some pre-exposure (moderate- familiarity "cue") and another icon on the opposite side that had received extensive pre-exposure (high-familiarity "cue") or no pre-exposure (novel "cue"). Target RTs were shortest for targets appearing in the novel "cue's" location, slowest for targets in the high-familiarity "cue's" location and intermediate and equivalent for targets in the moderate-familiarity "cue's" location, regardless of the other "cue's" familiarity. In Experiment 2, target RTs were virtually identical when the "cuing" display contained a single high- familiarity, moderate-familiarity or novel icon presented at fixation. Thus, low familiarity leads to attentional capture but familiarity has no effect on attentional disengagement.
Email: James Neely, jneely@albany.edu

2:30-2:45 (215)

Compatibility Effects in Numeral Comparison: A Reinterpretation. ALAIN CONTENT and MATHIEU GUILLAUME, *Université libre de Bruxelles*—How do we access magnitude from Arabic symbols and how is magnitude represented mentally? Based on the decimal place-value convention, researchers have suggested that numerical magnitude is represented in a compositional way as a combination of different range magnitudes (units, decades, hundreds). One strand of evidence is the unit/decade compatibility effect in numeral comparison tasks. The compatibility effect refers to the performance drop observed when the magnitude relation between the unit digits diverges from the overall magnitude relation, with the largest number containing a smaller unit (73_29), suggesting that the comparison of unit digits contributes to the comparison. Here we present a study based on two-digit numeral comparison in which we examined how each digit magnitude affects the overall comparison. Contrary to the standard compatibility interpretation, which assumes that only the two decades digits and the two unit digits are compared, the results demonstrate that all pairwise digit comparisons are performed. We conclude that compatibility effects may reflect automatic parallel processing of individual digits, rather than compositional magnitude representations.
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Human Learning & Instruction II
Salon D, Saturday Afternoon, 1:30-2:50
Chaired by Bennett Schwartz, Florida International University

1:30-1:45 (216)

Survival Processing Does Not Improve Paired-Associate Learning. BENNETT L. SCHWARTZ, *Florida International University,* BROCK R. BROTHERS, *Oakland University*—Evaluating words for survival relevance leads to better free recall than many common encoding strategies (Nairne & Pandeirada, 2011). We addressed if survival processing advantages would generalize to paired-associate learning by asking participants to evaluate word pairs, either Swahili-English (e.g., duara-wheel) or Lithuanian- English (e.g., karalius – king) under survival processing instructions or other encoding instructions. In Experiment 1 we instructed participants to learn the pairs, whereas in Experiments 2 through 4, we used an incidental task. In Experiment 1, recall was constant across conditions. In Experiments 2, 3 and 4, pleasantness judgments led to better cued recall than survival processing. Feeling-of-knowing judgments and feeling-of-forgetting judgments were not affected by survival processing versus pleasantness judgments. Thus, survival processing improves free recall of lists but not paired-associate learning. This suggests that the survival processing instructions promote relational learning among items, but not associative learning within pairs.
Email: Bennett Schwartz, schwartb@fiu.edu

1:50-2:05 (217)

The Partial Reinforcement Extinction Effect and the Contingent Sampling Hypothesis. IDO EREV, *Technion,* GUY HOCHMAN, *Duke University*—Two experiments are presented that compare alternative explanations of the apparent inconsistency between basic and field research of the partial reinforcement extinction effect (PREE). Experiment 1 shows that partial reinforcements increase the tendency to select the promoted option during extinction. However, this effect is much smaller than the negative effect of partial reinforcements on the tendency to select the promoted option during the acquisition phase. Experiment 2 demonstrates that the overall effect of partial reinforcements can be predicted with a contingent sampling model: The participants behave as if they base their current choice on a small sample of experiences under similar contingencies (recent outcomes). As a result, partial reinforcements increase the tendency to select the promoted option only when they increase the likelihood of positive experiences with this option under the relevant contingencies.
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2:10-2:25 (218)

Memory Athletes: Does Their Ability Generalize to Other Cognitive Tasks? HENRY L. ROEDIGER, III and MARY A. PYC, *Washington University in St. Louis,* TIM TULLY, *Dart Neuroscience,* DAVID A. BALOTA and KATHLEEN B. MCDERMOTT, *Washington University in St. Louis*—Memory competitions represent a growing sport in the U.S. and the world, with competitors attempting and accomplishing remarkable feats (e.g., serial recall of 100 rapidly-presented digits). We have begun testing competitors in a battery of standard cognitive and memory tests and comparing their performance to two groups of younger subjects: students who compete in local trivia competitions and students from our general subject pool (mean V+Q SATs of about 1470). The memory athletes performed extraordinarily well on most memory tests (e.g., they recalled many words and made few

or no errors on a powerful version of the DRM paradigm). In addition, they also showed excellent performance on measures of working memory (computation span) and cognitive control (they showed reduced Stroop interference). Extensive memory training for memory competitions may provide cognitive benefits that extend to tasks that have not been practiced.
Email: Henry Roediger, roediger@wustl.edu

2:30-2:45 (219)

Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering. LAURA R. NOVICK, *Vanderbilt University*—The United States faces a great imperative to improve undergraduate science and engineering education. In service of this goal, the National Research Council recently released their consensus report on discipline-based education research (DBER), an emerging, interdisciplinary research enterprise that combines the expertise of scientists and engineers with methods and theories of human learning and cognition. The report includes chapters on identifying and improving students' conceptual understanding, problem solving and the use of representations, and emerging areas of research for DBER such as transfer and metacognition. Cognitive psychologists have considerable expertise in all of these areas. Among the recommendations of the Committee are (1) additional basic research in DBER and (2) interdisciplinary studies to examine cross-cutting concepts (e.g., energy, systems) and cognitive processes. Collaborations with cognitive psychologists have, to date, been productive though relatively limited. There is a great opportunity for cognitive psychologists to contribute to this important area of research.
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SYMPOSIUM IV: Psychonomics without Experiments? Discovering Psychological Principles by Mining Large Data Sets
Salon C, Saturday Afternoon, 1:30-3:40
Chaired by Robert Goldstone, Indiana University

1:30-1:40 (220)

Introduction. ROBERT GOLDSTONE, *Indiana University*—The very expertise with which psychologists wield their tools for achieving laboratory control may have had the unwelcome effect of blinding us to the possibilities of discovering principles of behavior without conducting experiments. When creatively interrogated, a diverse range of large, real-world data sets provides powerful diagnostic tools for revealing principles of human judgment, perception, categorization, decision making, language use, inference, problem solving, and representation. Examples of these data sets include web site linkages, dictionaries, image statistics, large corpora of texts, history of financial transactions, photograph repository tags and contents, patent use, consumer product sales, performance in high-stakes sporting events, and scientific citations. The goal of this symposium is to present some exemplary case studies of mining large data sets to reveal important psychological principles and phenomena, and to discuss some of the underlying issues involved with conducting traditional experiments, large data analyses, and the synthesis of both methods.
Email: Robert Goldstone, rgoldsto@indiana.edu

1:40-1:58 (221)

Predicting Visual Memorability From Image Statistics. AUDE OLIVA, *Massachusetts Institute of Technology*—In the vast majority of contemporary models of perception and memory, the emphasis is on the limited capacity of human perceptual and mnemonic systems. However this framework also has its limits. Converging evidence from behavioral, computational and cognitive neuroscience suggest that there are neural mechanisms designed to quickly extract information from visual input and, when tested suitably, appear effortless and unlimited in capacity. The human brain employs a strategy for representing a summary of the visual input that is independent of the visual complexity of the image. This framework emphasizes that under specific conditions, observers can have a phenomenal long-term memory capacity for the visual details of images. In this talk, I will discuss the role for visual image statistics in both image understanding and visual long term memory, and describe a model that predicts more accurately than human judgments when an image will be memorable, or not.
Email: Aude Oliva, oliva@mit.edu

2:01-2:19 (222)

Testing Models of Cognition Using Large Databases of Images. *THOMAS L. GRIFFITHS, *University of California, Berkeley*—Most cognitive psychology experiments evaluate models of human cognition using a relatively small, well-controlled set of stimuli. This approach stands in contrast to current work in machine learning, which has begun to focus on using large datasets that can be found "in the wild" (i.e., online). I will talk about how some of the insights gleaned from machine learning can be exploited to develop new experimental methods that allow us to use large datasets to evaluate models of cognition. I will focus on recent work using large databases of images to explore questions in three different domains: defining a quantitative measure of representativeness, identifying prior knowledge used in word learning, and determining the structure of natural categories.
Email: Thomas L. Griffiths, tom_griffiths@berkeley.edu

2:22-2:40 (223)

The Arbitrariness of the Sign: Insights From Corpus Analyses. MORTEN H. CHRISTIANSEN, *Cornell University*—Psychologists have used experimental methods to study language for more than a century. However, only with the recent availability of large-scale linguistic databases has a more complete picture begun to emerge of how language is actually used and what information is available as input to language acquisition. Analyses of these databases have resulted in reappraisals of key assumptions about the nature of language. As an example, this talk focuses on corpus-based research that has shed new light on the arbitrariness of the sign: the longstanding assumption that the relationship between

the sound of a word and its meaning is arbitrary. The results reveal a systematic relationship between the sound of a word and its lexical category—nouns and verbs sound differently from each other—but also point to a division of labor between arbitrariness and systematicity in sound-meaning mappings.
Email: Morten H. Christiansen, christiansen@cornell.edu

2:43-3:01 (224)

Baby Names, Social Influence, and the Psychological Foundation of Culture. JONAH BERGER, *University of Pennsylvania*—This talk covers two projects that use first names data to examine cultural evolution and abandonment. The first project uses over 100 years of first names data to investigate how the popularity of other, similar variants shapes cultural success. Names can be broken into phonetic parts, or phonemes, and we examine how a name's popularity is influenced by the popularity of that name's component phonemes in other names in the past year. The second project demonstrates that the velocity of item adoption may affect abandonment: Analysis of over 100 years of data on first-name adoption in both France and the United States illustrates that cultural tastes that have been adopted quickly die faster (i.e., are less likely to persist). Taken together, the projects shed light on how psychological processes shape collective outcomes and illustrate how researchers can use field data to address these types of questions.
Email: Jonah Berger, jberger@wharton.upenn.edu

3:04-3:22 (225)

Projection Bias in the Car and Housing Markets. DEVIN G. POPE, *The University of Chicago*—Projection bias is the tendency to overpredict the degree to which our future tastes will resemble our current tastes. We test for evidence of projection bias in two of the largest and most important consumer markets – the car and housing markets. Using data for more than forty million car transactions and four million housing purchases, we explore the impact of the weather on purchasing decisions. We find that the choice to purchase a convertible or a 4-wheel-drive vehicle is highly dependent on the weather at the time of purchase in a way that is inconsistent with classical utility theory. Similarly, we find that the hedonic value that a swimming pool adds to a house is, on average, $1400 more when the house goes under contract in the summertime compared to the wintertime.
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3:25-3:40 (226)

Open Discussion. ROBERT GOLDSTONE, *Indiana University*

Action, Cognition, and Object Manipulation

Marquette VIII, Saturday Afternoon, 3:10-4:30

Chaired by David Rosenbaum, The Pennsylvania State University

3:10-3:25 (227)

How We Grasp Reveals What We Plan. DAVID A. ROSENBAUM, *The Pennsylvania State University*—Two overarching questions can be said to drive all research described at Psychonomics: What do we know and how do we know it? How we act often reveals what we know, and some of what we know concerns action itself. For example, as shown in a study that laid the foundation for the work to be presented here, neurologically normal adults generally use a thumb-down rather than a thumb-up grasp to grasp an inverted glass before righting it for pouring. Adoption of the initially awkward grasp allows for a more comfortable, easier-to-control, grasp during the pouring. Subsequent research led to a related discovery: Neurologically normal adults generally take hold of an object at a height inversely related to the height to which the object will be moved. These and other results will be presented, along with an overview of the special session and its significance.
Email: David Rosenbaum, dar12@psu.edu

3:30-3:45 (228)

Object Manipulation in Non-Human Animals. DANIEL J. WEISS and KATE CHAPMAN, *The Pennsylvania State University*—A longstanding question concerning the evolution of complex cognition has been the extent to which our abilities for foresight and reasoning are shared with other species. Previous attempts at addressing this question have focused almost exclusively on sophisticated cognitive functions, such as tool use, that appear to be restricted to a subset of species. In this presentation, we will discuss an emerging line of research on motor planning that investigates anticipation in the context of prehension. Recent studies conducted with several nonhuman primate species (including tool-users and non tool-users) have demonstrated that the way in which individuals grasp objects often reflects what they intend to do with the objects. These findings suggest that motor planning abilities have a lengthy evolutionary history in primates and may be ubiquitous in mammals. We conclude by speculating how such anticipation may have led to the development of more advanced types of foresight and reasoning.
Email: Dan Weiss, djw21@psu.edu

3:50-4:05 (229)

Object Manipulation in Complex Task Settings. ROBRECHT P. VAN DER WEL, *Rutgers University*—A wealth of studies shows that people grasp object in ways that let them end the object manipulations in comfortable rather than uncomfortable postures. Most of these studies have relied on manipulations of single objects moved with one hand. This talk examines the extent to which the same planning effects hold up in more complex task settings. The first of these involves bimanual object manipulation. Here the core experimental question is how the tendency to end comfortably interacts with the tendency to make symmetric hand movements. Findings are presented which suggest that planning for bimanual object manipulations relies on flexible rather than fixed prioritization of action constraints. The second complex task setting involves manipulation of objects by two people. Here the question is whether people generalize their own action constraints to accommodate others'. Evidence is presented that they do.
Email: Robrecht van der Wel, r.vanderwel@rutgers.edu

4:10-4:25 (230)

Object Manipulation: Neural, Clinical, and Computational Aspects. OLIVER HERBORT, *Eberhard Karls Universität Tübingen* (Sponsored by Robrecht van der Wel)—The finding that healthy adults grasp objects in ways that enable or facilitate future interactions with the object has been observed in a range of tasks. However, the processes that enable the production of such anticipatory actions are not well understood. Here I discuss evidence from several lines of research that shed light on these processes. Recent neuro-imaging studies provide insights into the neural substrates of the representations involved in the planning of anticipatory actions. Moreover, findings from several clinical conditions that impair anticipatory action selection (e.g., autism and hemiparetic palsy) make it possible to relate the anticipatory deficits to problems in other tasks or processes. These findings are complemented by experiments showing systematic - potentially suboptimal - biases in anticipatory actions of healthy adults. A computational perspective integrating these findings suggests that anticipatory action selection is driven by a heuristic anticipatory process as well as situational and habitual factors.

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Visual Processing
Salon E, Saturday Afternoon, 3:10-4:30
Chaired by Nicholas Altieri, Idaho State University

3:10-3:25 (231)

An Accuracy-Response Time Capacity Assessment Function that Measures Performance Against Standard Parallel Predictions. NICHOLAS A. ALTIERI, *Idaho State University,* JAMES T. TOWNSEND, *Indiana University*—Measures of efficiency under increases in mental or attentional workload are vital for studying perception, cognition, and action. Such measures have typically been confined to either reaction time (RT) or accuracy alone. For example, within the realm of RTs, a non-parametric measure known as workload capacity (Townsend & Nozawa, 1995) has been employed in numerous studies. However, the combined contribution of accuracy and correct versus incorrect response times, has been unavailable in the RT-only context. A non-parametric statistic capable of taking into account both accuracy and RT will prove highly beneficial for researchers across a wide variety of disciplines including, but not limited to, vision and multisensory processing. This study develops such a tool for two important decision rules. Preliminary data from a visual detection experiment illustrates one potential application.

Email: Nicholas Altieri, nick.altieri@ou.edu

3:30-3:45 (232)

The First Two Seconds: Three Stages of Visual Information Processing? JANE JACOB and BRUNO G. BREITMEYER, *University of Houston* (read by Bruno G. Breitmeyer)—We compared visual priming and comparison tasks to assess information flow during the first 2 seconds after stimulus onset. In both tasks a 40-ms prime was followed at varying SOAs by a 40-ms probe. In the priming task Os identified the probe as rapidly and accurately as possible; in the comparison task Os determined as rapidly and accurately as possible whether or not the probe and prime were identical. Priming effects attained a maximum at an SOA of 133 ms and then declined monotonically to zero by 700 ms, indicating reliance on visuosensory (iconic) memory. In contrast, the comparison effects showed a multiphasic function, showing one minimum at 133 ms, followed by a maximum at 240 ms, followed by another minimum at 720 ms and another maximum at 1200 ms before declining thereafter. Assuming three separate processing stages corresponding to icnoic visible persistence, iconic informational persistence, and working memory, we could characterize the temporal characteristics of each stage by a separate scaled Weibull density function. We relate these three stages to stages assumed to characterize other paradigms such as the attentional blink.

Email: Bruno Breitmeyer, brunob@uh.edu

3:50-4:05 (233)

Chromatic-Contrast and Visual Short-Term Memory. GEOFF G. COLE, *University of Essex,* GUSTAV KUHN, *Brunel University*—Luck and Vogel (1997) showed that retention within visual short-term memory can be enhanced if the information is integrated to form discrete objects. In a central experiment, observers were presented with pairs of small and larger squares and were required to retain the colour of each pair. Either the pairs overlapped to form one object or were diagonally displaced to form two separate objects. Vogel et al. found that retention was increased when the pairs were integrated (i.e., overlapped). In the present study we examined whether chromatic-contrast contributes to retention within visual memory. Using a variant of the Luck and Vogel paradigm, we show that although visual memory improves when pairs of objects overlap to form a single object this is conditional on the availability of chromatic-contrast. When the contrast is abolished via the use of a mask no improvement occurs. We further showed that this effect was not due to a visual limitation caused by the presence of the mask. These results suggest that chromatic-contrast is represented within visual memory.

Email: Geoff Cole, ggcole@essex.ac.uk

4:10-4:25 (234)

Effect of Prior Sleep Deprivation on Encoding Depends on the Memory System Studied. DANTE PICCHIONI and KELLY K. MCWHIRTER, *Walter Reed Army Institute of Research,* ANNE S. MORROW, BETH A. LEE, BISHU SHRINIVAS and ALAN J. ZAMETKIN, *National Institutes of Health,* THOMAS J. BALKIN, *Walter Reed Army Institute of Research,* CAROLYN B. SMITH, *National Institutes of Health*—It has been shown that one night of sleep deprivation prior to encoding can result in impaired ability to form declarative memories. We examined whether one night of acute sleep deprivation would impair encoding of non-declarative memory. We compared performance on the texture discrimination task (TDT) in 9 controls and 9 sleep-deprived subjects 9.5h after training. All subjects were permitted to nap during the interval. Performance on the TDT did not differ between the two groups. The TDT is known to elicit neural changes at the earliest portion of the visual processing

stream. Thus our results indicate that encoding capacity may be affected not only by prior sleep status but also by the type of task and concordantly the brain regions involved in the corresponding memory system. These factors are important to consider in cases where encoding must take place during a period of sleep deprivation.
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Associative Learning
Salon G, Saturday Afternoon, 3:10-4:30
Chaired by Karin Butler, University of New Mexico

3:10-3:25 (235)
Effects of Associative Strength and Study Order on Illusory Recollection. KARIN M. BUTLER and BRYAN A. FRANKS, *University of New Mexico*—Illusory recollection of source information for false memories was examined following study of lists of associated words. To examine the processes that contribute to illusory recollection, we created three sets of items from each list, such that sets differed in their associative strength to the themes (BAS). Each studied set was presented at one of four possible locations. The presentation order of the High and Medium BAS sets was manipulated as well as whether these items were presented at adjacent locations or locations separated by an empty space. Participants were tested immediately following each study phase with a recall (Experiment 1) or a cued source recall (Experiment 2) test to ensure accurate source memory. In both experiments, illusory recollections were more likely to be attributions to the source of the items that were studied first when it was High or Medium BAS source information. Theoretical explanations are considered.
Email: Karin Butler, kmbutler@unm.edu

3:30-3:45 (236)
An Instance-Based Account of Retrospective Revaluation. RANDALL K. JAMIESON and CHRISSY M. CHUBALA, *University of Manitoba,* SAMUEL D. HANNAH, *University of Saskatchewan,* MATTHEW J. C. CRUMP, B*rooklyn College, CUNY*—After learning that a compound cue AB predicts an outcome X, learning that A alone predicts X forces a deflation in the predictive validity of B—a phenomenon called retrospective revaluation. We model retrospective revaluation using an instance model of associative learning based on the MINERVA 2 model of human memory. According to the model, each experience is stored to memory as a unique trace and response strength is determined by the similarity between the target outcome and the information that a cue retrieves from memory. We show that the model accommodates retrospective revaluation at the first and higher orders of association and we argue that associative learning is consistent with an instance-based approach to learning.
Email: Randy Jamieson, randy.jamieson@ad.umanitoba.ca

3:50-4:05 (237)
When Do Previous Emotional Associations Impair and When Do They Facilitate Subsequent Learning of New Associations? MICHIKO SAKAKI, ALEXANDRA YCAZA and MARA MATHER, *University of Southern California*—Cues previously associated with an emotional event (emotional harbinger cues) trigger strong emotional reactions and draw one's attention more strongly than cues previously associated with a neutral event (neutral harbinger cues). However, recent research revealed that people sometimes exhibit poorer memory for the context of emotional harbinger cues than of neutral harbinger cues (Mather & Knight, 2008). The current study addressed when and why this impairing effect occurs for emotional harbinger cues. Participants first learned that some neutral faces predicted emotionally arousing events and others predicted neutral events (conditioning phase). Participants then studied associations between the harbinger faces and new contextual details (context learning phase). Across four studies, we found that how well people can learn additional contextual information about harbinger cues depends on memory strength for the cues themselves. That is, emotional harbinger cues produced poor contextual memory when participants had weak representations for the cues. In contrast, participants showed better contextual memory for emotional harbinger cues when they acquired strong memory for the cues during the conditioning phase.
Email: Michiko Sakaki, msakaki@usc.edu

4:10-4:25 (238)
Encapsulated Nature of Distrust: Learned Untrustworthiness is Immune to Intentional Suppression. ATSUNOBU SUZUKI and YOSHIKO HONMA, *Nagoya University,* SAYAKA SUGA, *Japan Science and Technology Agency*—People readily learn about others' reputation through verbal communication. However, gossips are often inaccurate and need to be suppressed intentionally. Although recent evidence indicates the flexibility of reputation-learning processes, it remains unclear to what extent people can inhibit learned reputation at will. Here we report two studies addressing this issue. In both studies, participants learned to associate each unfamiliar face with a verbal label (good or bad person), and then were instructed to suppress the associations intentionally. Before learning, they were informed that the labels were arbitrarily preset (Study 1) or were based on actual behaviors of the displayed persons (Study 2). Results consistently showed that in the suppression phase, perceived trustworthiness remained low for bad persons, while it almost returned to a pre-learning level for good ones. This was not modulated by facial trustworthiness. The findings indicate an encapsulated nature of distrust, suggesting our preparedness for remembering cheaters.
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Mechanisms of Linguistic Relativity
Marquette II, Saturday Afternoon, 3:10-4:30
Chaired by Barbara Malt, Lehigh University

3:10-3:25 (239)
Assessing the "Language Directs Attention" Hypothesis. BARBARA MALT, *Lehigh University*—One prominent interpretation of linguistic relativity is that language selectively directs attention to aspects of the world. There are two versions of this possibility: that being a speaker of a language influences routine ways of processing objects and events, and that actively

using language causes selective attention to features of an ongoing event. Both are compatible with accepted views of how attentional processes work. But placing them in the context of a general attentional framework raises other considerations about how attention is directed to elements of the world. I will consider the many influences on feature sensitivity in early stages of processing and orientation of attention in later stages. Because the outcomes of attentional processes are multiply determined, attentional consequences of language may rarely be found in real-world contexts. They will be seen mainly when tapping language-related ways of attending to the world that do not compete with other learned tendencies nor with conflicting temporary goals, and when "thinking for speaking" if the task is mainly about speaking and not also about extracting other information from the event.
Email: Barbara Malt, barbara.malt@lehigh.edu

3:30-3:45 (240)

Relational Language Influences Relational Thought. DEDRE GENTNER, *Northwestern University*—I discuss four ways that language is instrumental in learning relational concepts, such as carnivore, consequence or limit. First, applying a common label to two exemplars invites comparison; this process can lead to abstracting a common meaning, which may become the seed of a category. Second, naming a relational constellation permits it to serve as an argument to a higher-order proposition, facilitating the expression of complex assertions. Third, naming makes a constellation more likely to be retained and applied in the future. This contributes to relational transfer and to the development of uniform relational encoding. Finally, Linguistic structure invites conceptual structure. Learning semantic relations within the lexicon can invite finding parallel conceptual relations. Once learned, systems of semantic relations provide representational tools with which to structure knowledge. I illustrate some of these claims with empirical studies
Email: Dedre Gentner, gentner@northwestern.edu

3:50-4:05 (241)

Seeing for Speaking. KATHRYN BOCK, *University of Illinois*—Languages express fundamental conceptual distinctions in their grammars. For example, virtually every utterance that an English speaker produces demands information about time (past, present), interpersonal roles (me, you, them), and numerosity (singular, plural). These unrelenting semantic categorizations are fast, automatic, and have consequences that cascade across multiple words and word ordering options. If there is any domain in which language shapes thought, this should be it. Focusing chiefly on the role of number in syntax, I will consider findings from research on language-specific differences in how speakers deal with grammatically relevant variations in numerosity in the perceptual and conceptual world.
Email: Kathryn Bock, jkbock@illinois.edu

4:10-4:25 (242)

What Do Words Do? Towards a Theory of Language-Augmented Thought. GARY LUPYAN, U*niversity of Wisconsin, Madison* (Sponsored by Mark Seidenberg)—Both proponents and critics of the Whorfian question have assumed a separation between language and "nonverbal" thought. I will argue that, given the massive interactivity in virtually every aspect of human cognition and perception, this position is untenable. Rather, language is more usefully viewed as an operator that augments ongoing cognitive and perceptual processes. I will support this thesis with three sources of evidence: First, I will present evidence of linguistic effects on putatively nonverbal processes such as categorization, memory, cognitive control, and basic visual processing: For example, referring to a triangle by its name ("triangle") can affect visual judgments of its orientation and relative side-length, and simply hearing a verbal label can make an otherwise invisible object, visible. Second, I will show that down-regulating activity in cortical areas classically associated with language processing using TMS and tDCS, affects performance on "nonverbal" perceptual and cognitive tasks in ways similar to impairments observed in aphasia. Third, I will present evidence that representations of both familiar and newly learned concepts are different when activated via verbal versus nonverbal means.
Email: Gary Lupyan, lupyan@wisc.edu

Human Learning & Instruction III
Salon D, Saturday Afternoon, 3:10-4:30
Chaired by Steven Smith, Texas A&M University

3:10-3:25 (243)

Training Wheels and Desirable Difficulties: Effects of Contextual Constancy and Variation on Acquisition and Retention. STEVEN M. SMITH, JUSTIN D. HANDY, JEREMY H. NICHOLS and GENNA ANGELLO, *Texas A&M University*—"Training wheels" provide support early in the process of learning, whereas difficulties may be desirable for strengthening learning that is beyond the earliest stages. Episodic memories, the earliest experiences in the development of new knowledge, are fragile, susceptible to forgetting, and highly context-dependent. Conceptual knowledge, in contrast, is more decontextualized. We report several experiments showing that the acquisition of new knowledge benefits from contextual constancy, whereas retention may favor contextually variable practice. Paired associates consisting of Swahili-English words and novel face-name pairs were studied either with the same context on each practice trial (constant context) or with new contexts on each trial (variable contexts), and retention was tested in the presence of new contexts. Constant context, relative to variable contexts, produced greater acquisition, but showed greater forgetting on the final retention test.
Email: Steven Smith, stevesmith@tamu.edu

3:30-3:45 (244)

Do Children Access their Addition Facts to Perform Subtraction? TIMOTHY C. RICKARD and DREW E. WALKER, *University of California, San Diego*—Holistic models of arithmetic fact representation imply that memorized addition facts (e.g., 7 + 4 = 11) can be retrieved to perform complement subtraction problems (e.g., 11 – 4 = _). The identical elements (IE) model (Rickard, Healy, & Bourne,

1994) implies that they cannot. Among adults, the addition format for subtraction (7 + _ = 11) yields better performance than does the subtraction format (11 – 7 = _), a finding that supports the holistic model but that can also be accommodated by the IE model. An addition format advantage cannot be accommodated by the IE model, however, provided that children have been exposed to subtraction problems primarily in subtraction format. Developmental format specificity results will be reported for a sample of 126 first through sixth grade students. Theoretical and educational implications will be discussed.
Email: Timothy Rickard, trickard@ucsd.edu

3:50-4:05 (245)

University Students' Opinions about the Mathematics that is Taught in Grades K-12. PATRICIA BAGGETT, *New Mexico State University,* ANDRZEJ EHRENFEUCHT, *University of Colorado, Boulder*—Five hundred seven undergraduate students enrolled in eleven mathematics and computer science classes at two universities responded to an anonymous survey about what mathematics should be taught in grades K-12, and how it should be taught. There was considerable agreement on some issues (e.g., 92% said that children should memorize addition and multiplication "facts"), but not on others (e.g., which mathematical topics are most important, and at what level children should start using technology). In the talk we will present a description of the subjects, the questions they were asked, a summary of the data, and the framework for their interpretation. We will point out the differences between students' opinions and current trends in math education.
Email: Patricia Baggett, baggett@nmsu.edu

4:10-4:25 (246)

The Effect of a Bottleneck in Cultural Transmission of a Function Concept. MICHAEL L. KALISH, *University of Louisiana at Lafayette,* *THOMAS L. GRIFFITHS, *University of California, Berkeley,* STEPHAN LEWANDOWSKY, *University of Western Australia*—Information changes as it is passed from person to person, with the process of cultural transmission allowing individuals to shape the information that they transmit. A mathematical model of cultural transmission predicts that the amount of information passed from person to person should affect the rate at which that information changes. We tested this prediction using a function-learning task, in which people learn a mapping between two continuous variables by observing the values of those variables. We varied the total number of observations and the number of those observations that take unique values. We found an effect of the number of observations, with functions transmitted using fewer observations changing form more quickly. We did not find an effect of the number of unique observations. We show that noise in memory or perception could account for this result.
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Business Meeting
Salon C, Saturday Afternoon, 4:40-5:50
Chaired by Jeffrey Zacks, Washington University in St. Louis

Presentation of the Psychonomic Society 2012 Best Article Awards. COLIN M. MACLEOD, *University of Waterloo*

Business of the Psychonomic Society. JEFFREY M. ZACKS, *Washington University in St. Louis*

Speech Perception
Marquette II, Sunday Morning, 8:00-10:00
Chaired by Robert Remez, Barnard College, Columbia University

8:00-8:15 (249)
Short-Term Perceptual Tuning to Talker Characteristics. ROBERT E. REMEZ, EMILY F. THOMAS, AISLINN T. CRANK, NATALIE A. C. PORTER, STAVROULA M. KOINIS, KATRINA B. KOSTRO, NINA U. PADDU and CHLOE B. CHEIMETS, *Barnard College, Columbia University*—When a listener encounters a new talker, the perceptual accommodation to the unique characteristics of the talker has two distinct aspects. First, the listener assesses acoustic characteristics of speech, presumably to resolve the unique properties of sound production that express phonemic contrasts. Second, the listener appraises the talker's idiolect, subphonemic linguistic-phonetic properties that compose the finest-grain of production. Tests show that a listener can adapt to some talker-specific properties within a few seconds. A new study assayed the variety of phonemic types that tuning depends on, to determine whether the perceptual benefit depends on exposure to an entire phonemic inventory. Exposure included sentences of restricted phoneme composition, varying from the most constrained (vowels, liquids and nasals) to unrestricted composition. Effects of exposure were measured using a spoken word identification task consisting of easy words (likely words drawn from sparse neighborhoods of less likely words) and hard words (less likely words drawn from dense neighborhoods of more likely words). This study reveals the intricate nature of perceptual exposure and tuning, and hints at non-normative aspects of intelligibility.
Email: Robert Remez, remez@columbia.edu

8:20-8:35 (250)
Individual Differences in the Perception of Foreign-Accented Speech. TESSA BENT, *Indiana University*—Substantial individual differences in speech perception abilities are present even for adults with normal hearing. These differences cannot be explained by non-speech auditory abilities or global cognitive skills (Kidd, Watson & Gygi, 2007), but are related to the ability to make perceptual wholes from fragments (Zekveld et al., 2007) and familiar sound recognition (Kidd et al., 2007). However, a significant portion of the variability remains unexplained. In the current study, the relationship between phonological processing skills – phonological memory, processing speed, and phonological awareness – and foreign-accented speech recognition was investigated. Compared to typical, low-variability speech recognition tasks with single, native talkers, foreign-accented speech recognition poses a unique perceptual challenge that could lead to even greater individual differences. Large individual differences in speech recognition scores were observed and they were significantly correlated with phonological awareness skills. Better phonological awareness may help listeners map non-canonical pronunciations of words onto stored lexical items.
Email: Tessa Bent, tbent@indiana.edu

8:40-8:55 (251)
Is Listening to Non-Native (L2) Speakers Detrimental to Native (L1) Speakers? ARTHUR G. SAMUEL, *Basque Center on Cognition Brain and Language; Ikerbasque; Stony Brook University,* SAIOA LARRAZA, *Basque Center on Cognition Brain and Language*—Non-native speakers systematically mispronounce words in their L2. Sebastian-Galles et al. [JML, 2005, 52, 240-255] found that exposure to these erroneous pronunciations caused native speakers to become insensitive to mispronounced words in their own language: Native Catalan speakers accepted mispronounced Catalan stimuli as words if the mispronunciation was a vowel substitution that native Spanish speakers often produce when speaking in Catalan (their L2). We tested whether this phenomenon occurs for Basque-Spanish bilinguals who hear native Spanish speakers' mispronunciation of a consonantal distinction that is present in Basque but not in Spanish. We then tested whether the phenomenon reflects rule-based generalization or encoding of mispronounced tokens of individual words: We taught people new Basque "words" that have the relevant consonant, and then tested whether listeners accepted only the learned version (token-based effect, as incorrect tokens were never heard during training), or if they also accepted a mispronounced version (rule based generalization).
Email: Arthur Samuel, a.samuel@bcbl.eu

9:00-9:15 (252)
Adults Rely on Phonetic Cues When Processing Audiovisual Speech, Infants Do Not: Or Do They? MARTIJN BAART, *Basque Center on Cognition, Brain and Language, Donostia/San-Sebastian,* JEAN VROOMEN, *Tilburg University,* KATHLEEN SHAW and HEATHER BORTFELD, *University of Connecticut* (read by Heather Bortfeld)—It is not clear whether audiovisual speech integration in infants is driven by phonetic binding, the perceived temporal congruence, or both (as is the case in adults). We used speech or artificial sounds that share the temporal characteristics of their speech counterparts (Sine-wave speech; SWS) and compared infants (N=30) with adults (N=52). Adults saw two articulating faces and matched a speech or SWS sound to one of these faces. Infants were tested in a preferential looking paradigm (15 heard speech, 15 heard SWS). Adults were almost flawless when sounds were speech and significantly less accurate when sounds were SWS. Infants looked longer at the face that matched the audio, irrespective of whether the sounds were speech or SWS. These results indicate that infants rely on temporal cues when processing AV speech. Possibly however, infants perceived the phonetic content of the SWS signal and lose this ability during development (perceptual narrowing).
Email: Heather Bortfeld, heather.bortfeld@uconn.edu

9:20-9:35 (253)
Perceptual Integration of Two Sources of Indexical Information in Bilingual Speech. ANN R. BRADLOW, CHARLOTTE VAUGHN and SUSANNE BROUWER, *Northwestern University*—The present research examines whether talker and language information are perceptually integrated in bilingual speech. Using a speeded classification

paradigm (Garner, 1974), variability in the talker's gender (male vs. female) and in the language being spoken (Mandarin vs. English) was manipulated. English-speaking participants were asked to classify short, meaningful sentences obtained from different Mandarin-English bilingual talkers on these two indexical dimensions. Results showed a significant interference effect, indicating that gender and language are processed in an integral manner. Listeners are not able to ignore variation in the gender dimension while processing the language dimension, and vice versa. This suggests that talker-specificity (at least at the level of gender identity) is not fully segregated from language-specificity. Currently, follow-up studies investigate this talker-language dependency for talkers of the same gender and for Mandarin-English bilingual listeners.
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9:40-9:55 (254)

Phonotactic Effects Come From the Top-Down: Evidence From Granger Analysis of Multimodal Imaging Data. DAVID W. GOW and CONRAD NIED, *Massachusetts General Hospital*—Phonotactic legality and frequency manipulations affect performance on a variety of tasks that tap subjects' ability to perceive, produce, remember and acquire spoken language. These effects are typically interpreted as either bottom-up processing biases that favor frequent sequences, or as the result of processing mediated by abstract phonological rules or constraints. An alternative interpretation is that phonotactic effects reflect the role of top-down lexical "gang effects" on acoustic-phonetic processing. In this paper we present the results of two studies that use Granger causality analysis of MR-constrained MEG/EEG activation movies to explore directed processing interactions between acoustic-phonetic processing associated with superior temporal cortex and activation in brain regions associated with wordform representation. The results show that both phonotactic legality effects on phoneme categorization and phonotactic frequency effects in spoken lexical decision are the result of top-down lexical influences on speech processing.
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Selective Attention II

Salon D, Sunday Morning, 8:00-10:00

Chaired by Ronald Hübner, University of Konstanz

8:00-8:15 (255)

Mechanisms and Effects of Task-Set Selection in Task Switching. RONALD HÜBNER and LISA TÖBEL, *University of Konstanz*—When a stimulus activates several competing task sets, then the relevant one must be selected for performing the required task. Unfortunately, little is known about the involved task-selection processes. We therefore conducted several task-switching experiments to investigate how task selection proceeds under different degrees of task conflict. Conditional-accuracy functions for responses to congruent and incongruent stimuli show that accuracy to incongruent stimuli did not converge to that for congruent stimuli, even for slow responses. This indicates that task selectivity remains limited during the whole course of task processing. We propose that this effect results from task confusions and reflects a basic limitation of task selection. Furthermore, we show how performance can be explained by a recently developed dual-stage two-phase model of selective attention. This model is also able to estimate the proportion of unobservable task confusions in the different conditions.
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8:20-8:35 (256)

Location-Specific Effects of Attention during Visual Short-Term Memory Maintenance. MICHI MATSUKURA, *University of Iowa,* JOSHUA D. COSMAN, *Vanderbilt University,* ZACHARY ROPER, DANIEL VATTEROTT and SHAUN P. VECERA, *University of Iowa*—Recent neuroimaging studies suggest that early sensory areas such as V1 are recruited to actively maintain a selected feature of the item held in visual short-term memory. These findings raise the possibility that visual attention operates in similar manners across perceptual and memory representations. In the present study, we investigated whether and how attention is deployed to a particular item's location already stored in memory, using an exogenous cue, in a well-controlled setting. Consistent with the sensory recruitment hypothesis, significant exogenous cuing benefits were observed. The results further indicate that, in accordance with endogenous cues, the exogenous cuing benefit was produced by a mechanism that attention serves to protect the cued item from passive decay or interference by other un-cued items in memory, rather than a mechanism that attention merely prioritizes the cued item (over the rest of un-cued items) in memory to compare with the test item in perceptual representations.
Email: Michi Matsukura, michi-matsukura@uiowa.edu

8:40-8:55 (257)

The Necessity of Attention to Visual Categorization of Real World Objects. NURIT GRONAU, *The Open University of Israel*—The question of whether attention is necessary for visual object categorization has been extensively debated. Most studies investigating this question have used divided attention paradigms, in which participants explicitly searched for a task-relevant category. Here, I asked whether objects are categorized when they are located outside the focus of attention and are task-irrelevant, therefore they are strictly unattended. Participants searched for a nonsense stimulus among pairs of stimuli. Within pairs containing real-world objects, items either belonged to the same category or to different categories. When both objects were attended, RT for same-category pairs was significantly shorter than for different-category pairs, indicating that object category was registered. When participants were cued to respond to one of two objects in a pair, while the other object served as an unattended (irrelevant) distractor, no categorical effect was observed. The unattended distractor affected behaviour only if it competed with response to the target. These results suggest that when unattended objects are strictly task-irrelevant they may not be automatically categorized, providing evidence against arguments of attention-free processing.
Email: Nurit Gronau, nuritgro@openu.ac.il

9:00-9:15 (258)

Ocular Capture by Abrupt Onsets is Severely Reduced During Mental Arithmetic: Evidence Against Cognitive Load Theory. ALEJANDRO LLERAS and SIMONA BUETTI, *University of Illinois*—Cognitive load theory predicts that the attentional system will be more susceptible to visual distractors in conditions of high cognitive load. Here we present evidence against this theory. We asked participants to engage in a running arithmetic task where they had to complete twenty successive simple arithmetic operations on an initial number. We manipulated the range of difficulty of the mental operations (e.g., +1 vs. -4) and the amount of phonological load (2 vs. 3 digit initial number). Operations were presented at fixation for 500 ms every 3 seconds. Photographs were presented peripherally every 3 seconds, on average 2 seconds after the onset of the operation. Ocular capture was measured as the percent of fixations to the onset of new images. Surprisingly, neither the degree of phonological load or the difficulty of the operation affected the degree of capture (~18%). However, capture was substantially reduced compared to a condition where participants only kept track of the number of repetitions of operations in a trial (~80%). Implications for cognitive load theory and distractibility are discussed.
Email: Alejandro Lleras, Alejandro.Lleras@gmail.com

9:20-9:35 (259)

Subliminal Visual Feature Integration. BRUNO R. BOCANEGRA and RENÉ ZEELENBERG, *Erasmus University Rotterdam*—According to many accounts, visual feature integration requires top-down attentional processing, which is often envisaged as reentrant feedback from higher to lower visual areas. One effective way to eliminate top-down feedback is through backward masking, which preserves the initial feed-forward sweep of activation. Indeed, previous masked priming studies have shown that simple stimulus features like, orientation, size or color can be processed subliminally despite complete masking. Here, we investigated whether it is possible to integrate two visual features subliminally in a masked priming task. In a dual feature task, we asked participants to respond to the exclusive disjunction (XOR) of two binary visual features of a gabor target (horizontal vs. vertical orientation, high vs. low spatial-frequency). In a single feature task, participants were asked to respond only to the orientation or the spatial-frequency of the gabor target. As expected, we found a subliminal priming effect in the single feature task, replicating previous findings. Interestingly, we also found a subliminal priming effect in the dual feature task, suggesting that orientation and spatial-frequency can be integrated in the absence of visual awareness.
Email: Bruno Bocanegra, bocanegra@fsw.eur.nl

9:40-9:55 (260)

The Neural Locus of Emotion-Induced Blindness. JAMES E. HOFFMAN and BRIANA KENNEDY, *University of Delaware,* JEN RAWDING, *University of Notre Dame,* STEVE MOST, *University of Delaware*—Emotion-induced blindness (EIB) refers to an inability to report a target picture that appears shortly after an irrelevant emotional picture. We examined the neural locus of this effect by recording event-related brain potentials (ERPs) to RSVP streams containing background pictures (outdoor scenes and buildings) and targets (rotated scene pictures). Targets (T2s) were preceded by an irrelevant picture (T1) that was negative (a snake), neutral (animals and people) or a background scenes. When targets were preceded by background scenes, T2 elicited a prominent negative component (the early posterior negativity or EPN) located over occipital areas and having a latency of 230 msec. When T1 was a negative picture, this component was completely suppressed. T1 elicited this same component, which was larger for negative pictures compared to neutrals. This resulted in a trading relationship between the EPN to T1 and T2. EIB appears, at least partly, to produce early suppression of the target.
Email: James Hoffman, hoffman@udel.edu

Biological Aspects of Memory
Marquette VIII, Sunday Morning, 8:00-10:00
Chaired by Rachel Diana, Virginia Polytechnic Institute & State University

8:00-8:15 (261)

Medial Temporal Lobe Activation During Cognitive Context Reinstatement. RACHEL A. DIANA, *Virginia Polytechnic Institute & State University,* ANDREW P. YONELINAS and CHARAN RANGANATH, *University of California, Davis*—Episodic memory is defined by the binding of information with contextual details from a moment in time. The context of an episodic memory may include details about the cognitive state or "train of thought" that occurs during an event. The BIC theory of medial temporal lobe subregion function proposes that parahippocampal cortex plays a key role in processing episodic context. Therefore, we predicted that parahippocampal cortex activation would be correlated with the processing of cognitive context even when an associated item had not yet been retrieved. We measured brain activation using fMRI in response to reinstatement of a cognitive context, prior to presenting an item memory probe. Activation in parahippocampal cortex was greater during cognitive context reinstatement when a matching item probe was eventually recollected than when the item was judged to be familiar. These findings suggest that parahippocampal cortex activity predicts whether a cognitive context will drive recollection of an item.
Email: Rachel Diana, rdiana@vt.edu

8:20-8:35 (262)

From Memory to Perception: The Medial Temporal Lobe and Visual Discrimination. ANDREW P. YONELINAS and MARIAM ALY, *University of California, Davis*—Recent work has suggested that the medial temporal lobe (MTL) plays a critical role in high-level perception. This conclusion is based on neuroimaging results and patient results indicating that MTL damage leads to deficits on visual perception tasks. We have shown, however, that overall visual discriminations can be based on two independent processes; a threshold state process of perceiving specific details, or on a continuously graded knowing process based on global match. Perceiving

and knowing are characterized by different subjective experiences, they are functionally dissociable, and they show distinct temporal dynamics. In the current study, we tested patients with MTL damage and used fMRI in healthy individuals to examine the role of the MTL in perceiving and knowing. We found that 'perception' was not depended on the MTL, but that judgments of knowing were. Thus, impaired high-level perception in patients with MTL damage may be a result of impaired relational or global processing, while item-specific or local processing is spared.
Email: Andrew Yonelinas, apyonelinas@ucdavis.edu

8:40-8:55 (263)

Age-Related Differences in Brain Activity Associated With Memory for Externally vs. Internally Generated Features. KAREN J. MITCHELL, ELIZABETH ANKUDOWICH, KELLY A. DURBIN and MARCIA K. JOHNSON, *Yale University*—Using fMRI, we compared young (YA) and older adults (OA) on source tests of externally vs. internally generated features (item format [picture, word] vs. encoding task [self-relevant, other-relevant]) and old/new recognition. Both groups showed test type sensitivity (source > old/new) in representational areas and a region of inferior frontal gyrus (IFG) associated with controlled retrieval. YA showed feature-sensitivity (e.g., picture > word in parahippocampal gyrus) in all of these areas; OA showed feature-sensitivity only in IFG for the most difficult feature (words). In a more posterior region of IFG and a region of anterior cingulate cortex—areas associated with cognitive control—YA showed source test differences in activity (format > encoding task, old/new) but OA did not (format = encoding task = old/new). In these regions, both groups showed feature-sensitivity. The findings suggest age-related changes in control circuits operating at different levels (i.e., test type vs. feature type) in agenda-driven remembering.
Email: Karen Mitchell, karen.mitchell@yale.edu

9:00-9:15 (264)

Representation of Episodic Memory Strength by Single Neurons in the Human Hippocampus. JOHN T. WIXTED, *University of California, San Diego,* MEGAN H. PAPESH and STEPHEN D. GOLDINGER, *Arizona State University,* YOONHEE JANG, *University of California, San Diego,* PETER N. STEINMETZ, *Barrow Neurological Institute*—We investigated whether the mnemonic signal in the human hippocampus exhibits discontinuous threshold properties or continuous signal-detection properties by recording single neuron activity in 4 epilepsy patients undergoing intracranial monitoring to localize the source of their seizures. Each patient completed a recognition memory task in which they first studied 32 words and then completed an old/new recognition test involving 32 targets randomly intermixed with 32 foils. Single-unit firing rates during the interval from 200-1000 ms following the presentation of test items were used in the analysis. Of 120 neurons in the hippocampus, 12 showed a significant effect (F-ratio test, $p<0.05$) of new/old status on firing rate, and 15 showed a significant effect of confidence rating on firing rates. We asked whether the neural ROC (derived from the firing rates of neurons that distinguish between old items and new items) is linear or curvilinear and whether the slope of the corresponding z-ROC is less than 1 (as is typically true of behavioral z-ROC data). The answers to these questions indicate whether the episodic memory signal in the human hippocampus exhibits discrete threshold properties or continuous signal-detection properties.
Email: John Wixted, jwixted@ucsd.edu

9:20-9:35 (265)

Similarities and Differences in the Cognitive Processes and Neural Substrates That Support Working Memory and Long-Term Memory. NATHAN S. ROSE, FERGUS I.M. CRAIK and BRADLEY R. BUCHSBAUM, *University of Toronto*—The extent to which recall on working memory (WM) tasks involves retrieving items from long-term memory (LTM) largely depends on the amount of disruption to active maintenance processes (Rose & Craik, 2012). In this study, participants were to make a deep or shallow judgment on a word and recall the word after a 10 s delay on each trial. During the delay, participants either rehearsed the word or performed an easy or hard math task. Immediate recall was best following rehearsal-filled delays and for deeply processed items, but only when followed by difficult, math-filled delays. In contrast, LTM for items initially recalled following rehearsal-filled delays was worst, and better for deeply processed items regardless of the delay. We repeated the experiment in an fMRI study. Activation was greater for deep than shallow processing in left inferior frontal and anterior temporal cortex and the hippocampus during both encoding and immediate recall, particularly when retrieval occurred following a math- vs. rehearsal-filled delay. Whereas shallow processing and rehearsal-related areas can support active maintenance in WM, deeper processing benefits recall on WM tasks when the conditions invoke the neural substrates that support LTM.
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9:40-9:55 (266)

A Neural Signature of Retrieval Practice Effects in Parietal Cortex. STEVEN M. NELSON, KATHLEEN M. ARNOLD, ADRIAN W. GILMORE, LAURA M. NAJJAR, BRIDGID FINN and KATHLEEN B. MCDERMOTT, *Washington University in St Louis* (read by Kathleen B. McDermott)—A growing body of literature suggests that retrieval practice is beneficial for long-term retention, both by directly enhancing performance on tested information and by facilitating learning from subsequent encounters with the information. Here, functional MRI was used to examine the effects of retrieval practice on later encoding attempts. Subjects initially studied pairs of associated words; each pair was then either 1) tested; 2) restudied; or 3) neither tested nor restudied. All items were then studied once more in expectation of a final test. We asked how this final study event was impacted by prior history (whether the pair had been previously tested, restudied, or neither). A region in the left posterior inferior parietal lobule (pIPL), previously implicated in memory retrieval, reflected prior retrieval practice during final study. In addition, left pIPL activity predicted "new learning" across subjects, indexed by the proportion of items retrieved on a final test that were not

retrieved prior to the final study opportunity. Attempting to retrieve may potentiate subsequent encoding by promoting study-phase retrieval during the later encoding episode.
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Word Recognition
Salon E, Sunday Morning, 8:00-10:00
Chaired by Marlene Behrmann, Carnegie Mellon University

8:00-8:15 (267)
The Joint Development of Hemispheric Lateralization for Words and Faces. MARLENE BEHRMANN, EVA DUNDAS and DAVID C. PLAUT, *Carnegie Mellon University*—Functional imaging studies in adults have demonstrated face and word selectivity in the right and left inferior temporal cortex, respectively. What has not been determined is how this pattern of mature hemispheric specialization emerges developmentally. We measured the hemispheric superiority for faces and words in children, adolescents and adults in a discrimination task with brief stimulus presentation in either hemifield. Whereas adults showed the expected left and right visual field superiority for face and word discrimination, the young adolescents demonstrated only the right field superiority for words and no field superiority for faces. Although the children's overall accuracy was lower than that of the older groups, they exhibited a right visual field superiority for words but no field superiority for faces. The emergence of face lateralization was correlated with reading competence. These findings suggest that the hemispheric organization of face and word recognition do not develop independently, and that word lateralization, which emerges earlier, may drive later face lateralization. A theoretical account in which competition for visual representations unfolds over the course of development is proposed.
Email: Marlene Behrmann, behrmann@cmu.edu

8:20-8:35 (268)
What is the Difference Between Oasis and Opera? Roughly Five Pixels: How Word Structure Determines Word Length. FABIENNE CHETAIL and ALAIN CONTENT, *Université Libre de Bruxelles*—In previous work, we argued that the categorization of letters as consonants and vowels constrains the perceptual structure of letter strings, with each vowel or vowel cluster determining one perceptual unit. Here we examine whether the number of perceived orthographic units influences the appraisal of physical length. Participants had to estimate the length of briefly displayed words by drawing a horizontal line on the screen. Pairs of words matched on the number of letters and syllables were selected, with one word comprising one vowel cluster less than the other (e.g., OASIS: hiatus word, vs. OPERA: control word). Across four experiments, we varied presentation duration, letter spacing, and the type of hiatus words. Hiatus words were consistently estimated about five pixels shorter than control words, even in presentation conditions blocking full stimulus identification. Thus the findings support the view that letter categorization determines perceptual structure at an early stage of processing.
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8:40-8:55 (269)
Semantic Priming and Phonological Ambiguity Interact. LAURIE B. FELDMAN, *University at Albany; Haskins Labs,* DUŠICA FILIPOVIĆ ĐURĐEVIC, *University of Novi Sad*—In Serbian, recognition of words composed of letters that exist in both the Roman and Cyrillic alphabets (some of which have different phonemic interpretations in each) is slower than for the unique alphabet transcription of those same words in the lexical decision task. In this study, we use the effect of phonological ambiguity to explore the time course of semantic facilitation. Targets are either the phonologically ambiguous forms (e.g., PETAK meaning "Friday" when pronounced as a Roman string /petak/ but without meaning when pronounced in Cyrillic as /retak/) or the unique alphabet transcription of the same word (ПЕТАК). To maximize the effect of alphabet ambiguity, primes are alphabetically mismatched but vary on semantic similarity to the target. We compare semantic facilitation for the phonologically ambiguous than for the unique alphabets transcription of the same target and discuss its implications.
Email: Laurie B. Feldman, lfeldman@albany.edu

9:00-9:15 (270)
How Many Words Can We Read At Once? More on the Intervenor Effect in Masked Priming. KENNETH FORSTER, *University of Arizona*—Cross-language masked translation priming is obtained with a 50 ms prime-target SOA, but it is generally thought that at least 150 ms is needed to retrieve meaning. This suggests that the prime continues to be accessed after the target has been presented. So we must be able to access two words at once. But what happens if an unrelated masked word intervenes between the prime and the target? That would involve accessing three words at once. However, although identity priming survives in a reduced form, form priming is eliminated altogether, suggesting that the capacity of the lexical system has been exceeded. New experiments show that priming is unaffected if the intervenor is a word in an unfamiliar script (Hebrew), suggesting that it is the attempt to access the intervenor that disrupts priming. This predicts that a nonword intervenor should disrupt priming just like a word intervenor. This prediction is confirmed.
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9:20-9:35 (271)
Separating Lexical and Non-Lexical Effects in Visual Word Recognition Development. SASCHA SCHROEDER, *Max Planck Institute for Human Development*—In this study, 100 10-year-old children and 20 adults performed the naming and the lexical decision task using the same items. Participant's response behavior was decomposed by means of hierarchical diffusion (lexical decision) and shifted Wald modeling (naming). In both tasks, children responded more slowly than adults but their response accuracy was not impaired. Cognitive model analyses revealed that children's speed deficits in the two tasks were caused by different cognitive processes. In naming, children's speed deficit was exclusively driven by their less efficient orthographic processing. In lexical decision, in contrast, children performed more slowly because they responded more cautiously and needed more

time for stimulus encoding and response execution beyond orthographic processing. Results underline the need to use cognitive models in order to disentangle task-specific and lexical effects from real developmental differences in visual word recognition.
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9:40-9:55 (272)

Implicit Lexical Decisions During Reading. WONIL CHOI and PETER C. GORDON, *University of North Carolina at Chapel Hill* (read by Peter C. Gordon)—Words that are easy to recognize due to factors such as frequency, repetition or predictability, are more likely to be skipped over by the eyes during first-pass reading. In two series of experiments we examine whether this lexical effect on eye movement control depends on recognizing the letter string in parafoveal preview as a word while the immediately preceding word is fixated. Skipping rates increased as a function of word frequency and repetition when valid information about the word was present in the parafovea but not when the word was presented as a highly-similar transposed letter (TL) nonword, even though such TL nonwords produce substantial lexical priming in a variety of tasks. The same pattern was found for preview of pseudohomophone nonwords that contained no illegal letter clusters. These findings support the idea that coordination between word-recognition and oculomotor processes occurs at the level of implicit lexical decisions.
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Language Processing
Salon G, Sunday Morning, 8:00-9:40
Chaired by Adrian Staub, University of Massachusetts, Amherst

8:00-8:15 (273)

Predicting the Next Word: Data and Model From a Speeded Cloze Task. ADRIAN STAUB and MARGARET GRANT, *University of Massachusetts, Amherst,* LORI ASTHEIMER, *York University,* ANDREW COHEN, *University of Massachusetts, Amherst*—The present study investigated the nature of lexical prediction via a speeded version of the cloze task. Subjects (N = 33) read sentences in RSVP format, and at some point in the sentence were prompted to speak the next word within 3 seconds. Each subject completed 380 critical trials. Responses were highly consistent with previous paper-and-pencil cloze norming for these items. The critical findings were that RT decreased linearly with (a) the probability of the subject's response, and (b) the item's level of constraint. These two effects were both highly significant in mixed-effects models, and were additive; higher item constraint resulted in reduced RT at each level of response probability. A simple counter model of lexical selection is shown to produce these patterns. Lexical items race toward a response criterion, with variation in the probability of moving toward criterion at each time step. Across a wide range of parameter settings, RTs are faster when a response has higher probability, and when the item is more constraining; as in the data, these effects are additive. Based on the data and model, we suggest that cloze responses may reflect a relatively automatic processes of lexical activation.
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8:20-8:35 (274)

Learning New Words: Evidence of Lexicalisation using masked form priming. SAMANTHA F. MCCORMICK and KATHY RASTLE, *Royal Holloway University of London*—People acquire most of their vocabulary during childhood, but continue to learn new words throughout their lives. This study examined the acquisition of orthographic representations crucial for skilled reading by observing the processes through which adults learn new words in laboratory conditions. Participants learned novel words that were orthographic neighbours of existing words (beshop, a neighbour of BISHOP) in a two-hour training session. These recently acquired words were then used as related primes in a masked priming study (e.g., beshop-BISHOP) conducted immediately after training or following a one week interval. Results showed that trained words inhibited recognition of their base words, but only when testing was conducted one week after training. Trained words facilitated recognition of their base words when testing was conducted immediately after training. The results support the notion that words acquired in adulthood can become integrated with existing lexical entries but that this requires offline memory consolidation.
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8:40-8:55 (275)

Masked Affix Priming and the Visual Identification of Complex Words. DAVIDE CREPALDI, *University of Milano Bicocca,* KATHLEEN RASTLE and COLIN J. DAVIS, *Royal Holloway University of London*—Previous studies on masked affix priming have obtained mixed results. While Duñabeitia et al. (2008) and Dominguez et al. (2010) were able to show genuine morphological effects between Spanish words sharing a suffix or a prefix, respectively, Chateau et al. (2002) failed to report prefix priming with English words. This study investigates suffix priming effects in a masked priming paradigm where nonword primes and word targets sharing a suffix (towerful-FATIHFUL) were contrasted with both morphological (towerism-FATIHFUL) and non-morphological (towerpak-FATIHFUL) unrelated controls. Three conditions with monomorphemic targets were also set up so as to control for pure orthographic effects (muskach-SPINACH vs. muskful-SPINACH vs. muskesp-SPINACH). Compared to the monomorphemic conditions, related complex primes yielded shorter response times than both morphological and non-morphological controls. These results show that affixes determine facilitation in masked priming similar to what stems do, thus favoring theories that suggest the two types of representation to be similar.
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9:00-9:15 (276)

Naming Acronyms: What's the Difference Between an EEG and an EGG? CRISTINA IZURA and DAVID R. PLAYFOOT, *Swansea University* (Sponsored by Jo Saunders)—Acronyms are a growing and an idiosyncratic part of our everyday vocabulary. In this study acronym naming and recognition times were examined with reference to the variables known to affect the processing of common words. The factors under consideration were age of acquisition, acronym frequency, imageability, acronym length, number of orthographic neighbours, bigram and trigram frequencies, voicing and print-to-sound characteristics. The factors were entered into a multilevel regression analysis. Results indicate that acronym naming is affected by lexical and sublexical variables. The overwhelming influence of orthographic measures in acronym naming as opposed to standard word naming (i.e., effects of bigram and trigram frequencies are difficult to detect in standard word naming studies) indicates that a crucial difference between acronyms and mainstream words might reside at a pure orthographic level. The challenges that acronym naming imposes in current models of word reading will be discussed.
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9:20-9:35 (277)

Speech Perception Difficulties for Dyslexic Readers. LEAH FOSTICK, ORTAL KORECKY and DANIELLA MALTZ, *Ariel University Center,* HARVEY BABKOFF, *Bar-Ilan University*—Dyslexic readers exhibit difficulties in acquiring reading skills. One of the leading theories for dyslexia suggests that a deficit in auditory temporal processing (ATP) is the cause for dyslexia. A very similar theory explains difficulties in speech perception among aging adults. In the current study we aimed to examine whether difficulties in speech perception, caused by a deficit in ATP in aging adults, are also evident among dyslexic readers, who show a similar ATP deficit. As compared with 20 normal reader students, 20 dyslexic reader students had longer TOJ thresholds and lower scores on reading and phonological awareness tasks, and on speech perception of regular and non-words in SNR 0 and -5. Although to date dyslexia is not defined with speech perception difficulties, the findings of the current study suggest that dyslexic readers suffer from difficulties in speech perception that are to be checked and be treated.
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False Memory and Eyewitness Identification
Salon C, Sunday Morning, 8:00-9:40
Chaired by Georgina Anne Tolan, University of Southern Queensland

8:00-8:15 (278)

False Recall in Short-Term Memory for Young and Normal Aging Samples. GEORGINA A. TOLAN and JACLYNN ROCHE, *Australian Catholic University,* GERALD TEHAN, *University of Southern Queensland*—This study explored false recall in short-term memory (STM). False recall has traditionally been examined within a long-term memory framework using the Deese-Roediger and McDermott (DRM) paradigm. The DRM paradigm used free recall tasks with long lists of words. Further, there has been little attention paid to the impact of using both semantic and phonemic codes to elicit false recall. Thus, it is prudent to examine false recall within a STM framework using varying combinations of semantic and phonemic codes to determine its impact on false recall. Further, age effects within these conditions are also of interest. The results revealed that there was no significant difference in levels of false recall between young and normal aging samples. However, the hybrid lists that use both semantic and phonological codes boasted significantly higher levels of false recall than when these codes were used in pure lists.
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8:20-8:35 (279)

Is Post-Access Monitoring Sufficient for Output Control in Memory? REED HUNT, *University of Texas at San Antonio*—In most theories of false memory, output control is accomplished through post-access monitoring, but research exists questioning the sufficiency of monitoring. Two experiments will be reported extending the previous work to a criterial recollection test of recognition. Subjects saw two categorized lists. Half of the items in the second list also appeared in the first list. Orienting tasks (OT) were performed on the lists, either the same or a different task on each list. The test required discrimination of second list items from first list and novel distracters. Manipulations at test included conditions previously shown to reduce or eliminate monitoring. Under standard test conditions, performing different OTs on the two lists reduced both types of false alarms. Although the evidence indicated that some of that reduction was due to monitoring, the OT effect persisted under conditions designed to eliminate monitoring, showing that monitoring alone is not sufficient to explain the results.
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8:40-8:55 (280)

Aging and Reduced Suggestibility: The Role of Prior Knowledge. SHARDA UMANATH and ELIZABETH J. MARSH, *Duke University* (read by Elizabeth J. Marsh)—Prior knowledge is an important factor in understanding older adults' memory performance, even on tasks that tap aspects of memory that decline with age, such as episodic memory. Critically, we found that prior knowledge can serve a protective function, with less suggestibility in older than younger adults when misinformation contradicts general knowledge (e.g., older adults are less likely to later claim that the Atlantic is the largest ocean after reading that error). Such findings are surprising, given that older adults are more suggestible in most false memory paradigms. When our participants explicitly marked errors during encoding, older adults were no better than younger adults at detecting relatively blatant contradictions (a form of knowledge neglect, or an inability to apply relevant stored knowledge). Instead, older adults' reduced suggestibility was linked to overcoming knowledge neglect: compared to younger adults, they were better able to later recover and retrieve their stored knowledge.
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9:00-9:15 (281)

Receiver Operating Characteristic Analysis in the Assessment of Lineup-Based Eyewitness Memory. LAURA MICKES, *University of California, San Diego,* HEATHER D. FLOWE, *University of Leicester,* JOHN T. WIXTED, *University of California, San Diego*—A police lineup presents a real-world signal-detection problem because there are two possible states of the world (the suspect is either innocent or guilty), some degree of information about the true state of the world is available (the eyewitness has some degree of memory for the perpetrator), and a decision is made (identifying the suspect or not). Receiver Operating Characteristic (ROC) analysis is the appropriate way to measure the diagnostic accuracy of a lineup procedure, but it has never been used for that purpose. Instead, the diagnostic performance of different lineup procedures, such as simultaneous vs. sequential presentation, has been compared using methods that provide no relevant information (e.g., by comparing their diagnosticity ratios). We report three experiments that were designed to investigate the diagnostic accuracy of simultaneous vs. sequential lineups using ROC analysis. Our results suggest that the sequential procedure is inferior to the simultaneous procedure in discriminating between the presence or absence of a guilty suspect in a lineup, which means that for any given hit rate, the simultaneous procedure can achieve a lower false alarm rate than the sequential procedure.
Email: Laura Mickes, lmickes@ucsd.edu

9:20-9:35 (282)

Evolution and Decline Effects in Eyewitness Identification Reforms. STEVEN E. CLARK and MOLLY B. MORELAND, *University of California, Riverside,* SCOTT D. GRONLUND, *The University of Oklahoma*—Recently, scientists in many disciplines have begun to raise questions about the evolution of research findings over time (Ioannidis, 2008; Jennions & Moller, 2002; Mullen et al., 2001; Schooler, 2011), as many phenomena exhibit decline effects, i.e., reductions in the magnitude of effect sizes as empirical evidence accumulates over time. The present research employs cumulative meta-analytic techniques to examine the evolution of empirical effects in the area of eyewitness identification reforms. The results of these analyses show that some effects (including the sequential lineup superiority effect) that were initially shown to be quite large, have shrunk, disappeared, or reversed, with the accumulation of experimental evidence. Importantly, these large effects have been shrinking even as many state governments and local law enforcement jurisdictions have been adopting the new procedures that were supported by the initial results. Implications for psychological science and public policy are discussed.
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Explicit Memory IV
Salon D, Sunday Morning, 10:20-12:00
Chaired by Jeffrey Rouder, University of Missouri

10:20-10:35 (283)

Evidence for Discrete-State Processing in Recognition Memory and Word Identification. JEFFREY N. ROUDER, JORDAN M. PROVINCE and APRIL R. SWAGMAN, *University of Missouri*—We provide evidence that recognition memory is mediated by a detect-or-guess mental state model without recourse to concepts of latent strength or multiple memory systems. We assess performance in a two-alternative-forced-choice (2AFC) recognition memory task with confidence ratings. The key manipulation is that sometimes participants are asked which of two new items is old, and the resulting confidence distribution is unambiguously interpreted as arising from a guessing state. The confidence ratings for other conditions are seemingly the resultant of mixing this stable guessing state with an additional stable detect state. Formal model comparison supports this observation, and an analysis of associated response times reveals a mixture signature as well. The same mixture property holds for the perceptual identification of words as well.
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10:40-10:55 (284)

New Data Supporting Dual-Process Account of Recall Using Remember-Know Judgments. TALYA SADEH, RANI MORAN and YONATAN GOSHEN-GOTTSTEIN, *Tel-Aviv University* (read by Yonatan Goshen-Gottstein)—Though not as dominant as in the recognition literature, the idea that recall involves two processes has been gaining popularity in recent years. Specifically, Fuzzy Trace Theory (FTT; e.g., Brainerd, et al., 2012) suggests that recall consists of a recollective, contextual process (verbatim traces) and a retrieval process that is less dependent on context (gist). Participants in our study made remember-know judgments, presumably mapping the recollective and gist processes. Consistent with FFT, R-retrievals appeared earlier in the output sequence and errors appeared later in the output sequence. In addition, we found more errors following correct R retrieval than correct K retrievals. Finally, conditional-responses probabilities revealed stronger lag-recency effects for transitins following R retrievals than K retrievals.
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11:00-11:15 (285)

No Threshold Recollection Required: Decision Biases Underlie the Effect of Strength on Source Memory zROC slopes. JEFFREY J. STARNS, ANGELA M. PAZZAGLIA and CAREN M. ROTELLO, *University of Massachusetts, Amherst,* MICHAEL J. HAUTUS, *The University of Auckland,* NEIL A. MACMILLAN, *University of Massachusetts, Amherst*—Source memory zROC functions show dramatic changes in slope when sources are unequal in strength. For example, a zROC formed from Source 1 items studied 5 times (strong) and Source 2 items studied once (weak) has a different slope than a zROC with weak Source 1 items and strong Source 2 items. Yonelinas and Parks (2007) note that this result is consistent with a dual-process model of source decisions, because the threshold recollection process "pushes up" the zROC points on the end of the function associated with the strong source. The slope difference is also predicted by a continuous signal-detection model if one assumes that the source confidence criteria converge with increasing item strength (Hautus, Macmillan, & Rotello, 2008). In psychological terms,

participants are more willing to indicate high confidence in their source decision when they are more certain that the item was studied. Unlike the recollection account, the converging criteria account predicts that participants will make more high confidence source judgments for lure items when they are more confident that the item was studied. Data strongly confirmed this prediction, supporting the converging criteria account over the threshold recollection account.
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11:20-11:35 (286)

Blending Generative and Discriminative Models: A Bayesian Framework for Prediction and Classification. MARK STEYVERS and BRANDON M. TURNER, *University of California, Irvine*—The goal of many cognitive models in psychology is to provide explanations of the structure of the data. In some situations, the goal of cognitive modeling might extend to prediction and classification (e.g., classify individuals according to disease pattern). However, cognitive models that provide good explanations are not necessarily good classification models. In many cases, purely discriminative models that lack any explanatory power outperform generative models. We develop a hybrid modeling approach in the framework of Bayesian graphical models that blends discriminative and generative models. We show that the hybrid modeling approach is useful for converting generative models (e.g., the Linear Ballistic Accumulator model; Signal Detection Theory) into prediction and classification tools while retaining the explanatory power of the original cognitive model.
Email: Mark Steyvers, msteyver@uci.edu

11:40-11:55 (287)

The Negative Repetition Effect in Recall. NEIL MULLIGAN, *University of North Carolina,* DANIEL PETERSON, *Knox College*—There is perhaps no more basic phenomenon in human memory than the repetition effect: greater long-term memory for repeated stimuli. We present an interesting violation of this pattern in which a twice-presented stimulus produces worse free recall than a once-presented stimulus (Peterson & Mulligan, in press). The stimuli were a set of rhyming word pairs (e.g., Moon – Spoon) in which the second word from each pair came from one of a small set of categories (e.g., Utensils). One group was initially presented with the word pairs in a random order, and then a second time in which the word pairs were blocked by the category of the second word. Another group was presented only with the second ordering of the word pairs. Participants then recalled the second word from each pair, and the group given a single exposure to the word pairs recalled more items. This negative repetition effect was examined in several experiments from the perspective of the item-specific—relational framework. The effect generalizes over multiple encoding conditions, and occurs for free recall as well as cued recall. Alternative explanations of the effect (a retrieval account and a levels-of-processing account) were evaluated and rejected.
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Psycholinguistics II

Marquette II, Sunday Morning, 10:20-12:00

Chaired by Ken McRae, University of Western Ontario

10:20-10:35 (288)

The Importance of Real World Situations for Understanding Abstract Concepts. LISA KING and KEN MCRAE, *University of Western Ontario* (read by Ken McRae)—A recent view emphasizes the importance of real world situations for learning, representing, and processing abstract concepts. Although context availability theory highlights the contexts in which abstract words appear, studies have not used situations, but instead showed facilitation for highly predictable abstract words. Experiment 1 tested the novel, central prediction that abstract concepts are facilitated by situation descriptions. Participants heard three-sentence situations, and then made a lexical decision to an abstract concept. Significant priming obtained. Experiment 2 compared items for which the abstract concept captures the essence of the entire situation versus those that imply an internal state of "you" in the scenario. Significant priming obtained for abstract concepts that integrate the situation, but not for internal states. Thus, situations are central for the representation and processing of abstract concepts, and the distinction between abstract concepts denoting internal states and those that integrate situations as a whole is important.
Email: Ken McRae, mcrae@uwo.ca

10:40-10:55 (289)

Task Effects in Online Sentence Comprehension. DAVID CAPLAN, *Massachusetts General Hospital*, WILL EVANS, *Sargent College, Boston University*—Thirty-six participants performed a plausibility judgment task for written object- and subject-extracted relative clause sentences that varied in the semantic constraint of NPs in the RC. First pass and go-pass reading times were shorter in the subject than the object relative clause region. There were more regressions from the final noun phrase to earlier regions in the semantically constrained sentences. Accuracy was lower and total reading time for final noun phrase region longer in object-extracted constrained compared to object-extracted unconstrained sentences. The results differ from Traxler et al. (2002), where more regressions were found from the main verb in unconstrained sentences. The differences are attributable to the different demands of plausibility judgment and verification, and point to a hitherto underemphasized role for intentional context in affecting on-line sentence comprehension. The results will be related to theories of bounded optimality (Bratman et al, 2011; Howes et al, 2009) and good enough comprehension (Ferreira and Patson, 2007).
Email: David Caplan, dcaplan@partners.org

11:00-11:15 (290)

Propose but Verify: Fast Mapping Meets Cross-Situational Word Learning. JOHN C. TRUESWELL, TAMARA NICOL MEDINA, ALON HAFRI and LILA R. GLEITMAN, *University of Pennsylvania*—Here we examine the learning procedure used by adults as they pair novel words and visually presented referents over a sequence of referentially ambiguous trials.

Successful learning under such conditions has been argued to be the product of a learning procedure in which participants pair each novel word with several possible referents and use a statistical-associative learning mechanism to gradually converge on a single mapping across learning instances. Yet, such conclusions require an examination of how learning unfolds across learning instances, something seldom done in past studies. In three experiments, both explicit (referent selection) and implicit (eye-movement) measures reveal that even under simple referential conditions, participants do not retain multiple meaning hypotheses across learning instances. The findings indicate that a single hypothesized word-referent pairing is retained for each word, abandoned only if the subsequent instance fails to confirm the pairing – more a 'fast mapping' procedure than a gradual statistical one.
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11:20-11:35 (291)

The Impact of Neighbour Acquisition on Phonological Retrieval. NICOLAS DUMAY, *Basque Center for Cognition, Brain and Language,* MARKUS F. DAMIAN and JEFFREY S. BOWERS, *University of Bristol*—This research asked whether single word production entails coactivation of 'phonological neighbours.' Production of English hermit words ('carousel') was examined at various time points after teaching participants fictitious cohort or rhyme neighbours ('carousem,' 'barousel'). A pause detection task demonstrated engagement of the new cohort neighbour during recognition of the base word after a week and only after a recognition test had reactivated the consolidated, but possibly sleepy neighbour. Crucially, at the same time point, picture naming showed facilitation from the rhyme, but only a weak trend in the same direction from the cohort neighbour. Findings seem best explained by an interactive architecture, with feedback from the segmental to the lexical level enabling phonological neighbours to support encoding of the segments shared with the target. However, the reduced facilitation from cohort neighbours indicates that when mismatching segments are yet to come, the target's new best friend quickly becomes its worst enemy.
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11:40-11:55 (292)

Bayesian Language: Uncertainty and Inference in Natural Language. NOAH D. GOODMAN, *Stanford University*—How does language convey meaning? A traditional approach to semantics suggests that the literal meanings of words are truth-functions used to rule out possible worlds; the corresponding approach to pragmatics invokes a logical process of strengthening meanings by negating alternatives. While such approaches account for many aspects of language, they have difficulty accounting for graded effects in meaning and comprehension. We suggest probabilistic modeling techniques that extend semantics to include uncertainty and give an inferential account of pragmatics. This allows us to account for vagueness and ambiguity in lexical meanings and to understand how the inferential process of language understanding makes use of this uncertainty to convey meaning. We first consider situated reference games, showing that our modeling approach can account for quantitative effects of context on interpretation. We next apply the model to standard scalar implicatures and their interaction with epistemic states. We finally explore the effects of lexical uncertainty, focusing on hyperbole: we explain why "this abstract is a million characters long" expresses a strong opinion but little information about actual length.
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Perceptual Processes

Marquette VIII, Sunday Morning, 10:20-12:00

Chaired by Bruce Bridgeman, University of California, Santa Cruz

10:20-10:35 (293)

Illusions and Awareness: Unchecked Illusions are Accepted as Fact. BRUCE BRIDGEMAN, *University of California, Santa Cruz*—Illusions are recognized to be deceptive only after the observer is caught, for instance by confronting the perception in the Müller-Lyer illusion with a ruler. Without a ruler, the illusion is accepted as reality. An example of this occurs in perception of the slopes of hills. Observers greatly overestimate the slopes, and we have found that they overestimate more for longer segments than for shorter segments of the same hill. The overestimates are greater for a verbal measure than for a motor-matching measure. Since there is little illusion for the portion of the slope right under the observer's feet, we had people walk up and down a slope before measuring their perceived slope. Walking had absolutely no effect. The observer accepts the illusion as fact, unaware of a discrepancy between the world and the perception. Free will may be be a similar illusion, except that there is no ruler and no inclinometer.
Email: Bruce Bridgeman, bruceb@ucsc.edu

10:40-10:55 (294)

How Good Gestalt Explains Low-Level Vision. MICHAEL H. HERZOG, *Ecole Polytechnique Federale de Lausanne* (Sponsored by Greg Francis)—Classically, low-level vision is explained by low level neural mechanisms. For example, perception of a target deteriorates when flanked by nearby elements. Low-level explanations propose that the responses from neurons, coding for basic features of the target and flankers, are pooled and, thus, the signal to noise ratio deteriorates. Here, we show that the deleterious effects of the flankers can completely vanish when the flankers become part of a good Gestalt. For example, performance deteriorated when a vernier was flanked by two lines (crowding). When the two lines became part of a square, performance strongly improved. Low-level interactions cannot explain this effect because the flanking lines were part of the squares. It seems that good Gestalt determines crowding. Very similar results were also found for visual masking, feature integration, and many more low level visual paradigms. I will discuss how good Gestalts determine low level processing by recurrent, dynamic computations, mapping the physical to perceptual space.
Email: Michael Herzog, michael.herzog@epfl.ch

11:00-11:15 (295)

Dissociating Visual Crowding From Averaging in Size Discrimination. MELANIE PALOMARES, *University of South Carolina*—We evaluated the proposition that crowding of a target occurs due to compulsory averaging of the target with its neighbors. We presented three squares in the periphery and asked observers to perform a crowding and an averaging task on size information. In the crowding task, observers identified the size of the central target square in between the two flankers, which varied in distance or contrast. In the statistical averaging task, observers identified the average size of all squares. Results show that accuracy for identifying the target improves with increasing inter-element distance in the crowding task, but accuracy for identifying the average size was unaffected by distance. Interestingly, we found no effect of flanker contrast for either task. These results suggest that explicit statistical averaging of size does not share distance-dependent mechanisms that mediate visual crowding, but that "implicit" averaging contributes to the loss of identification accuracy in visual crowding.
Email: Melanie Palomares, mcp@ski.org

11:20-11:35 (296)

Dynamics of Multi-Sensory Integration. JUAN (JOANNE) GAO and JAMES L. MCCLELLAND, *Stanford University*—Researchers have studied the time course of gradual evidence accumulation in perceptual decision making with unimodal stimuli, and some studies suggest that humans, given enough time, can optimally integrate stimuli across sensory modalities. However, little is known about the dynamics of multi-sensory integration. Do subjects accumulate noisy information from multimodal sources simultaneously (independent parallel processing) or do they work on one channel at a time and switch to another channel when no additional information can be gained from the current channel (serial or resource-limited parallel processing)? We attempt to answer these questions in a localization task in which participants must respond immediately following a go cue that can occur 75-2000 msec after stimulus onset. We found that only some participants can optimally combine information from the two modalities, and for those, stimulus sensitivity in the bimodal condition asymptotes slower than in the unimodal condition, suggesting serial or parallel-resource-limited processing.
Email: Juan (Joanne) Gao, juangao@stanford.edu

11:40-11:55 (297)

Searching for Invisible Objects in Visible Scenes. MELISSA L. VO and JEREMY M. WOLFE, *Harvard Medical School*—Search for an object in a scene is guided by object features, scene layout, and scene semantics (e.g., pots are found on stoves). We separated the roles of object and scene guidance by asking observers to search for visible and invisible objects in scenes. Of course, invisible objects have no object features. Observers were told to fixate a candidate target locations and press a button while we tracked eye movements. Some invisible objects (e.g., faucets) could be fixated in one or two tries because scene guidance was powerful (faucets are near sinks). Others were much easier to find when visible, requiring feature guidance (e.g., corkscrews can be on any surface). In an unannounced second block, the same scenes were searched again, with all targets invisible. We found search benefits for previously invisible objects indicating that observers had stored object locations even for targets that had been invisible.
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Attentional Control

Salon E, Sunday Morning, 10:20-12:00

Chaired by Andrew Leber, The Ohio State University

10:20-10:35 (298)

Flexibly Attending One Location While Suppressing Another. ANDREW B. LEBER, *The Ohio State University,* RYAN J. O'TOOLE, *The University of New Hampshire*—Attention research has provided clear evidence that observers 1) can simultaneously enhance multiple noncontiguous regions of space, and 2) can suppress single regions of space. What remains unknown is whether multiple attentional foci can be simultaneously used in opposite ways: one that enhances and another that suppresses. One roadblock to investigating this question is an onerous experimental task ("enhance" and "suppress" cues are difficult to process simultaneously). We describe a learning procedure that circumvents this roadblock. Observers searched displays in which one location contained a target, while another contained a salient distractor. An arrow cue pointed to the target location with 70% validity; this encouraged observers to implement endogenous enhancement of one location. Also, unbeknownst to observers, the same arrow cue validly predicted the distractor location. Results showed facilitated RTs to the predicted target location, confirming enhancement. Critically, distractor interference was reduced at the predicted distractor location, revealing that incidental learning allowed observers to use suppression. These results demonstrate flexible and simultaneous use of enhancement and suppression.
Email: Andrew Leber, aleber@gmail.com

10:40-10:55 (299)

Can Self-Schemas Serve as Top-Down Attentional Control Settings? CHARLES L. FOLK and DEBORAH KENDZIERSKI, *Villanova University,* BRAD WYBLE, *The Pennsylvania State University*—Models of attention allocation typically assume that top-down "set" is limited to simple feature properties such as color, orientation, etc. Recent evidence, however, suggests that the attention allocation system can be set for more complex properties such as superordinate categories (Wyble, Folk & Potter, 2011). Here we explore whether schemas associated with the "self" can also serve as attentional control settings that bias attention to schema-consistent images. Participants defined as exercise schematic or aschematic viewed RSVP streams of landscape/architectural images and reported the direction of a single oriented target image. Distractor images related to exercise (e.g., jogging, swimming) produced a significant drop in accuracy when presented two frames prior to the target (relative to trials containing no distractors or non-exercise control images). However, this effect was found for both

schematics and aschematics, suggesting that the activation of a schema can bias attention towards schema-consistent images regardless of relation to self-schema.
Email: Charles Folk, charles.folk@villanova.edu

11:00-11:15 (300)

Symbolic Control of Spatial Attention: Knowing Direction is Better Than Knowing Distance. BRADLEY S. GIBSON, *University of Notre Dame,* KIRSTEN C.S. ADAM, *University of Oregon,* GREGORY J. DAVIS, *University of Notre Dame*—The symbolic control of spatial attention is thought to rely on a spatial frame of reference in which separate spatial parameters for direction and distance can be specified. For instance, spatial symbols typically convey information about direction (e.g., "above") or distance (e.g., "near"), but not both. However, very little is known about the relative efficacy of direction and distance cues because: (1) direction cues have been used exclusively in previous studies; and (2) the uncued spatial parameter has always remained fixed, thus providing extra-symbolic information about distance. In order to address these issues, direction and distance cues were shown in separate blocks in which the uncued spatial parameter was either random or fixed. The main results showed that direction cues controlled attention more effectively than distance cues, regardless of whether the other spatial parameter was random or fixed, thereby demonstrating the superiority of directional information.
Email: Bradley Gibson, bgibson@nd.edu

11:20-11:35 (301)

Effects of Action Video Gaming on Perceptual and Cognitive Control Parameters in the Context of TVA. TORSTEN SCHUBERT, *Humboldt University Berlin,* PETRA REDEL, VERONIKA EDER and KATHRIN FINKE, *Ludwig-Maximilians-University Munich,* TILO STROBACH, *Humboldt University Berlin* (Sponsored by Peter Frensch)—Previous research has found that playing action video games can improve numerous cognitive functions, for instance, temporal resolution of vision and attentional resources. To date, however, it has not been possible to determine which basic cognitive aspects of perceptual and attentional processing are enhanced by playing action games. The present study employs whole and partial report based on the Theory of Visual Attention (TVA) which allow a separate investigation of parameters of these aspects: visual perceptual threshold, perceptual processing speed, top-down control, and visual working memory store capacity. Comparing subjects who trained on an action game for 15 hours to controls showed that visual perceptual processing speed seems to be the major factor that can be improved by playing action games. These findings may provide an explanation for the previous findings of increased attentional resources and optimizations in other cognitive functions as a result of game training.
Email: Tilo Strobach, tilo.strobach@hu-berlin.de

11:40-11:55 (302)

Task Nature and Cognitive Engagement Affect the Return of Intrusive Thoughts. IRA E. HYMAN, HOLLYANN M. DUSKIN, JOSEPH A. PEARSON and KAYLEIGH I. CUTSHAW, *Western Washington University*—We explored intrusive thoughts and mind wandering through the phenomenon of having a song stuck in one's head. In a series of experiments, we looked at how both task nature and cognitive engagement influence the return of intrusive songs. Participants listened to songs then worked on a cognitive task that was either easy or challenging. Intrusive songs were more likely to return during challenging than easy Sudoku and anagram puzzles. Overall, participants were less likely to have a song return during the anagram puzzles than the Sudoku puzzles due to the verbal nature of anagrams. If the individual had the song return during the experiment, then the song was also likely to return over the ensuing 24 hours. When an intrusive thought gets started in someone's head, that thought is likely to return repeatedly.
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Action and Perception III

Salon G, Sunday Morning, 10:00-12:00

Chaired by Michiel van Elk, Ecole Polytechnique Federale de Lausanne

10:00-10:15 (303)

Who's Walking Down the Street? Inferring Agency From Footstep Sounds During Walking is Reflected in a Modulation of the Auditory Evoked Potential. MICHIEL VAN ELK, OLIVER KANNAPE and OLAF BLANKE, *Ecole Polytechnique Federale de Lausanne*—Agency is a central aspect of bodily self-consciousness and allows us to distinguish our own from others' movements. An important functional mechanism underlying our feeling of agency is the use of a forward model that allows us to predict the sensory consequences of our own actions. Whereas many agency studies have focused on goal-directed upper-limb movements, less is known about the feeling of agency over automated movements that involve the whole body, like walking. In the present study participants' EEG was recorded while they were walking and the sound of their footsteps was presented either online or with a delay. Increased temporal delays resulted in a decrease of the feeling of agency and an increase in the auditory evoked potential in relation to the footstep sounds. These findings suggest that similar functional and neural mechanisms may underlie the feeling of agency for full body movements as those identified for upper-limb movements.
Email: Michiel van Elk, michielvanelk@gmail.com

10:20-10:35 (304)

Angry Stimuli and Response Effects, Both Superior and Inferior. DEAN G. PURCELL, *Oakland University,* ALAN L. STEWART, *Stevens Institute of Technology*—The Anger-Inferiority Effect (AIE) occurs when responses to angry stimuli are slower than to happy stimuli. The Anger-Superiority Effect (ASE) occurs when responses to angry stimuli appear to be faster than to happy stimuli. The AIE is found when stimuli are judged one at a time. The ASE is found when schematic angry and happy target faces are searched for within an array of neutral schematic faces. We determined that the AIE results from an increase in reaction time to angry stimuli. This supports the hypothesis that angry stimuli interfere with responding. We found that the ASE was produced indirectly, by delaying the response to a happy schematic face, not by

direct effects of the angry face. With the AIE an angry stimulus plays a major role. With the ASE the happy face plays a major role by self-limiting its own detectability.
Email: Dean Purcell, purcell@oakland.edu

10:40-10:55 (305)

Social Attention is Not Restricted to the Eyes: Pointing also Automatically Orients Direction of Attention. BENNETT I. BERTENTHAL, *Indiana University,* TY W. BOYER, *Georgia Southern University,* JI MIN HAN, *Indiana University*—Considerable evidence reveals that observers automatically follow the direction of another's gaze, which some attribute to a dedicated eye processor. Alternatively, this response could reflect a more general process for socially relevant directional information. We conducted three experiments testing whether finger pointing can automatically orient spatial attention in a manner similar to eye gaze. A 2AFC response time paradigm tested localization of a peripheral target following the appearance of a central pointing hand or arrow with an SOA of 100 or 600 ms. The stimulus cue was counterpredictive of the target location on 75% of the trials. The results from three experiments measuring response times, eye movements, or heart rate variability converged to show that participants oriented automatically to the direction of the pointing finger and the arrow at 100 ms SOA, but more subtle differences in responding suggested that pointing, like eye gaze, is specialized for orienting attention.
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11:00-11:15 (306)

Perceived Distance is Influenced by Memory and Social Factors. DAVID VINSON and J. SCOTT JORDAN, *Illinois State University* (read by J. Scott Jordan)—It has been known for some time that the perceived distance to an object is greater if one wears a backpack while estimating the distance (Proffitt, 2006). The present experiments examined whether this effect can be modulated by memory and social factors. In Experiment 1, if participants made distance estimates while carrying a weighted backpack in phase 1, and then made distance estimates while not wearing a weighted backpack in phase 2, we replicated Proffitt's (2006) backpack effect. In Experiment 2 however, we reversed this effect (i.e., distance estimates were greater in the phase 2, no backpack condition) if, during phase 2, participants made distance estimates while following an experimenter who was carrying a weighted backpack. Experiments 3 through 5 revealed this reversal requires phase-1 experience carrying the backpack, and phase-2 exposure to another carrying a weighted backpack. These memory and social influences are consistent with an action planning account.
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11:20-11:35 (307)

Magnification Modifies the Utility of Depth Cues. BING WU, *Arizona State University,* ROBERTA L. KLATZKY and JOHN GALEOTTI, *Carnegie Mellon University* (read by Roberta L. Klatzky)—Stereo microscopy affords the possibility of disparity cues to the two eyes, but how effective is stereo vision under magnification? Subjects viewed targets with the naked eye or a stereoscopic microscope; the independent variables were magnification power (1.0x, 3.5x, and 5.0x) and viewing condition (monocular vs. binocular). Experiment 1 assessed the consequences of magnification for the accuracy of relative depth judgments using a matching task. Under binocular viewing, matching error was found to increase with magnification and to be lowest with the naked eye. In contrast, performance improved with magnification under monocular viewing. In Experiment 2, where performance in a reaching task was tracked and analyzed, similar patterns were observed for action responses. The results suggest that changes in depth cues induced by magnification, particularly decreased effective range of distance and increased demands on accommodation, result in differential cue utilization. (Supported by an ASU SSE grant to BW & an NIH grant (R01EY021641) to RK & JG)
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11:40-11:55 (308)

Hypnotic Disruptions of Face and Person Recognition. ROCHELLE E. COX, MAX COLTHEART and ROBYN A. LANGDON, *Macquarie University, Sydney*—In this paper, I describe our use of hypnotic suggestion to disrupt recognition of self and others. First, I describe our work on hypnotic mirrored-self misidentification, where we gave hypnotised subjects a suggestion to see a stranger when they looked in the mirror. High hypnotisable participants failed to identify themselves in the mirror and claimed that the stranger was copying their actions. Second, I describe an experiment that used hypnosis to disrupt recognition of others. We gave hypnotised subjects a suggestion that a stranger (a confederate) was a person known to them in disguise. High hypnotisable subjects falsely identified the confederate as somebody they knew and maintained their belief despite exposure to the confederate's voice and gait. Notably, we found that participants did not falsely identify photographs of the confederate. Findings are discussed in terms of the value of this approach for investigating false recognition and delusional beliefs.
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Letters and Word Processing II

Salon C, Sunday Morning, 10:00-12:00

Chaired by Ami Eidels, University of Newcastle

10:00-10:15 (309)

Forcing the Observer to Process the Carrier Word in the Stroop Task: Revisiting the Origin of the Stroop Effect. AMI EIDELS and WENDY DEVINE, *The University of Newcastle,* DANIEL ALGOM, *Tel Aviv University*—It takes people longer to classify the ink-colour of mismatching colour words than that of matching colour words, the Stroop effect. Because the calculation of the Stroop effect rests on the means, it is not clear that each and every word in a block of trials is actually read to meaning. We introduced a new task -- the forced-reading task -- in which the participant responds to the colour of only a subset of the presented words defined by some semantic feature. Participants exhibited a larger Stroop effect in the forced-reading task than in the usual Stroop task. In another task, the critical subset was defined by an

orthographic, non-semantic feature. The Stroop effect was again larger in the semantic (forced-reading) task than in the non-semantic (orthographic) task. We conclude that semantic processing does not occur on all trials, thus challenging the strong mandatory nature of reading.
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10:20-10:35 (310)

On the Persistence of a Primed Meaning in Lexical Ambiguity Processing. DAVID S. GORFEIN, *University of Texas at Dallas*—Most major models of ambiguity processing suggest that the effect of priming a particular meaning of a homograph or homophone dissipates over a few intervening trials. An exception to this view is that of the Activation-Selection-Model, or ASM, (Gorfein, Brown, & DeBiasi, 2007). In that paper we showed priming well beyond ten minutes. In a much earlier book chapter, (Gorfein & Walters, 1989) we reported that we had found homophone priming that persisted to testing on a second day. The present study shows similar effects for homographs and extends the time frame to a full week. The role of underlying processes is discussed with respect to ASM and word frequency.
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10:40-10:55 (311)

Consonants and Vowels in Visual Word Recognition: An MEG Study. NICOLA MOLINARO, MIKEL LIZARAZU, JON ANDONI DUÑABEITIA and MANUEL CARREIRAS, *Basque Center on Cognition, Brain and Learning* (read by Manuel Carreiras)—Previous studies have showed that the nature of letters—consonant vs. vowel—is crucial for printed word recognition. We recorded MEG evoked activity while participants read words in a masked priming experiment (e.g., acero [steel] or farol [lantern]). Targets were preceded 1) by a subset of vowels or consonants (e.g., aeo-acero and frl-farol), 2) by different consonants or vowels (e.g., iui-acero and tsb-farol), or 3) by the same word (acero-acero, farol-farol). Evoked MEG activity (MNE noise-normalized) showed a large activity peaking ~170 ms in the occipital-temporal regions. Related consonant subset primes produced similar effects to the identity condition, while the unrelated control condition was more negative. However, vowel subset primes produced similar effects to the unrelated control condition, and they were more negative than the identity condition. These data show that (pre-lexical) processing stage is mainly sensitive to the information brought by consonants with respect with vowels.
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11:00-11:15 (312)

Parafoveal Processing of Russian Morphology During Silent Reading: Evidence From Eye Movements. KIEL CHRISTIANSON and ANASTASIA STOOPS, *University of Illinois at Urbana-Champaign*—Russian allows all six possible word orders and has rich inflectional paradigms. In a series of three boundary-change eye-tracking experiments we investigated whether syntactic information in Russian modulates the integration of morphological structure (case marking) across (Experiment 1) and within words (Experiment 2) during parafoveal and foveal (Experiment 3) viewing in silent reading. In Experiment 1 (across-word boundaries) gaze durations revealed that morphological information in the parafovea was not used for lexical access. Total time indicated that parafoveally viewed morphological information produced inhibitory effects only during post-lexical integration. In Experiment 2 (within-word boundaries) gaze durations revealed that morphological information viewed in the parafovea was used during lexical access, modulated by syntactic context. In Experiment 3 (foveal processing) gaze durations on the target word n were modulated by the grammatical category of word n+1. These results indicate that morphology is processed parafoveally in Russian, modulated by word length and syntactic context.
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11:20-11:35 (313)

Errors During Letter Detection: Where are They? GARY E. RANEY, ANDRES G. ALI and JOANNA C. BOVEE, *University of Illinois at Chicago*—Researchers use letter detection tasks to study word processing during reading. To effectively use this task, properties that influence error rates must be understood. We explored whether position of a word on a page influences letter detection accuracy. Participants read short texts (15-18 lines each) for comprehension while circling the letter t. Passages were created with target words positioned on the top two lines, middle two lines, and bottom two lines of the page. Within each critical line, the target words were the first word, a middle word, or the last word of a line. We found that fewer errors were made on target words embedded in the top two lines of a text than in the middle or bottom lines. Fewer errors were made on target words that were the first words in critical lines than middle or last words. Individual differences (e.g., language background, vocabulary knowledge) in these position effects will be discussed.
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11:40-11:55 (314)

What Do Neurons in Cortex Respond to Information in Such a Selective Way? JEFFREY S. BOWERS, MARKUS F. DAMIAN and IVAN I. VANKOV, *University of Bristol,* COLIN J. DAVIS, *Royal Holloway University of London*—Single neurons often respond to information in a highly selective manner. But why? We show that it is difficult (often impossible) to co-activate multiple things at the same time over the same set of units relying on nonselective (distributed) representations. That is, a superposition of co-active distributed representations often results in a blend pattern that is ambiguous; the so-called superposition catastrophe. In a series of simulations we show that PDP models often learn local representations of letters and words in order to co-activate multiple things at the same time. Furthermore, we find that highly selective representations provide a better format for generalizing when there is a requirement to code multiple things at the same time. Given that various cortical systems co-activate multiple things in short-term memory we suggest that the superposition constraint plays an important role in explaining the existence of highly selective codes in cortex.
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POSTER SESSION I

Thursday Evening
Minneapolis Convention Center, Ballroom A
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION I •

(1001)

Challenging the Inappropriate Constancy Scaling Account of the Müller-Lyer Illusion. KAREN B. SCHLOSS and WILLIAM PRINZMETAL, *University of California, Berkeley*—The Müller-Lyer illusion is one of the most familiar of the classical visual illusions. The most popular theories of the Müller-Lyer illusion assume that observers perceive the wings-in (arrowhead) portion as closer and thereby larger than the wings-out (arrow tail) portion, based on inappropriate size scaling (e.g., Gregory, 1963; Gillam, 1998). We tested the assumption that perceived convexity (for wings-in) and concavity (for wings-out) are necessary for the Müller-Lyer illusion. We found that the illusion persists, even when the wings-out portion is part of a convex object (Experiment 1), when the wings-in portion is part of a concave corner in a natural scene (Experiment 2), and when the wings-in part is a concavity and the wings-out part is a convexity in a single object (Experiment 3). The illusion's persistence, despite the opposite depth interpretation (wings-in as convex; wings-out as concave), challenges the popular account of the Müller-Lyer illusion.
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(1002)

Are Illusory Conjunctions a Unitary Phenomenon? CYNTHIA M. HENDERSON and JAMES L. MCCLELLAND, *Stanford University*—An illusory conjunction (IC) occurs when a subject erroneously reports a stimulus that did not appear but that combines features of the stimuli that were present. Pelli, Palomares, & Majaj (2004) noted that many IC studies use crowded stimuli. We replicated a representative study (Prinzmetal, Henderson, & Ivry, 1995) with low processing and memory loads. We found ICs with the original stimulus spacing but no ICs when spacing exceeded that of crowding. Pelli et al also noted a few studies reporting ICs with large stimulus spacing. We replicated one representative study with high processing and memory loads (Cohen & Ivry, 1989). However, ICs were eliminated when processing and memory loads were reduced even though accuracy was held constant by reduced stimulus contrast and duration. Our results suggest that spacing constraints critical for crowding may drive many IC results while ICs between distant stimuli may be driven by a distinct mechanism.
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(1003)

Exposure to Multiple Views Increases Application of 3-D Representation in Matching Face Silhouettes. GARY C.-W. SHYI and JULIA LIN, *National Chung Cheng University*—Some researchers believe face recognition is based on 2-D view-specific representations, whereas others believe faces are recognized via application of 3-D representations. In four experiments we investigated whether faces are recognized via 3-D representation by showing participants faces of 2-D frontal view and asking them to extract 3-D information from that view in order to match subsequently presented profile view and silhouette of faces. Furthermore, we examined whether frequent exposure to multiple views would increase the use of 3-D representation. Results of the first two experiments replicated those reported by Schwaninger and Yang (2011, VR) and established the basic finding implicating application of 3-D representation in face matching. Results of Experiments 3 and 4 showed exposure to multiple views further enhances application of 3-D face representation. Finally no differences were found between exposed views, suggesting that frontal and slightly off-centered views were equally powerful in building 3-D face representations.
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(1004)

Recognizing Real-World Objects: The Role of Familiarity, Context, and Features. ELAN B. BARENHOLTZ and EVANGELIE DASKAGIANNI, *Florida Atlantic University*—The current study assessed the contribution of contextual, featural and familiarity-based factors in the recognition of real-world, photographed objects. The experimental task consisted of sequentially resolving degraded photographs of household objects while attempting to identify them; the threshold of degradation at which recognition of each object was accurate was taken as a measure of performance. Participants included people who were highly familiar with the environments in which the pictures were taken and people who were unfamiliar with them. We included five contextual conditions: 1) No Context 2) Contextual Scene 3) Contextual Scene and Position 4) Contextual Scene and Object Size 5) All of the above cues. We also considered the impact of several object dimensions including the consistency of the object within the context as well as how typical the object was as an example of its category. Overall, we found that context and object dimensions affect recognition differently in familiar and unfamiliar conditions; people who are familiar with a scene use their individual memory to identify objects while people unfamiliar with the scene use schema-based expectations.
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(1005)

Visual Perception of Viscoelasticity in Virtual Materials. BING WU, *Arizona State University,* ROBERTA L. KLATZKY and RALPH HOLLIS, *Carnegie Mellon University,* GEORGE D. STETTEN, *Carnegie Mellon University/University of Pittsburgh*—When forces are applied to soft materials, regularities in the deformation pattern arising from the material's internal structure provide cues to its visco-elastic properties. Imaging techniques can make structural deformation visible and hence subject to perceptual

judgments. Here, such cues were provided by means of videos showing simulated ultrasound imaging of virtual visco-elastic materials under compression by a constant load. The simulations varied with respect to the geometric regularity of the material's structure and the amount of speckle (noise) generated by the imaging process. Participants indicated on each trial which of two videos showed stiffer or more viscous material, and JNDs were measured adaptively over trials. Judgments of elasticity and viscosity were significantly aided by the structural regularity of material and impaired by simulated imaging noise. Ongoing experiments investigate interdependence of the perception of viscosity and elasticity in virtual materials from simulated visual cues. (Supported by NIH grant 4R00EB008710)
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(1006)

Age, Working Memory Load, and the Extraction of Distance in a Real-World Environment. DANIEL A. GAJEWSKI, COURTNEY P. WALLIN and JOHN W. PHILBECK, *The George Washington University*—Humans can walk accurately to a briefly glimpsed target without vision. To investigate the role for working memory load and age in this ability, we compared younger and older adult performance with number of potential targets (1 or 3) manipulated (one object specified as target after the glimpse). Brief viewing durations were set for each participant and condition using a color detection task (<129 ms). Control durations were 4 times longer and randomly mixed. Older adults required longer glimpses to detect target color. Surprisingly, their blindwalking was more accurate than younger adults at their respective threshold durations. Both groups underestimated less with multiple targets. A second group of young adults performed better than the first when their control durations were lengthened to match the older group. While information extracted from longer control trials likely supports performance at brief durations for both age groups, we found no cost of load on blindwalking.
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(1007)

Great Expectations: Perceptual Challenges of Visual Surveillance in Lifeguarding. LYNDSEY K. LANAGAN-LEITZEL, *Eastern Connecticut State University,* EMILY SKOW, *Simpson College,* CATHLEEN M. MOORE, *University of Iowa*—Many of the occupational search tasks extensively studied by our field require spatial search (e.g., baggage screening, radiology). We argue that lifeguard surveillance, a temporal search task, could benefit from controlled laboratory study. The lifeguard faces a number of major challenges due to known limitations of visual processing and attention: sun glare, turbulence and turbidity of the water, extreme heat, fatigue, and overcrowded swimming areas. Additionally, their target is complex, dynamic, ill-defined, and rare. Prior research suggests that each of these characteristics should make it difficult for the lifeguard to notice and respond to drowning incidents quickly, and some people have drowned unnoticed by lifeguards on duty. After exploring how these limitations could affect lifeguards, we propose ways that existing search tasks can be modified to allow for surveillance to be examined systematically in the laboratory. This research may suggest improvements for lifeguard surveillance instruction.
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(1008)

Eye Movements Reveal Trade-Offs in Application of Target Knowledge During Visual Search. ERIN MCWILLIAMS, *University of Hull,* JOHAN HULLEMAN, *University of Manchester* (Sponsored by Steve Dewhurst)—Young and Hulleman (JEP:HPP, in press) proposed a theoretical framework that explains how task-difficulty moulds visual search. In easy search, multiple items are processed in parallel during each fixation. But in very difficult search only a single item is processed per fixation. So, effortful item-by-item processing is a last resort rather than the default. This leads to two predictions when participants search for a moving/static T among various ratios of moving and static Ls. (1) Knowing the target's motion status will not yield faster search when this motion status is shared by most distractors. (2) Processing will switch from parallel to item-by-item when the motion status of the target becomes so rare that it is worth the effort. Results provided support for both hypotheses: RTs only improved when 33% of the items had the target's motion status, and this was accompanied by reduced influence of surrounding items on eye movements.
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(1009)

Found Targets are Powerful Distractors in Multiple-Target Search. MATTHEW S. CAIN and STEPHEN R. MITROFF, *Duke University*—Multiple-target visual search—when more than one target can appear in a given search display—is a common type of real-world search in fields like radiology and baggage screening. Second targets are often missed in multiple-target searches, and we investigated why. Through three experiments we examined how the perceptual salience of the first target and memory for the first target affect subsequent search performance. Removing found first targets from the display, or making them salient and easily segregated color singletons, improved second-target accuracy. However, replacing found targets with random distractor items did not. Removing and highlighting found targets likely reduced both salience and memory effects, while replacing a target likely reduced salience, but not memory load—the first-target object file was likely updated but not discarded. Collectively, these experiments suggest that the working memory load of a first target has a larger effect on second-target accuracy than does its perceptual salience.
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(1010)

A New Frame of Reference for the Perception of Biological Motion. ZSOLT PALATINUS and JAMES A. DIXON, *University of Connecticut,* DAMIAN G. STEPHEN, *Wyss Institute for Biologically Inspired Engineering*—Point-light displays of humans performing everyday activities were created from motion-capture data. The displays were rendered

either from a fixed-camera position or from a moving position on a curvilinear trajectory around the target. Participants were asked to identify each activity as quickly as possible. Mean recognition time and accuracy for the two conditions were nearly identical, suggesting that the information for making correct judgments remained accessible despite the superposition of camera-movement-induced changes on the point trajectories. These results pose a challenge to extant computational approaches to biological-movement perception all of which require a static frame of reference. Alternatively, we propose that the registration of patterned energy distributions manifests in the fractal fluctuations of exploratory movements during vision. On this account, subtle fluctuations in seated posture and head sway should moderate the effects of optical energy arrays upon the perceptual system.
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(1011)

The Ternus Effect in Depth. SAMUEL D. JAFFEE and DALE S. KLOPFER, *Bowling Green State University*—Our Ternus stimulus is a three-element apparent motion display that yields one of two percepts depending upon the length of the inter-frame interval (IFI). At short IFIs, viewers see one element moving back and forth across two stationary ones; at long IFIs, the three elements are seen moving as a group. Perceptions of group motion arise when within-frame spatial grouping dominate across-frame temporal grouping. Most Ternus displays show the elements in a 2D frontal plane, in which case the spatial grouping that occurs necessarily takes place in 2D space. We introduced pictorial depth cues to the display so that the elements could be seen as moving in depth. Thresholds for seeing group motion were the same for the 2D and 3D versions of the display, suggesting – similar to Attneave & Block's (1973) findings with two-element apparent motion -- that the space in which apparent motion grouping occurs is isotropic.
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• PERCEPTION I •

(1012)

Facial Feedback, Training, and the Perception of Facial Emotions. CHRIS KOCH and MICHAEL BROUGHAL, *George Fox University*—Contrary to Carney, Cuddy, and Yao (2010), Koch and Broughal (2011) found that posture did not influence the perception of facial emotions. The current study was conducted to examine other factors that might contribute to recognizing emotions. Specifically, four different training strategies were compared in order to determine the most effective method for improving the perception of facial emotions. Block randomization was used to assign subjects into the control, facial feedback, METT and SETT training, and facial feedback combined with METT and SETT training conditions. After the training session, subjects indicated the emotional expression on a series of static facial images. Results suggest that facial feedback is plays an important role in recognizing the facial emotions of others.
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(1013)

Effect of Stimulus Format and Number of Identities on Facial Expression Recognition. EMILY R. PRAZAK and E. DARCY BURGUND, *Macalester College*—Controversy exists over whether facial expression recognition is a holistic or feature-based process. In previous work using a composite facial expression recognition paradigm we observed holistic processing with photographic stimuli and feature-based processing with schematic stimuli. Unclear from this work, however, is whether differences in holistic and feature-based processing are due to stimulus format per se, or to the greater number of facial identities used for photographic compared to schematic stimuli. We examined this issue in the present study by comparing performance on the composite expression recognition task in three stimulus conditions: multiple-identity photographic (MP), single-identity photographic (SP) and single-identity schematic (SS). Replicating our previous work, holistic processing was observed in the MP condition and feature-based processing was observed in the SS condition. In addition, holistic processing was observed in the SP condition but was decreased relative to that observed in the MP condition. Together, results suggest that the extent to which facial expression processing occurs holistically may be influenced by the number of facial identities in the stimulus set as well as by stimulus format.
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(1014)

The Confusion Between Fear and Surprise: An ERP Investigation of The Perceptual Limitation Hypothesis. JOEL D. DICKINSON, ANNIE ROY-CHARLAND, MELANIE PERRON, SEAN C. THOMAS and OLIVIA BEAUDRY, *Laurentian University*—The perceptual limitation hypothesis posits that the reason we have difficulty perceiving the difference between the facial expressions of fear and surprise is due to several shared action units (AUs), even though the Brow Lower (AU4) and the Lip Stretcher (AU20) are distinct in fear. The main objective of this study was to examine whether brain activity would differ between facial prototypes of fear and surprise. An oddball task using fear and surprise images that either differed in the brow (AU4), mouth (AU20), or brow and mouth (AU4 + AU20) were used to test the perceptual limitation hypothesis. Although consistent differences were found in both early and late components between fear and surprise images when both the mouth and brow region AU's were engaged, these differences were not significant when the difference was only demonstrated in the brow region. These findings provide support for the perceptual limitation hypothesis.
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(1015)

Does Facial Processing Prioritize Change Detection? Event-Related Brain Potentials Reveal Task Differences in the N170. MIKO M. WILFORD, LORI A. SJOLUND and ROBERT WEST, *Iowa State University,* KIRA BAILEY, *University of Missouri*—Wilford & Wells (2010) demonstrated that facial processing resulted in more accurate change detection than object processing (i.e., houses) with a modified

change-blindness paradigm. Interestingly, when the task required change localization rather than detection, this advantage in accuracy was reversed such that performance for houses was better than faces. The current study used event-related potentials to examine the neural basis of this interaction. Participants completed change detection and change localization tasks with faces and houses. For faces, the N170 peaked about 10 ms earlier in the change localization task than in the change detection task; and the amplitude of the N170 was greater in the change localization task than the change detection task. Sustained parietal activity, indicative of greater effort, was lower in amplitude for faces for the change detection task than for other trials—which is consistent with the behavioral accuracy data.
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(1016)

Picture Ahead! Picture Superiority in Memory for Road Signs. EUMJI KANG and CARRICK C. WILLIAMS, *Mississippi State University*—When driving, one encounters road signs containing words or pictures (e.g., No Entry). Although they have the same meaning, word and picture information may not be equally represented in memory. In addition, road signs are processed without intentionally storing the information long term. Of interest was whether the picture superiority effect (i.e., pictures are remembered better than words) would extend to both road signs and incidental encoding. Participants rated the pleasantness of "normal" pictures and words (e.g., Apples) and picture and word road signs either knowing a memory test would follow or not (Intentional or Incidental encoding). A four alternative forced choice memory test followed. Normal stimuli showed a marginal picture superiority effect, but a large picture superiority effect was found for road signs. Also, incidental encoding produced a larger picture superiority effect. These results indicate that even under driving conditions, a picture superiority effect can be found.
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(1017)

Pinky, Greeny, and the Brain: Anatomically Driven Perceptual Models Predict Temporal Thresholds Associated With Specific Brain Pathways. STEVEN R. HOLLOWAY and MICHAEL K. MCBEATH, *Arizona State University*—The anatomical specialization of cortical visual pathways suggests that presenting an observer with characteristic stimuli should allow us to disambiguate and measure temporal thresholds associated with the specific targeted brain pathways. Useful neural pathway models should specify distinct, measurable, psychophysical correlates with timing properties. By limiting the characteristics of a stimulus to those that match known response characteristics of a specific cortical pathway, we should be able to measure the functional processing characteristics of that neural system. Using cortical system distinctions as a guide, we created classes of stimuli that vary in shape, movement-speed, and color (e.g. red vs. green). This allowed us to develop and test several objective measures of temporal processing that are associated with recent neural anatomical models and that predict distinct levels of information processing. Results from a series of experiments converge upon distinct processing-speed thresholds that are consistent with a model of neural processing that follows the anatomical infrastructure of the visual cortex.
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(1018)

Which Way Does the Horse Race? Biases in Figure Depiction. BELEM G. LÓPEZ, SÜMEYRA TOSUN and JYOTSNA VAID, *Texas A&M University*—Previous research has demonstrated that handedness and script direction (reading/writing from left to right or from right to left) affect directionality preferences in representational drawings (Vaid, Rhodes, Tosun, & Eslami, 2011). Other research suggests that directionality biases observed in graphic production are not necessarily the same as those observed for judgments of preferred orientation of objects (Rhodes, 2010), suggesting that biomechanical variables come into play in graphic production while aesthetic variables are more salient in figure perception. To examine factors influencing aesthetic judgments, photographs of horses from horse racing magazines were subjected to a content analysis. Variables examined were facing direction, page side (left side or right side) and page axis. It was hypothesized that an overall rightward facing bias in portraying horses in movement would be found, but that it would be affected by page side and axis. The findings are discussed in relation to studies of compositional biases in figure depiction
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(1019)

Estimating Averages of Skewed Distributions of Tone Durations. RICHARD SCHWEICKERT and HYE JOO HAN, *Purdue University,* MOTONORI YAMAGUCHI, *Vanderbilt University,* CLAUDETTE FORTIN, *Universite Laval*—People are good at estimating the average of a sample of stimuli, but no one has investigated duration. We presented tones of various durations. Durations were sampled from three distributions, one symmetric, one skewed positively and one negatively. For each sample, participants judged whether comparison tones were longer than average. Estimates of averages were calculated from participants' psychophysical functions. Experiments 1 and 2 showed that estimates of averages were affected by irrelevant earlier samples and by the distribution of comparison tone durations. In Experiment 3, each distribution was tested with comparison tone durations selected to be percentiles of the distribution. Each participant was presented with only one distribution. Estimated means were accurate for the smallest population mean (the positively skewed distribution), but larger means were underestimated. Underestimation increased with the mean. Results are explained by subjective shortening of durations in memory, long durations shortened more than short ones.
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(1020)

Memory for Vocal Tempo. MARILYN G. BOLTZ, *Haverford College*—Previous research has demonstrated that both musicians and nonmusicians are able to remember a tune's tempo with a remarkable degree of accuracy. The purpose of the present research was to investigate whether a similar ability applies to the remembering of vocal rate. If so, then what underlying cognitive mechanisms are at play? Two experiments were conducted that both relied on a recognition memory paradigm. In Experiment 1, vocal tempo recognition was assessed relative to vocal pitch recognition when attention was directed toward one dimension alone, both in tandem or, as a control, neither dimension (i.e., incidental). Experiment 2 was designed as a converging operation by examining the ability to recognize vocal tempo in the presence of systematic pitch variations (and vice versa). As a set, these studies provide insight into the relationship between pitch and tempo and whether these act as independent or interactive dimensions in perceptual processing.
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(1021)

Quantifying Temporal Ventriloquism in Audio-Visual Rhythm Perception. JAMES F. JUOLA, IRENE A. KULING and ARMIN KOHLRAUSCH, *Eindhoven University of Technology*—We used a rhythm perception paradigm to quantify the effects of small temporal discrepancies between audio-visual stimulus pairs. In this paradigm, observers had to align the onset of a target stimulus (position 3) within a rhythmic sequence of four markers (positions 1, 2, 4, and 5). In Exp 1, the modalities of the markers and targets were crossed in a 2X2 design. In unimodal conditions, the target was placed accurately for both audio (click) and visual (flash) conditions, but in bimodal conditions, there was a consistent 25-30 ms bias in target placement. In Exp 2, the markers were bimodal with various SOAs between the audio and visual components, and the targets were visual flashes. The results demonstrated temporal ventriloquism in which adjustment of the visual target was affected by the timing of the audio components of the bimodal markers, even when observers were told to use the visual components only.
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(1022)

Do "Autistic" Traits Predict Audiovisual Integration in Speech Perception? JOSEPH D.W. STEPHENS and JULIAN L. SCRIVENS, *North Carolina A&T State University,* AMY A. OVERMAN, *Elon University*—Stewart and Ota (2008) reported that lexical influences on speech perception were reduced among individuals with higher Autism Quotient (AQ) scores in a sample of non-autistic university students. Models of information integration in speech perception such as the FLMP (Massaro, 1998) assume that information integration mechanisms are relatively invariant across individuals, and are essentially identical for integration of lexical vs. visual information with auditory speech. Thus, the present study examined whether AQ is related to the influence of visual information on speech perception. In two experiments, participants' responses to audiovisual stimuli were recorded and modeled with the FLMP. AQ was found to be a poor predictor of visual influences on speech perception, and of FLMP fits to individual data. The results raise questions regarding the nature of AQ's relation to information integration in speech perception.
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(1023)

Relative Influence of Language Familiarity and Congruency in Early Audiovisual Integration. KATHLEEN SHAW and NICOLE DEPOWSKI, *University of Connecticut,* MARTIJN BAART, *Basque Center on Cognition, Brain and Language, Donostia/San-Sebastian,* HEATHER BORTFELD, *University of Connecticut*—It is not clear whether audiovisual speech integration in infants is driven by phonetic familiarity, perceived temporal congruence, or both. In Experiment 1, infants (N=21) heard familiar (English) and unfamiliar (Spanish) speech samples that were either phonetically congruent or incongruent with the visual speech produced by a face in an accompanying video while their looking behavior was tracked. Although we observed no age-related biases, two distinct groups of infants emerged: infants who looked longer to congruent stimuli regardless of language, and infants who looked longer to incongruent stimuli. In Experiment 2, infants (N=16) were tested in a preferential looking paradigm in which they were exposed to two faces, one articulating in Spanish and the other in English. Accompanying audio speech matched one or the other face. Overall, infants looked longer at the face that matched the audio. Results are interpreted in light of recent findings on perceptual narrowing in infancy.
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(1024)

Sensitivity to Emotion and Language Discrepancies in Face and Voice. THERESA C. COOK, JAMES W. DIAS and LAWRENCE D. ROSENBLUM, *University of California, Riverside*—In previously reported experiments, we compared the perceptual salience of audiovisual emotional and linguistic information in crossmodal congruence judgments. We recorded the audiovisual speech of 2 actors saying 5 word-pairs in 3 emotions (happy, angry, sad). Each member of a word-pair differed from the other on 1 visible phoneme. Participants judged which of two stimuli were more audiovisually congruent. On critical trials, 1 stimulus was emotionally congruent/linguistically incongruent while the other was linguistically congruent/emotionally incongruent. Results suggested that, in audiovisual integration, perceptual sensitivity to emotional and linguistic information varies among perceivers. The current study correlates intersubject sensitivity to emotional and linguistic discrepancies with demographic and personality factors, revealing a relationship between conscientiousness and sensitivity to crossmodal linguistic information ($r = .29$, $p = .03$). Additionally, neuroticism ($r = .24$, $p = .06$) and gender ($r = .24$, $p = .07$) showed discrete, trending relationships with sensitivity to crossmodal emotion information.
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• ACTION AND PERCEPTION I •

(1025)

Holistic Processing Facilitates Change Detection but Impairs Change Localization. TODD A. KAHAN, KATHERINE M. MATHIS and SIMONE H. SCHRIGER, *Bates College*—Wilford and Wells (2010) report that detecting changes in faces is superior to detecting changes in houses but that the reverse is true when localizing changes. The authors claim that the holistic processing of faces results in enhanced change-detection accuracy but impaired change-localization accuracy relative to the feature-based processing of houses. However, since the stimuli that they compared (faces vs. houses) differed in numerous ways from one another and since these stimuli might be processed in specialized brain regions, it remains unclear whether these results are specific to faces and houses or whether a similar pattern would emerge with other, more directly comparable, stimuli. In the current experiment we examined change-detection and change-localization accuracy with Kanisza rectangle patterns that were arranged to either form a gestalt whole or not. Results support the change-detection/change-localization hypothesis; holistic processing facilitates the detection of change but obstructs its localization.
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(1026)

Event Perception Ability Predicts Action Performance. HEATHER R. BAILEY and JEFFREY M. ZACKS, *Washington University in St. Louis,* CHRISTOPHER A. KURBY, *Grand Valley State University,* TANIA GIOVANNETTI, *Temple University*—Older adults with dementia of the Alzheimer's type frequently suffer impairments in performing everyday actions, such as packing a lunchbox. These impairments can be a major impediment to independent living. Here, we asked how action comprehension is related to performance. In particular, does one's ability to segment activities into appropriate components during perception predict one's ability to perform a different set of actions? Cognitively healthy and mildly demented older adults segmented three movies of everyday events, completed an action performance test, and underwent structural MRI scans. Both segmentation and action performance were worse in more demented participants, and segmentation ability strongly predicted action performance. Further, atrophy of the medial temporal lobes (MTL) statistically accounted for the decline in segmentation ability and action performance. The fact that event segmentation predicts action performance suggests a potential course of intervention: tools to scaffold event representations may help demented patients perform everyday activities.
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(1027)

Effects of Stimulus-Response Assignments on the Joint Simon Effect. AKIO NISHIMURA and CHIKASHI MICHIMATA, *Sophia University*—When two individuals sitting side by side engage in separate but complementary go/no-go tasks (e.g., the left participant presses a left button to one color, and the right participant presses a right button to the other color, of a target presented on left or right side), performance is better when the target and the actor are on the same side (joint Simon effect). The present study manipulated the stimulus-response assignments. When two participants shared the target color (e.g., both responded to red and withheld responses to green), the joint Simon effect emerged. Even when one engaged in a go/no-go task and the other engaged in a detection task, both participants showed a comparable joint Simon effect. The findings indicate the importance of response button complementary, rather than task or action timing complementary, in the joint Simon effect.
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(1028)

Shared Representation in Social Orthogonal Simon Task. SOO MIN KIM, SEAH CHANG and YANG SEOK CHO, *Korea University* (Sponsored by Peter Urcuioli)—When two participants perform complementary go/no-go tasks together, performance is better when the stimulus location corresponds with the response location than it does not. It has been suggested that this social Simon effect is due to participants taking their co-actor's task and action as their own. Two experiments were conducted to assess whether two participants share the task representation when they were to perform two complementary go/no-go orthogonal Simon tasks together. When they made their responses at a left position in a block and at a right response position in another block together in Experiment 1, a larger up-right/down-left advantage was obtained at the right position than the left position. When one participant made responses at the left position and the other made responses at the right position in Experiment 2, no response eccentricity effect was obtained. The findings suggest that individuals form a representation of the co-actor's task.
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(1029)

Hand Posture Affects Object Perception. DAVID CHAN, *University of Toronto,* MARY PETERSON, *University of Arizona,* JAY PRATT, *University of Toronto*—Typically, object perception has been associated with the parvocellular pathway (P), which carries high spatial frequency (HSF) information. However, Moshe Bar and colleagues (2007) found that participants made faster and more accurate categorization responses to the low spatial frequency (LSF) images than HSF images. They hypothesized this was due to "gist" information being carried by the faster magnocellualar pathway (M) that carries LSF information. To test this hypothesis, we used a hand posture manipulation that our lab has recently shown to bias activity in the visual pathways: hands near displays bias M (better temporal resolution) and hands far from displays bias P (better spatial resolution). Using this manipulation, we replicated the original advantage in categorizing LSF images, and found this effect was greater when the hands were near the images. This later finding supports the hypothesis that M activity is involved in speeded object perception.
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(1030)

Perceiving Affordances for Remembered Objects. BRANDON J. THOMAS, JEFFREY B. WAGMAN and DAWN M. MCBRIDE, *Illinois State University*—Previous research has shown that perception of affordances for an intended behavior is action scaled even when the means of performing that behavior would bring about (future) changes in action capabilities. Three experiments investigate whether perception continues to be action scaled even when such means are no longer present. The results show perception of maximum reaching height was action scaled both when the means of performing the reaching task (and changing reaching ability) were present and when they were no longer present. In addition, the results show that when two different means of performing a reaching task are functionally equivalent, they are both perceived and remembered to be functionally equivalent. The results are discussed in the context of prospectivity, retrospectivity, and flexibility—three fundamental hallmarks of goal-directed behavior.
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(1031)

Individual Differences in Mood Induction: Strength of Handedness and Right Hemisphere Access. STEPHEN D. CHRISTMAN, *University of Toledo,* RUTH E. PROPPER, *Montclair State University*—Mixed-handedness is associated with more negative affect (Denny, 2009; Propper, Brunyé, Christman, & Bologna, 2010), arising from (i) mixed-handers' greater functional access to right hemisphere processing and (ii) the right hemisphere's role in negative affect (e.g., Davidson, 2004). The current study examined the efficacy of mood induction in strong- versus mixed-handers. The International Affective Picture System (Lang, hman, & Vaitl, 1988) was used to induce one of four emotional states yielded by the crossing of positive versus negative affect with high versus low arousal. Subjects' happiness and calmness were assessed before and after mood induction. While there were no handedness or sex differences in baseline mood, the induction of negative, but not positive, affect was more effective in mixed-handers and in females. Also, after mood induction, strong-handers reported a larger decrease in calmness. These results suggest that research using mood induction should take subjects' strength of handedness into account.
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(1032)

Ideomotor Perception Modulates Visuospatial Cueing. DAVOOD GOZLI, JOSHUA B. MOSKOWITZ and JAY PRATT, *University of Toronto*—The ideomotor theory of action posits that an action representation consists, at least in part, of its known perceptual effects. Here we investigate an implication of this theory; a bias in response selection should produce a perceptual bias toward the known effects. In an initial exposure phase, subjects implicitly mapped two colors to two keypress responses. In the test phase, response bias was manipulated by presenting an exogenous spatial response cue at the left or right periphery. Following this response cue, we assessed subjects' sensitivity to colors using a visual orienting paradigm, employing color transients that either matched or mismatched the effect of the cued response. As expected, the response cue biased response selection. Importantly, response selection produced a perceptual bias; there was greater visual cueing by color transients that matched, rather than mismatched, the cued response. The findings extend the scope of the ideomotor theory to perceptual processes.
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• EMBODIED COGNITION I •

(1033)

Bilingualism, Space and Time. MONICA GONZALEZ-MARQUEZ, *Cornell University; Bielefeld University,* RAYMOND BECKER, *Bielefeld University* (Sponsored by James E. Cutting)—A basic premise of cognitive linguistics theory is that language is spatial. Given that the average person speaks more than one language, we investigated what effect bilingualism would have on spatial processing directly, and on time as another process also argued to be structured by space. We tested 104 monolingual and bilingual participants with the classic table-top route learning task, and a time estimation task with trials grouped into 10, 25, 45, and 60 second intervals. The classic finding for route-learning is that men excel and women do poorly. Here, we found the gender difference was reversed for bilinguals with the women performing better than the men. The time estimation data showed the same pattern for the two largest intervals, both thought to be processed beyond working memory. This suggests that space, time and language may share a common cognitive substrate.
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(1034)

I Can Go West, Right? Priming Abstract Spatial Concepts Influences Motor Movement Trajectories. SARAH TOWER-RICHARDI, *Tufts University,* STEPHANIE A. GAGNON, *Tufts University; Stanford University,* HOLLY A. TAYLOR, *Tufts University,* TAD T. BRUNYÉ, *Tufts University; U.S. Army NSRDEC*—Perception and action within our environment play important roles in grounding abstract concepts such as social status, time, and emotion. Might people similarly ground abstract spatial concepts in more experience-based domains? We explore this possibility by implicitly priming abstract spatial axes (north, south, east, west) and then measuring participants' hand movement trajectories in response to reading a body-referenced spatial target (up, down, left, right). Results demonstrate temporally dynamic and prime-congruent movement trajectory biases in cases of incongruence between primes and targets (e.g., east-left, south-up). In other words, priming abstract coordinate directions influences the ability to perform actions in response to concrete target directions. These data provide the first evidence that abstract concepts of world-centered coordinate axes are implicitly understood in the context of concrete body-referenced axes. Grounding abstract spatial concepts in concrete and body-centered space might allow us to better understand otherwise intangible concepts.
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(1035)

How Good is My Good Side? Motor Fluency and the Body Specificity Hypothesis. JORDAN C. DAVISON and ZENZI M. GRIFFIN, *University of Texas at Austin*—Our interactions with the physical world form the basis of many associations, concrete and abstract, between concepts and space. The Body Specificity Hypothesis (BSH) claims that these interactions are substantially smoother on the dominant hand side, which creates an association between the dominant hand-side and positive valence (Casasanto, 2009). For example, left-handers are more likely than right-handers to judge left-side objects as better than equivalent right-side objects. Casasanto (2011) shows that this association is reversed following temporary difficulty using the dominant hand. Can recent fluent motor experiences evoke these lateralized preferences in the absence of lateralized visual items? We report two experiments that test this hypothesis by presenting visually centered items, manipulating which hand is used to interact with items, and manipulating the level of contrast between the degree of difficulty of using each hand.
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(1036)

Push and Pull: Memory Differences Using a Motor-Induced Forgetting Paradigm. MARK A. OAKES, *St. Lawrence University,* PENNY L. YEE, *Hamilton College*—The current study investigated the use of extension and flexion arm movements as embodiment analogs for explicit memory instructions (i.e., to forget and remember) given during Directed Forgetting studies. Thirty-two words, 16 containing the vowel 'O', appeared sequentially on a computer. Half of the participants made an arm flexion response (pulled a joystick toward their body) to identify the O-words and the other half made an arm extension response (pushed a joystick away from their body). Participants made the opposite extension/flexion response for the non O-words. A recognition test revealed that extension words were significantly more difficult to distinguish from never-presented foils than flexion words. This result supports previous research that physical movements influence cognitive and affective processes (see Wilson, 2002). In this case, an extension movement may activate a cognitive process in which a memory trace becomes less available for rehearsal, producing a forgetting effect.
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(1037)

Embodiment Meets Metamemory: Weight as a Cue for Metacognitive Judgments. MICHAEL W. ALBAN and COLLEEN M. KELLEY, *Florida State University*—Weight is conceptualized as an embodiment of importance by recent research on embodied cognition (Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009). Is importance as embodied by weight used as a cue that items are memorable? Three studies varied participants' perceptual experiences of weight as they studied words and predicted later memory performance via judgments of learning (JOLs) for a recall (Study 1) or recognition (Studies 2-3) memory test. Greater weight was associated with higher judgments of learning (JOLs) although weight did not affect actual memory performance. Even cognition about our own cognition is embodied.
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(1038)

Effects of Sensorimotor, Emotional, and Introspective Knowledge in Semantic Processing. PAUL D. SIAKALUK, PHILLIP I. NEWCOMBE and CALE CAMPBELL, *University of Northern British Columbia,* PENNY M. PEXMAN, *University of Calgary*—Previous research on lexical-semantic processing has mainly focused on words that refer to concrete concepts. Here we examined the effects of imageability, body-object interaction (BOI), emotional experience (the extent to which words evoke an emotional experience), and introspective knowledge (the extent to which the meanings of words are learned from linguistic sources as opposed to bodily experience) in the semantic processing of concrete and abstract words. For concrete words, imageability and BOI were associated with faster and more accurate responding, emotional experience was associated with less accurate responding, and introspective knowledge did not influence responding. For abstract words, BOI was associated with slower and less accurate responding, emotional experience was associated with faster and more accurate responding, introspective knowledge was associated with slower responding, and imageability did not influence responding. We discuss the impact of our findings for perceptual symbol systems theory, in which simulation underlies semantic processing (Barsalou, 1999).
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(1039)

Evaluating Embodiment Task Parameters. EMILY SHIELDS, DALLAS SWINDELL, TYLER HUBBARD and WILLIAM LANGSTON, *Middle Tennessee State University*—Embodied cognition suggests that action potentials are a component of language comprehension (e.g., reading "close the drawer" makes it difficult to move towards one's body). The purpose of the research was to evaluate task components contributing to embodiment. For all studies, participants categorized verbs that had implied motion (e.g., "emerge"). For the baseline condition, participants responded with both hands (a non-embodied task). For the rest of the studies, following each verb, the participants moved in a direction that was consistent or inconsistent with the implied verb motion. The task parameters that were manipulated were whether the instructions were explicit (e.g., indicate the direction of motion) or implicit (e.g., indicate the tense of the verb), the response modality (paper and pencil or computer), presentation format (blocked or mixed), and distance moved. The results were that embodiment effects are dependent upon task parameters.
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(1040)

The Influence of Embodiment on the Comprehension of Metaphors. DAWN G. BLASKO, VICTORIA A. KAZMERSKI and ASHLEY E. KERR, *Pennsylvania State University, Erie*—

Metaphors have received a great deal of recent attention because their conceptual roots are often perceptually embodied. Sixty metaphors using auditory imagery (The order was barked) and 60 using motor imagery (The rejection letter was a slap) were read word-by-word. Familiarity, imagery, interpretability, plausibility, and figurativeness were examined. Metaphors and literal control sentences, ending in the same last word, were compared on a meaningfulness task. Motor metaphors tended to be rated as more meaningful than auditory metaphors. Familiarity had the strongest impact on ratings with high familiar metaphors rated as more meaningful than low familiar metaphors. Reading times on the full sentence and the last word containing the vehicle of the metaphor showed that metaphors took longer to process than literal only when familiarity and imagery were low. Individual differences were also analyzed including working memory, verbal and performance IQ, five-factor personality traits, and laterality. The results suggest that the semantic leap required by less familiar metaphors may require more resources, but this effect may be mitigated by familiarity and a vivid perceptual experience.
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(1041)

Different Brains Process Numbers Differently: Variances in Brain Structure Related to Representational Biases in Number Cognition. FLORIAN KRAUSE, *Radboud University Nijmegen,* OLIVER LINDEMANN, *University of Potsdam,* HAROLD BEKKERING and IVAN TONI, *Radboud University Nijmegen*—How do we process and represent numbers? While a traditional view on number processing comprises the idea of a spatial number representation (mental number line), more recent research emphasizes the role of a non-spatial, magnitude-related representation of numbers (generalized magnitude system). Here we show that both aspects are dissociable and that their expression vary strongly among individuals. We further demonstrate that these individual differences are predictive of variances in parietal brain structure. A Voxel-Based Morphometry (VBM) analysis revealed an association of spatial (left-right) and non-spatial (response force modulation) number-response compatibility effects with grey matter volume in brain regions implied in spatial processing (right Precuneus) and magnitude/semantic processing (left Angular Gyrus), respectively. Our data suggests that the way we represent numbers depends on persistent individual biases with distinct structural correlates in the brain.
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• SPATIAL COGNITION I •

(1042)

Zooming in on Spatial Scaling Processes: Mental Transformations or Proportional Judgments? WENKE MÖHRING and NORA S. NEWCOMBE, *Temple University,* ANDREA FRICK, *University of Bern*—Spatial scaling is an important prerequisite for several spatial tasks and involves an understanding of how distances in spaces of different sizes relate to each other. The kind of mental processes that adults use to scale spatial information remain unclear. In the present study, adults' speed and accuracy in a spatial scaling task were measured using a touch screen. Adults were asked to locate a target on an area, based on information from different maps that varied in size and target locations. Results indicated that when target locations were varied along two dimensions, response times and error rates increased with larger scaling factors. This suggests that when scaling two-dimensional spatial information, adults may use a mental imagery strategy (e.g., imagine zooming into or expanding the space) rather than making relative (proportional) judgments.
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(1043)

Development of Landmark Knowledge and Navigation Strategies in Large-Scale Environments. LIN WANG and WEIMIN MOU, *University of Alberta,* XIANGHONG SUN, *Chinese Academy of Sciences*—Two experiments distinguished different landmark knowledge and related navigation strategies of human adults in a large-scale environment. Participants learned a route in a virtual city once or for five times. One distinctive landmark was placed in each intersection of the route. At test, participants were released at each intersection as in the learning order and were required to make turns. At each intersection, the landmark was removed (no landmark), correctly placed (one landmark), duplicated on the other side (two identical landmarks), or misplaced from another intersection (two different landmarks). The results showed that participants could associate the correct turns with the landmark that was placed correctly even after learning the route once; participants could not distinguish between two identical landmarks after learning the route once but could do so after learning the route for five times; participants could select correct turning directions even without landmarks although the performance was still inferior to the performance with the presence of landmarks. These results suggest that humans develop knowledge for guidance, landmark knowledge for place recognition and knowledge of landmark sequence in navigation.
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(1044)

The Impact of Culture and Recipient Perspective on Direction Giving During Wayfinding. ALYCIA M. HUND, *Illinois State University,* MARTIN SCHMETTOW and MATTHIJS L. NOORDZIJ, *University of Twente*—We examined how culture and recipient perspective affect direction giving during wayfinding. Participants from the US and the Netherlands provided directions from starting locations to destinations for fictional recipients driving through a town (route perspective) or looking at a map of the town (survey perspective). US participants provided street names more frequently than did Dutch participants, whereas Dutch participants provided landmarks more frequently than did US participants. Moreover, US participants provided more cardinal descriptors when addressing listeners adopting a survey perspective but more landmarks and left-right descriptors when addressing listeners adopting a route

perspective. Participants from the Netherlands evinced a similar pattern with the important distinction that they mostly ignored cardinal terms unless explicitly primed to do so and in a survey condition. These findings revealed remarkable flexibility and cultural variations in spatial descriptions.
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(1045)

Local Coding of Directions After Navigational Experience. STEVEN A. MARCHETTE, LINDSAY K. MORGAN, ANTHONY STIGLIANI and RUSSELL A. EPSTEIN, *University of Pennsylvania*—Behavioral evidence (e.g., Hirtle & Jonides, 1985) suggests that navigable environments may be represented hierarchically. One consequence of such a representational scheme is that spatial quantities, like direction, might be encoded relative to sub-regions of the environment. To test this, we had participants navigate a virtual park containing four buildings, each containing multiple objects. In a subsequent retrieval phase, participants imagined facing different directions within each building and located target objects from these perspectives. Participants localized objects faster when imagining the same direction across successive trials, suggesting that participants adopted a reference frame for localizing targets, and then updated across trials when their orientation changed. Consistent with reference frames tied to the local environment, directional priming only occurred when direction was repeated within a building but not when it was repeated across buildings. Taken together, these results suggest that navigation produces local representations with idiosyncratic reference frames and directional codes.
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(1046)

Contribution of Attention to Spatial Learning for Navigation. ELIZABETH CHRASTIL and WILLIAM H. WARREN, *Brown University*—We used an orienting task to manipulate attention to different spatial properties during exploration. Three groups learned the locations of 8 objects by freely walking in a virtual hedge maze: (a) Graph orienting task: participants were informed they would be tested on the maze, and practiced walking through the maze hallways to a target object; (b) Survey orienting task: participants were informed they would be tested on object locations, and practiced facing the remembered location of a target object; (c) No orienting task. In Experiment 1, all groups were tested on their Graph knowledge: participants walked from object A to object B within the maze corridors, with occasional detours. In Experiment 2, all groups were tested on their Survey knowledge: participants walked novel shortcuts directly from A to B. Orienting attention does not seem to influence graph knowledge, but appears to contribute to survey knowledge, during free walking.
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(1047)

The Influence of Cast Shadows and External Landmarks on Learning a Wormhole Environment. JONATHAN D. ERICSON and WILLIAM H. WARREN, *Brown University* (Sponsored by William H. Warren)—Previously, we created a non-Euclidean virtual hedge maze containing two "wormholes" that teleported participants between locations via covert maze rotation. Despite the addition of external landmarks (LM), participants were unaware of this violation of Euclidean structure, and shortcuts indicated "rips" and "folds" in spatial knowledge. Here we provide further orientation cues by adding cast shadows (CS). Participants learned the locations of 8 objects (places) while freely walking in three conditions: (1) maze only, (2) LM and CS rotate with the maze, and (3) LM and CS stay fixed with respect to the laboratory. Despite adding cast shadows, participants still take shortcuts toward wormhole target locations rather than Euclidean target locations, consistent with our previous results. Wormholes distort spatial knowledge, consistent with a labeled topological graph supplemented with coarse metric information that is not integrated into a globally consistent Euclidean map.
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(1048)

Can Environmental Previews Impact the Effects of Disorientation? BENJAMIN A. KRAMER, JOHN W. PHILBECK and JENNIFER KAMINSKY, *The George Washington University*—Disorientation decreases the between-object coherence of remembered locations in a configuration. Here, we tested whether memory of the surrounding spatial context supplied by environmental previews enhances the coherence of remembered object locations (diminish configuration errors), even when participants are disoriented. Participants first learned the locations of six objects around them in a circular enclosure. On each trial of the Preview condition, participants saw the circular room, donned a blindfold, were disoriented, and then pointed to the objects. In the No-Preview condition, participants remained blindfolded before each trial. Configuration errors were significantly lower in the Preview condition, even though analyses showed those subjects to be equally disoriented as those in the No-Preview condition. This suggests that having access to a relatively high-fidelity memory of the surrounding spatial context (induced here by a recent environmental preview) can ameliorate the negative effects of disorientation on configuration errors.
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(1049)

A Room With a (Different) View: Evidence for a Role of Field of View in the Reorientation Process. BRADLEY R. STURZ, ZACHARY A. KILDAY, SAMUEL P. POLICE and KENT D. BODILY, *Georgia Southern University*—We manipulated the amount of an environment that was visually available to participants by manipulating field of view (FOV) in a virtual environment orientation task. Two groups of participants were trained to find a location in a trapezoid-shaped enclosure uniquely specified by wall lengths, corner angle, and the egocentric side of the principal axis. One group (FOV 50°) had visually less of the environment available to them from any one perspective compared to another group (FOV 100°). Following training, we presented both

groups with a control test along with three novel-shaped environments. Testing assessed the use of global geometry in isolation, in alignment with local geometry, or in conflict with local geometry. Constraining FOV diminished the ability to extract geometric properties and relationships of space and resulted in an inability to use either global or local geometric cues for reorientation. Implications for theoretical accounts of geometry learning are discussed.
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(1050)

Defining a Boundary in Goal Localization: Infinite Number of Reference Points or Extended Surfaces. WEIMIN MOU and RUOJING ZHOU, *University of Alberta*—This project examined the roles of extended surfaces and the number of reference points in the boundary superiority effect in goal localization. Participants learned the locations of four objects with the presence of a boundary, landmarks, or both in an immersive virtual environment in four learning blocks by reproducing the locations with feedback. Participants then localized the objects with the presence of either the boundary or the landmarks in four testing blocks without feedback. Results showed that when both one landmark and a circular boundary were presented during learning, localization error in the testing blocks increased significantly when only the landmark was presented during testing whereas localization error did not increase when only the boundary was presented during testing, demonstrating the boundary superiority effect. Such boundary superiority effect disappeared when 36 landmarks forming a circular shape and a circular boundary were presented during learning. Furthermore, when a varied number of landmarks were presented with a circular boundary, the localization error increase in the testing blocks negatively correlated with the number of the landmarks.
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(1051)

Perceptions of Effort and Distance Estimation. MATTHEW E. JACOVINA and DAVID N. RAPP, *Northwestern University*—Representations of distance are often exaggerated by boundaries. Previous research has focused on boundaries explicitly depicted on maps (e.g., Maddox, Rapp, Brion, & Taylor, 2008), and boundaries based on prior knowledge (e.g., Friedman & Montello, 2006). The current project tested whether the effort necessary to traverse regions might similarly demarcate boundaries leading to distance overestimations. We used topographic maps as they can provide information about boundaries given their depictions of changes in terrain slope. Participants explored these maps on a computer screen by moving a cursor across their areas. In experimental conditions, the cursor speed changed dynamically such that it slowed when moving across steeper slopes; in control conditions the cursor speed did not change. Participants' estimates of distances between map points were greater in experimental than control conditions. These results have implications for spatial understandings of map depictions, while also suggesting practical applications for training topographic reasoning.
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• COGNITIVE SKILL ACQUISITION I •

(1052)

Along the Path to Expertise, What Predicts Quitting vs. Persistence? SARA L. GREEN, SARAH K. MCQUEEN and TRAVIS L. SEYMOUR, *University of California, Santa Cruz*—Research into acquisition of expertise lacks focus on interactions between individual differences and task factors predicting quitting when progress plateaus. In this study, participants completed a sequence of logic puzzles. Sequence difficulty and puzzle solution time were manipulated. Easy sequences increased regularly in difficulty over time. Difficult sequences alternated between large and small increases in puzzle difficulty. Easy goals encouraged slower puzzle completion times than hard goals. Several individual difference measures were assessed, including personality, puzzle experience, stereotype threat and self-efficacy. When puzzles could not be solved, participants were offered a chance to try one more. This allowed assessment of the relationship between task and individual difference variables on performance and quitting. Although goal difficulty had little effect, sequence difficulty, extroversion, and tendency to think strategically were predictors of overall performance level and quitting. We discuss ways to incorporate these results into both expertise theory and applied training.
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(1053)

Hierarchical Control of Cognition and Action: On the Units of Processing in Skilled and Unskilled Typing. MOTONORI YAMAGUCHI and GORDON D. LOGAN, *Vanderbilt University*—Hierarchical theories of skilled performance hold that skill acquisition depends on changes in the structure of underlying processes. The present study investigated the units of processing in skilled and unskilled performance. Three experiments compared skilled typing of words with unskilled typing of nonwords and unskilled typing on a laser-projection keyboard. We manipulated stimulus quality (Experiment 1) and memory load (Experiment 2). Stimulus quality affected typing rate for nonwords, but not for words, indicating a larger encoding unit for words; memory load retrieval decreased much more with nonword length than with word length, indicating a larger memory unit for words. Typing was much slower on a laser-projection keyboard than on a regular keyboard (Experiment 3) and typing latency increased with nonword length but not with word length. These results suggest that acquisition of skilled performance relies on development of a larger processing unit at higher levels of the hierarchy.
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(1054)

Foreign Language Training Improves Other Cognitive Abilities. SUSAN G. CAMPBELL, MEREDITH M. HUGHES, JARED A. LINCK, NOAH H. SILBERT, MEDHA TARE, BENJAMIN K. SMITH and MICHAEL F. BUNTING, *University of Maryland Center for Advanced Study of Language*—People who have successfully completed

an intensive foreign language training program show better cognitive abilities in certain domains than people who are starting the same course. This difference, however, could be due to attrition; perhaps only people who have better cognitive abilities in the first place can finish intensive language training. We compared students who were starting a course to students who were close to completing the same course on cognitive abilities. Using outcome data about which students would go on to successfully finish the course, we could restrict our analysis to only those beginning students who finished as much of the course as our near-graduate sample. We determined from this analysis that certain abilities, such as associative memory and phonological short-term memory, improved during language training.
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(1055)

Revealing Non-Linear Numerical Perception Using Reaction Time. JEFFREY S. CHRABASZCZ and MICHAEL R. DOUGHERTY, *University of Maryland, College Park*—Previous research shows that children and adults differ in their numerical perception while children show a nonlinear mapping of numerical magnitude to linear space, adults show no such effect for small numbers, (<10000). The task underlying these findings is relatively coarse, however, and may miss subtle distinctions in processing of differently sized numbers for adults. To account for this possibility, we had undergraduates complete two numerical processing tasks: one in which participants chose the larger of two displayed numbers, and another in which participants judged whether a stimulus was numbers-only or included a non-numeric character. We found a logarithmic relationship between objective magnitude of number pairs and reaction time for task one, and no difference in processing time when judging stimuli of differing string-lengths for task two. This combination of findings suggests that adults may continue to process numerical stimuli nonlinearly.
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(1056)

Attitudes About Math and Writing: Were You Just "Born" That Way? MARK H. ASHCRAFT, NATHAN O. RUDIG and ALEX M. MOORE, *University of Nevada, Las Vegas,* THOMAS H. CARR, *Michigan State University*—Dweck's socio-cognitive model of motivation suggests that people's beliefs about their intelligence and abilities fall on a continuum, varying from fixed (entity theory) to malleable (incremental theory). To extend these ideas about intelligence to particular domains of educationally important cognitive activity, we surveyed undergraduates on two campuses to establish baselines in math and writing. Undergraduates like writing more than math, perceive themselves as better at writing than math, and espouse more entity beliefs about math than writing (more toward the "born" end of the scale). Curiously, they claim they can get better in both domains, although those toward the "born" end often respond to "how?" with "tutoring" rather than "practice." Psychology majors were more like entity theorists on math items than the overall sample, but more like incremental theorists than the sample on writing. Endorsing incremental beliefs correlated positively with the belief that one could improve.
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• EXPLICIT MEMORY I •

(1057)

Can't Remember the Tree Because of the Forest: When Context Interferes With Memory for Objects. KARLA K. EVANS and JEREMY M. WOLFE, *Harvard Medical School; Brigham and Women's Hospital* (Sponsored by Anne Treisman)—We ask observers to memorize single objects, embedded in scenes and clearly marked by an outlined box. Performance was quite poor (d'=1.40). If observers learned an object in one scene and were tested with another background scene, performance was very poor (d'=0.67) even though the scene contexts were completely irrelevant to the task. Without the scene recognition memory was, as usual, very good (d'=2.27). Memory for these rather similar indoor scene backgrounds was quite good (d'=1.84). If the scene context was present during the encoding phase and absent at test, performance was very poor (d'=0.64) and worse than if the scene context was presented only in the retrieval phase (d'=1.34). These findings suggest that scene information is involuntarily encoded with object information in a manner that has a disruptive effect on recognition memory for the object alone, in context, or, especially, in a novel context.
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(1058)

Enhancing Human Memory via Visual Search and Binaural Beats in the Theta Frequency. HOLLY A. WESTFALL and KENNETH J. MALMBERG, *University of South Florida*—We report the effects of visual search and the frequency of binaural beats on episodic memory. Neural oscillations may reflect the cognitive state of the brain (Buzsáki, 2002). Theta oscillations range from 2 to 8 Hz and occur during spatial navigation (Kahana et al., 1999; Vanderwolf, 1969). Theta is also correlated with enhanced learning in animals (Berry & Thompson, 1978), and the performance of a visual search task during study enhances free recall (Westfall & Malmberg, submitted). What is unknown is the relationship between visual search, theta, and enhanced episodic memory in humans. In general, neural oscillations can be induced in humans via passive sensory stimulation (Pratt et al., 2009), e.g. the frequency of binaural beats are used to entrain corresponding oscillatory frequencies. Our findings indicate that binaural beats with a frequency of 5 Hz enhance free recall task performance more than frequencies of 2 and 8 Hz, which occur at the peripheries of the theta range. The frequency of binaural beats across the theta band does not interact with the visual search task, suggesting that both neural entrainment and visual search each increase the efficiency the episodic encoding.
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(1059)

Sleep Aids the Consolidation of Spatial Relational Memories. MARC N. COUTANCHE, *University of Pennsylvania,* CAROL A. GIANESSI, *Yale University,* AVI J.H. CHANALES, KATE W. WILLISON and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Prior research suggests that sleep benefits relational memory formation. We asked whether sleep would help relational memories form within a two-dimensional space, which is more complex than previously examined learned hierarchies. We trained sixty subjects to learn spatial relationships (North, South, East or West) for pairs of buildings. Participants were never told that the buildings formed a grid and many spatial relations were not explicitly taught. Subjects returned after 12 hours with or without sleep, or after 24 hours (circadian control) and were assessed using distance judgments and a map construction task. The sleep group created more accurate maps than the wake group, with particular benefits found for relationships that were not explicitly taught. These results suggest that sleep plays a role in forming complex spatial relational memories. As the groups did not differ significantly in distance judgment accuracies, a flexible map task may be particularly sensitive to this effect.
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(1060)

Are Eye Movements "Functional" for Memory? MEGAN H. PAPESH, *Louisiana State University,* STEPHEN D. GOLDINGER, *Arizona State University*—Current theoretical debate, crossing the bounds of memory theory and mental imagery, surrounds the role of eye movements in successful encoding and retrieval. Although the eyes have been shown to revisit previously viewed locations during retrieval, the functional role of these saccades is not known. Whereas some researchers document a relationship between reinstated eye movements and retrieval success (e.g., Laeng & Teodorescu, 2002), others have observed no relationship between eye movements and overt memory performance (e.g., Richardson & Spivey, 2000). In a series of eye-tracked source-monitoring experiments, participants encoded audio-visual information while completing controlled eye movement patterns. Eye movements were also manipulated at retrieval. When retrieval eye movements were unconstrained, saccades were spontaneously generated to once-occupied (but now empty) screen locations. These reinstated eye movements were associated with increased source memory accuracy. Implications for the putatively functional role for eye movements during retrieval from explicit and implicit memory are discussed.
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(1061)

Forgetting and the Survival Processing Advantage. BRANDY E. ELMORE and DAWN M. MCBRIDE, *Illinois State University*—Recent research has found that processing information in relation to a primitive survival scenario aids in retention and recall of memory. This study examined the parameters of the survival advantage in an attempt to identify its mechanisms. One possibility is that survival processing provides a cognitive advantage by acting as a buffer against natural forgetting. The current study was designed to examine forgetting rates for words rated in a primitive survival scenario, and a moving scenario. Participants rated words in both study conditions, and then experienced a delay before a free recall test. Delays included 2-, 5-, 10-, and 15-min and 1-day and 1-week conditions. The results replicated the survival advantage, but forgetting rates did not differ between conditions. Thus, no support was found for slower forgetting of information processed in a survival context.
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(1062)

Threatening Memory: Explaining the Survival Processing Advantage. JUSTIN M. OLDS and DEANNE L. WESTERMAN, *Binghamton University, SUNY* (Sponsored by Dennis Delprato)—Information processed in relation to ancestrally related survival tends to have superior recall relative to other elaborate encoding manipulations (Nairne & Pandeirada, 2007). Recently, the ancestral specificity of this phenomenon has been challenged (Soderstrom and McCabe, 2011; Kostic et al., 2012). The current research examines if perceived threat is a general factor of the survival advantage. Survival processing was manipulated between subjects such that participants were presented with a grassland or city context, and either a low, medium, or high threat level. Unrelated nouns were rated based on their survival relevance or pleasantness and tested with surprise free-recall. Results replicated the recall advantage for words processed in light of survival. Importantly, recall rates improved as threat level increased. The findings as a whole suggest that perceived threat is a general mechanism that contributes to the survival processing advantage.
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(1063)

Survival Processing Enhances Source Memory: Evidence From a Within-Subjects Comparison. MINE MISIRLISOY, *Middle East Technical University,* NART B. ATALAY, *Selcuk University*—Survival processing is proposed to be one of the best encoding procedures identified in human memory research (Nairne, et al., 2008). In addition, it has been argued more than once that, from an adaptive perspective, survival processing should also enhance memory for source (Nairne, et al., 2011; Broder, et al., 2011). Nevertheless, studies so far have failed to demonstrate a survival advantage for source memory in the typical survival processing paradigm. The current study compared source memory performance for survival and moving conditions in a within-subjects design, rather than a between-subjects design. Participants rated one list of words according to survival and the other list according to moving relevance. Memory for item and source was tested with a recognition/source monitoring test. Results showed a survival processing advantage for both recognition and for source memory performance. A within-subject comparison of encoding scenarios seems to be aiding the source monitoring process.
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(1064)

The Compound Word Effect in Associative Recognition. FAHAD N. AHMAD and WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—Previous item recognition studies of compound words have shown a conjunction memory effect represented as higher false alarm rates to conjunction lures compared to new words (e.g., Jones & Jacoby, 2001). In the current study, we examined the conjunction effect in an associative recognition task in which participants studied compound and non-compound word pairs. In Experiment 1, hits and false alarm rates were significantly higher for compound word pairs. In Experiment 2, accuracy was significantly greater for compound word pairs in a two-alternative forced-choice test. In Experiment 3, a modified Remember/Know response procedure showed a familiarity-based recognition advantage for compound word pairs. Finally, in Experiment 4 the discrimination advantage for compound word pairs was eliminated when encoding emphasis was directed to the individual items of each word pair. These results demonstrate a compound word effect in associative recognition that is due to unitization and the increased use of familiarity.
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(1065)

A Unified Model of Episodic Memory: Application to Item and Associative Recognition. ADAM F. OSTH, SIMON DENNIS and PER B. SEDERBERG, *The Ohio State University* (Sponsored by Vladimir Sloutsky)—In recent years, episodic memory modeling has become splintered, resulting in models that address benchmark findings from only one or two episodic memory tasks. This is a major departure from the global memory models of the 1980's that were designed to address episodic memory as a whole. We present an extension of the matrix model of Humphreys, Bain, and Pike (1989) which uses three separate representations: An occurrence matrix that stores item-context bindings, a co-occurrence tensor that stores symmetric inter-item bindings within a context, and an order tensor that stores asymmetric inter-item bindings within a context. Memory strength is calculated by the match between the available cues and the respective representations. In item and associative recognition, decisions are made on the basis of a likelihood ratio transform used by Glanzer, Hilford, and Maloney (2009). For both item and associative recognition, the model is capable of producing mirror effects, null effects of list length and list strength, linearity and curvilinearity in associative recognition zROCs, as well as the appropriate changes in the false alarm rate with changes in associative strength.
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(1066)

Context Variability and Memory for Items and Associations. WILLIAM R. AUE, AMY H. CRISS and JESSICA FONTAINE, *Syracuse University*—The context variability effect is the finding that the number of pre-experimental contexts in which an item has been experienced influences how well the word is remembered. Specifically, low context variability words (LCV) tend to be better recalled and recognized than high context variability words. Here, we evaluate the mechanism that underlies the LCV advantage. One hypothesis suggests that context variability is a property of the word, similar to word frequency, and subsequently operates at the item level. Another proposal suggests that context variability operates on the ability to bind together information. Specifically, the hypothesis is that LCV words are easier to associate to an experimental context. In four experiments we examined these ideas by training participants to focus on either associative information or item information during encoding. Participants were then tested on their memory for individual items or pairs of items. If the LCV advantage is the result of easier item-to-context association, then focusing on forming item-to-item associations during encoding should eliminate benefit. If, however, context variability is a property of the word, then encoding strategies should not disrupt the context variability effect. Results and implications for models of memory are discussed.
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(1067)

Semantic (High Overlap) Partial-Match Cues Improve Prospective Memory in an Implied Unexpected Context. ADAM G. UNDERWOOD and MELISSA J. GUYNN, *New Mexico State University*—Prospective memory (PM) is memory dedicated to fulfilling an intention at a future point in time. Research indicates that expectations of the future context in which the PM cue may occur affect performance. Specifically, PM is improved when the cue occurs in the expected context and hindered when it does not (Cook, Marsh, & Hicks, 2005). The purpose of the current study was to examine whether the degree of overlap between PM cues and partial-match cues affects PM during an unexpected context, and moreover, to identify the cognitive processes mediating any improvement. To achieve this, expectation of context was implied during intention formation. Results indicated semantic (high overlap) partial-match cues, but not perceptual (low overlap) partial-match cues, improved PM. Furthermore, semantic partial-match cues resulted in adjustment of attentional allocation policies and more instances of spontaneous retrieval. The study suggests that PM can be improved during an unexpected context.
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(1068)

Same Tasks, Different Effects: Item-Specific versus Relational Encoding in the DRM Paradigm. MARK J. HUFF and GLEN E. BODNER, *University of Calgary*—Three recognition experiments using the DRM paradigm compared the effects of 1) item-specific versus relational encoding instructions, 2) item-specific versus relational pleasantness tasks, and 3) item-specific versus relational generation tasks. Relative to read control conditions, item-specific and relational encoding both increased correct recognition, but only item-specific encoding decreased false recognition. Item-specific and relational encoding both resulted in increased strategic monitoring at test (i.e., a distinctiveness heuristic), but increased monitoring did not reduce false recognition after relational encoding. Item-specific encoding, but not relational

encoding, reduced the amount of memory information encoded about critical items (i.e., impoverished relational encoding). Overall, false recognition was modulated by the extent to which a given encoding task required item-specific versus relational processing. We conclude that 1) item-specific encoding can lead to impoverished relational encoding, and 2) applying a distinctiveness heuristic at test reduces the DRM illusion only after item-specific encoding.
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• WORKING MEMORY I •

(1069)

Working Memory Training: Evidence for Near, but Not Far Transfer. MEREDITH MINEAR, FAITH BRASHER and CLAUDIA BRANDT GUERRERO, *The College of Idaho*—We report the results of a study comparing two methods used to train working memory, a spatial n-back and a complex verbal span. 31 undergraduates completed 4 weeks of n-back training and 32 completed 4 weeks of verbal span training. The pre-test/post-test battery included simple speeded tasks, short term and working memory measures from both verbal and visuo-spatial domains as well as two measures of attentional control (ANT and Spatial Stroop) and two measures of fluid intelligence (Raven's and Cattell). We found evidence for near transfer. The n-back group showed transfer to both verbal and object based n-back tasks while the verbal span training showed a trend towards better performance on verbal short term memory. The n-back group showed significantly better improvement on the ANT, but not on Stroop. However, we observed no evidence of transfer to traditional working memory span measures or to fluid intelligence tests.
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(1070)

Examining Visual Spatial Working Memory Training. SHARONA M. ATKINS, MICHAEL R. DOUGHERTY, MICHAEL F. BUNTING and DONALD J. BOLGER, *University of Maryland*—Working memory training has been shown to increase performance on the trained tasks and when properly constructed, generalizes those improvements to untrained tasks. The exact nature and extent of the generalization is still under debate, as not all working memory training studies show improvement, the persistence of improvement, or generalization of the improvement. We set out to examine process specific transfer of the working memory training from a neurological perspective. We examined task performance with fMRI prior to and immediately after training, in both an experimental-training group and a placebo-control group. Participants were scanned while performing both training-specific and novel visual-spatial working memory tasks. We compared the cortical response on both the trained and untrained task as well as behavior on cognitive assessments administered outside the scanner.
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(1071)

Transfer of Working Memory Training Observed in Contralateral Delay Activity. BORNALI KUNDU, DAVID W. SUTTERER, STEPHEN M. EMRICH and BRADLEY R. POSTLE, *University of Wisconsin, Madison* (Sponsored by Maryellen C. MacDonald)—Training on an adaptive working memory task can improve performance on the training task, and can transfer to other cognitive tasks. Our study explored the electroencephalographic (EEG) bases of these effects. Participants were trained on an adaptive, visuospatial dual n-back task, or a control non-mnemonic, adaptive, visuospatial task (Tetris). Pre- and post-training measures assessed individual performance on visuospatial short-term memory (VSTM), selective attention, and several other psychometric tasks. Although both groups showed training gains, only the experimental group experienced transfer to other tasks, including change-detection and visual search. Individual differences in dual n-back training gain predicted training-related change in VSTM capacity (K), and in performance on VSTM with encoding-period distraction. Additionally, training gains predicted change in the magnitude of the training-related decrease of an EEG correlate of K, the "contralateral delay activity" (CDA). These results were then replicated within a separate task through corollary measures of working memory within the visual search. These findings suggest working memory training may make cognitive and neural processing more efficient.
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(1072)

Working Memory Capacity Influences Strategic Choice on a Cognitive Control Task. LAUREN RICHMOND, *Temple University,* THOMAS S. REDICK, *Indiana University/Purdue University, Columbus,* TODD BRAVER, *Washington University in St. Louis*—Working memory capacity (WMC) has been shown to predict reasoning ability (Kyllonen & Christal, 1990), reading comprehension (Daneman & Carpenter, 1980) and fluid intelligence (Unsworth, 2010). However, the extent to which strategy modulates WMC is less well understood. Previously, Redick and Engle (2011) demonstrated a relation between WMC and performance on a widely used cognitive control measure, the AX-CPT. In order to assess alternate explanations for the data presented in Redick and Engle (2011), participants completed two complex WM tasks and the AX-CPT. Participants with high WMC exhibited a proactive approach, resulting in performance enhancements as well as costs, compared to low WMC. This relation is driven by cue information rather than dominant response tendencies to the X-probe. WMC did not predict the ability to switch strategy when instructions were provided. These results indicate that WMC does influence 'default' strategy, but that strategic approach is under volitional control regardless of WMC.
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(1073)

Individual Differences in a Neurophysiological Measure of Visual Working Memory. LI ZHOU and ROBIN D. THOMAS, *Miami University*—Visual working memory (VWM) maintains a limited amount of information about

objects for cognitive operations in the immediate visual environment. Previous studies found that ERP amplitude over parietal electrodes correlate with the capacity measure proposed by Cowen and (e.g., Vogel& Machizawa, 2004). An alternative measure based on spectral power has also been found to correlate to similar capacity measures (Gevins & Smith, 2000). We extend this latter approach to a more complex model of VWM introduced by Rouder (Roudner, 2005). Task-related neurophysiological and behavioral variables were collected from the data of 15 young adults during change detection paradigm. In the theta band, the power ratios of both frontal (Fz) and parietal (Pz) lobe in set-size-four condition correlated with the attention parameter and VWM capacity derived from Rouder's model, while, in the alpha band, only VWM capacity was correlated with power ratio of frontal lobe. The results suggested that spectral power can be another neural measure to predict individuals' VWM capacity.
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(1074)

Influence of Transcranial Direct Current Stimulation (tDCS) on Complex Span Performance. LAUREN L. RICHMOND, *Temple University,* LAUREN MANCUSO and DAVID WOLK, *University of Pennsylvania,* INGRID R. OLSON, *Temple University*—Recently there has been a great deal of interest in the ability of non-invasive brain stimulation methods to manipulate behavior. Unlike the more well-known methodology of transcranial magnetic stimulation, tDCS modulates the resting potential of underlying cortical tissue without eliciting neural firing. Previously, tDCS has been shown to influence performance on an n-back task (e.g. Fregni, et al., 2005) and a variant of the Sternberg task (Marshall, et al., 2005). However, the degree to which tDCS influences complex span and spatial working memory (WM) performance has yet to be explored. To this end, positive or sham tDCS was applied to left dorsolateral prefrontal cortex while participants performed an adaptive complex WM task (see Chein & Morrison, 2010; Richmond et al., 2011 for task description) over two sessions. Participants in the anodal condition showed greater improvement in verbal, but not spatial, WM performance compared to the sham group. These results demonstrate that tDCS can improve performance on complex WM tasks in the verbal domain.
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(1075)

Noise-Vocoded Speech Produces the Irrelevant Sound Effect: Experiments and Implications. JOSH DORSI and NAVIN VISWANATHAN, *State University of New York - New Paltz*—The Irrelevant Sound Effect is the finding that serial recall accuracy is impaired by the presence of speech backgrounds as compared to silent or white noise backgrounds (Colle & Welsh, 1976). Several studies have attempted to identify the properties of background distractors that cause the Irrelevant Sound Effect and, in particular, speech has been shown to produce the strongest effects (e.g., Schlittmeier et al., 2012). The current study used as background: noise-vocoded speech - a signal manipulation that preserves information about intensity variation in logarithmically spaced amplitude channels of natural speech (Shannon, Zeng, Kamath, Wygonski, Ekelid, 1995). We found that serial recall accuracy was reliably lower under noise-vocoded speech backgrounds compared to control white noise backgrounds suggesting that noise-vocoded speech contains properties that cause the Irrelevant Sound Effect. We discuss the implications of our findings to theories of Irrelevant Sound Effect.
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(1076)

Co-Articulation at Word Boundaries and the Frequency Effect in Serial Recall. LEONIE M. MILLER, STEVEN ROODENRYS and BENJAMIN ARCIONI, *University of Wollongong*—The frequency effect in serial recall is a complex of phenomena but is most typically described as the better recall of high (HF) than low frequency (LF) words, when items are presented in pure lists. One explanation of the effect points to differences in articulatory fluency of the word list, arising from differences in the ease of co-articulation at word boundaries that are integral to the successful integration of items into a single speech sequence. In contrast, other hypotheses (e.g. redintegration) view the effect as a product of differences in memory processing (e.g. associations between representations in long term memory (LTM)). The current study examined the serial recall of pure lists of HF and LF consonant- vowel-consonant words derived from word sets with matched onset and coda phonemes. Accordingly, the co-articulation at word boundaries should be controlled, and if co-articulation is a critical factor in the formation of the effect, the elimination of the frequency effect is anticipated. Contrary to this account, a robust frequency effect was observed, supporting explanations that implicate LTM in the formation of the effect.
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(1077)

Release From Proactive Interference Using Emotion and Emotion-Laden Words. HUGH KNICKERBOCKER and JEANETTE ALTARRIBA, *University at Albany, SUNY*—Word stimuli were presented using a Brown-Peterson task where participants viewed four words (300 milliseconds each with a 200 ms gap) followed by a retention interval (RI) with a distracting task (counting backwards from a random number) across a series of trials. The RI was varied (6 or 12 seconds), and participants completed an immediate recall task after each RI. Words from the same neutral word group were utilized for the first three trials. On the fourth trial, word category was varied between neutral, emotion, or emotion-laden words. Emotion and emotion-laden words were selected from the ANEW database (Bradley & Lang, 1999) and matched in word valence and arousal. Neutral words differed from both groups on those measures. Both immediate and final recall tasks were compared. The notion of an "emotional release from proactive interference" will be discussed with regards to attention, working-memory capacity, and emotion.
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(1078)

Free Recall of Auditory Stimuli Presented in Degraded Listening Conditions. ROBERT LJUNG, *University of Gävle*—The aim of the present study was to examine if degraded listening conditions affect free recall of auditory presented stimuli. The result showed that a long reverberation time (RevT) decreases free recall performance. More detailed analyses revealed that memory of words presented in the beginning of the list were more impaired by the unfavorable listening conditions, which is in agreement with earlier findings. In addition, the relationship between working memory capacity and the effects of degraded listening conditions was studied. People who made many invention errors in the operation span test performed significantly more false recall in low S/N. These findings give support for the hypothesis that degraded stimuli activate more candidate words, and people who make those specific errors have problem to suppress those candidates.
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(1079)

RSVP as a Method for Studying and Training Reading Strategies. JESSICA N. BUSLER and LEWIS BARKER, *Auburn University*—Rapid Serial Visual Presentation (RSVP) is a useful method for controlling the timing of text presentations and studying how readers' characteristics, such as working memory and reading strategies, influence text comprehension. In the current study a modified version of RSVP (Moving Window RSVP, MW-RSVP) was used to induce longer pauses at the ends of clauses and ends of sentences when reading texts with multiple embedded clauses. In previous research using self-paced moving windows presentation of similar texts, low-working memory readers showed shorter pauses at end of clauses/sentences and worse text recall than high-working memory readers. Preliminary data shows that inducing a longer pauses strategy improves text free-recall across all participants but especially among readers with low working memory. On the other hand, high-working memory readers, who are accustomed to longer pauses at end of clauses/sentences, recall less than low-working memory readers when exposed to a uniform MW-RSVP timing for all words in the text.
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(1080)

Evidence for Categorical Triage in Sternberg Search of Mixed Memory Sets. ERIC GREENLEE and DAVID B. BOLES, *University of Alabama*—We used the Sternberg search paradigm (Sternberg, 1966) to compare reaction times to visuo-spatial sets, phonological sets, and mixed sets of memory items. Assuming that the visuo-spatial and phonological components can be engaged in parallel, we predicted that RT slopes would be lower for the mixed sets compared to the slope of the average of the pure sets. Surprisingly, this was not found. However, RT intercepts were larger for mixed than pure sets, indicating an additional processing demand. Using a blocked design in study 2 resulted in lower mixed set slopes relative to pure set slopes, and intercepts of the mixed sets remained larger. Together, these results suggest that during mixed trials, an initial categorical judgment is made and only the visuo-spatial or phonological items relevant to the probe are searched.
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(1081)

Spatially Imprecise Representations in Working Memory. LAURA HEIN, KLAUS OBERAUER and HSUAN-YU LIN, *University of Zurich*—In serial recall, access to individual items reflects limits of temporal distinctiveness. This is reflected in the finding that neighboring list items are confused most often. We investigated the analogous effect of spatial proximity in a visual working-memory task. In a recognition experiment, items were presented simultaneously in different locations varying in spatial distance. A retro-cue indicated the location of the item relevant for the subsequent memory test. Probes matching spatially close neighbors of the relevant item led to more false alarms than probes matching distant neighbors or non-neighbors. In two additional probed-recall experiments, items were presented simultaneously or sequentially in different locations varying in spatial distance. Items closer to the cued location were more frequently chosen than more distant items. Our results reflect a spatial transposition gradient analogous to the temporal transposition gradient in serial recall, supporting the assumption of spatially imprecise, overlapping working memory representations.
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• METAMEMORY/METACOGNITION I •

(1082)

Delayed Judgments of Learning Make Unskilled Performers Less Unaware. MARISSA K. HARTWIG and JOHN DUNLOSKY, *Kent State University*—Previous studies have shown that when participants estimate their global (overall) performance on a cognitive task, low performers often overestimate their performance whereas high performers are more accurate or slightly underconfident (e.g., Kruger & Dunning, 1999.) The overestimates of low performers have been assumed to reflect their inability to discriminate which items they answered correctly versus incorrectly. Accordingly, we directly explored the relationship between item-by-item judgment accuracy (discrimination) and global-judgment accuracy on an associative learning task. Manipulations that decreased item discrimination did not decrease global-judgment accuracy. However, a manipulation that increased item discrimination did improve the accuracy of global judgments: Specifically, participants who made delayed (rather than immediate) judgments of learning (JOLs) estimated their global performance more accurately. Notably, low performers benefited most. Thus, delayed JOLs can improve the awareness of unskilled performers. Furthermore, poor item discrimination may be necessary – but not sufficient – for performers to misjudge their performance.
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(1083)

The Influence of Testing Versus Delayed Judgments of Learning on Final Test Performance: Resolving a Memory-Metamemory Paradox. SARAH K. TAUBER, JOHN DUNLOSKY and KATHERINE A. RAWSON, *Kent State University*—The positive effect of delayed practice testing on subsequent test performance is robust; by contrast, making delayed judgments of learning (JOLs) presumably encourages covert testing but typically has a minimal influence on final test performance. In two experiments, we explored this paradox. After initial study of each paired associate (dog – spoon), participants either were explicitly tested (dog - ?) immediately or after a delay or made a JOL (dog - ?) immediately or after a delay. Experiment 1 adopted the standard JOL method, using a short retention interval, whereas Experiment 2 adopted a common testing effect method, using a longer 2-day retention interval. Making delayed JOLs did not boost test performance, but explicit delayed tests did boost memory after a longer retention interval. These data indicate that differences in the mechanisms underlying testing and delayed JOLs (and not subtle differences in methods) are responsible for the apparent paradox.
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(1084)

Does the Underconfidence-with-Practice Effect Occur for New Items? BENJAMIN D. ENGLAND and MICHAEL J. SERRA, *Texas Tech University*—Judgments of learning (JOLs) exhibit marked underconfidence but increased relative accuracy across study-test trials (i.e., the underconfidence-with-practice or UWP effect). Current accounts rely heavily on previous-trial factors, such as past-test performance, to explain these outcomes. In the present experiments, however, we examined if any aspects of the UWP effect would carry over to new items introduced on the second study-test trial. Across experiments, JOLs for new items only exhibited underconfidence on Trial 2 when we manipulated memory for new items closer to older-item levels. Additionally, relative accuracy for new items on Trial 2 consistently trailed levels for older items. Overall, these outcomes suggest that no generalized effects of task experience occurred for new items, and support accounts that the UWP effect stems largely from prior experience with previously tested items. JOLs for new items, however, did not fall prey to specious manipulations of JOL magnitude, unlike JOLs for older items.
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(1085)

Metacognition Influences Item-Method Directed Forgetting. NATHANIEL L. FOSTER and LILI SAHAKYAN, *University of North Carolina at Greensboro*—We explored the role of metacognitive control in item-method directed forgetting across a series of experiments. In Experiment 1, participants studied loud and quiet items, which were subsequently cued as to-be-remembered or to-be-forgotten. Typically, the volume of stimuli does not influence recall, although loud items are judged as more memorable than quiet items (Rhodes & Castel, 2009). In contrast, we found a unique recall advantage for certain items when participants engaged in directed forgetting. Giving participants extra opportunities to engage rehearsal does not produce the effect (Experiment 2), nor does emphasizing the importance of some items over others (Experiments 3 and 4). We propose both a strategic rehearsal process as well as an unconscious heuristic process to explain the results. Finally, Experiments 5 and 6 investigated how people may be relying on encoding fluency or the salience of previously studied information when engaging in directed forgetting.
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(1086)

JORKs are Less Susceptible than JOLs to Metacognitive Illusions for Auditory Information. NICHOLAS C. SODERSTROM, *University of California, Los Angeles,* MATTHEW G. RHODES, *Colorado State University*—Prior work has shown that judgments of learning (JOLs) are prone to an auditory metacognitive illusion such that loud words are given higher predictions than quite words despite no differences in recall as a function of volume (Rhodes & Castel, 2009). The current study investigated whether judgments of remembering and knowing (JORKs; McCabe & Soderstrom, 2011)—judgments that focus participants on whether or not contextual details will be remembered—are less susceptible to such an illusion. Participants studied single words, making item-by-item JOLs or JORKs immediately after study, followed by restudy decisions. Indeed, although increased volume elevated judgment magnitude for both JOLs and JORKs, this effect was significantly attenuated when JORKs were elicited. Additionally, participants making JORKs were less likely than participants making JOLs to choose to restudy quite words relative to loud words, suggesting that JORKs are impacted less by irrelevant perceptual information than JOLs. Theoretical and practical implications are discussed.
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(1087)

Effect of Images on Memory and Metamemory for Paired Associates. FRANCESCA R. FLORES and MICHAEL J. SERRA, *Texas Tech University* (Sponsored by Patricia DeLucia)—We examined the effects of images and dual-coding (words plus images) on memory and metamemory for paired-associates over two study-test trials. Experiment 1 replicated past findings that replacing the stimulus word but not the response word of a paired-associate with an image increased memory for that pair. Experiment 2 examined effects of dual-coding by adding images to the stimulus or response component of word-word pairs. Again, images benefitted memory when added to the stimulus word but not the response word of a given pair. In both experiments, first-trial metamemory judgments were insensitive to the effect of an image's presence on memory whereas second-trial judgments relied on first-trial test performance rather than the presence of images. These results suggest that people shift from theory-based to experiential cues across trials but do not analytically factor the presence of images into metamemory judgments for paired associates on either trial.
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(1088)

Neural Correlates of Feeling of Knowing. ERIKA K. FULTON, *Georgia Institute of Technology,* RONIT H. GREENBERG, *University of Michigan,* HILLARY SCHWARB, ERIC H. SCHUMACHER and CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (Sponsored by Eric Schumacher)—Research on the neural underpinnings of metacognition implicates the frontal lobes in metacognitive monitoring such as the feeling of knowing (FOK), but localization of brain activity associated with accurate metacognitive monitoring is still an unresolved problem. We examined the neural correlates of feeling of knowing (FOK) using fMRI after participants studied a list of 108 concrete paired associates. Memory strength was manipulated by presenting items once or three times during an encoding session outside the scanner, which has been shown to influence FOK accuracy. After a 48-hour delay, participants were scanned during cued recall and a separate block of FOKs using a 1-4 scale. Multiple brain areas were involved in FOK judgments, including medial prefrontal cortex (especially for high versus low FOKs), and we observed a double dissociation between accurate and inaccurate FOKs within the prefrontal cortex (ventromedial and dorsolateral prefrontal cortices, respectively).
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(1089)

Support for the Accessibility Account of Increased FOK Accuracy With Repetition. LAUREN W. JONES and DEBORAH K. EAKIN, *Mississippi State University*—Prior research showed that multiple repetitions of cue-target pairs increased feeling-of-knowing (FOK) accuracy, and suggested that repeated study resulted in accessibility to more cues that were diagnostic of recall than pairs studied once (Hertzog, Dunlosky, & Sinclair, 2010). FOKs were theorized to be based on accessibility to these diagnostic cues, resulting in more accurate FOKs. However repetition also could have increased both familiarity with the cue and target strength, confounding cue familiarity and direct access with accessibility as theoretical bases for FOKs. We created unique conditions to test each theory by repeating the cue-target, or by repeating only the cue or only the target. FOK accuracy increased with cue-target repetition, but FOK accuracy decreased in the cue repetition condition and did not vary in the target repetition condition, eliminating the cue familiarity and direct access views. Repetition of the cue-target pairs resulted in associative–and diagnostic–cues on which FOKs were based, supporting the accessibility view.
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(1090)

Remembering and Knowing: Using Another's Subjective Report to Dissociate Knowing and Familiarity. HELEN L. WILLIAMS, *University of Richmond,* CHRIS J.A. MOULIN, *University of Leeds*—In the Remember-Know paradigm, whether a Know response is defined as a high-confidence state of certainty or a low-confidence state based on familiarity has been found to vary across researchers (Geraci et al., 2009) and to influence participants' responding (McCabe & Geraci, 2009; Rotello et al., 2005). Previously (Williams et al., 2011) we have demonstrated that participants can reliably differentiate between memory experiences justifying Know- and Familiar-based recognition both in terms of confidence and other inherent differences. In our methodology, participants are not asked about their own memory experiences but are placed in the role of 'memory expert' and classify others' justifications of recognition decisions. The current experiments utilize the same methodology and demonstrate that, under certain conditions, manipulations of confidence shift how justifications are assigned to subjective experience categories. Findings are discussed in relation to the separation of Know and Familiar response categories in the Remember-Know paradigm.
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• HUMAN LEARNING AND INSTRUCTION I •

(1091)

When Do Analogies Promote Learning From Science Texts? ANDREW R. TAYLOR and JENNIFER WILEY, *University of Illinois at Chicago*—Embedding analogies within expository text is a popular instructional technique that many assume ought to improve learning of either the underlying scientific principles, the content specific to the target domain, or both. While findings on the effectiveness of learning with analogies have been mixed, so to have been the methods used to explore this question. Studies have differed, among other dimensions, on the length of the text used, the nature of the target concept, the position and complexity of the analogy, and the type of learning measure used. The goal of the current study was to identify conditions under which learning from text via embedded analogies might be particularly beneficial.
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(1092)

Theoretical Connections Between Particular Guided Cognition Tasks and Unsupervised Learning of Mathematics. WILLIAM B. WHITTEN II 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 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 interpret and work story problems, and also to execute calculations for non-story problems, and these improvements have persisted for six months. What are students learning from the various Cognitive Events that facilitates later problem solving for story problems and for numerical-only problems? We will show problem frames for each of four Cognitive Events and will describe what students may be learning from each Event that can facilitate problem interpretation and execution (as required by story problems) and that can facilitate problem execution (as required by numerical-only problems).
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(1093)

The Benefit of Spacing on Retention and Transfer of Mathematics Knowledge. KELLIE M. MULLANEY, *Iowa State University,* SAMUEL R. WHITE, *University of South Dakota,* SHANA K. CARPENTER, *Iowa State University*—Many studies have shown that spaced practice is better for memory than massed practice (e.g., Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006). This has been shown for the learning of many relatively simple materials, but recent research has begun to extend these benefits to mathematics learning (e.g., Rohrer & Taylor, 2006). The current study explored the effects of spacing on a novel type of mathematical problem, and sought to determine whether these benefits transfer to new problems that look different but that rely on the same basic steps in order to be solved. Participants learned how to perform a chi-square test with a 2-category scenario (e.g., proportion of males vs. females among the student body) by completing 5 different practice problems that either occurred back-to-back (Massed) or in-between a word search activity (Spaced). Two days later, as a measure of retention and transfer, respectively, participants were given novel 2-category problems as well as 3-category problems (e.g., proportion of Asian, African American, and Caucasian students among the student body). Spacing produced benefits for both types of problems.
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(1094)

Effects of Spacing and Interleaving on Inductive Learning. MONICA S. BIRNBAUM, *University of California, Los Angeles,* NATE KORNELL, *Williams College,* ROBERT A. BJORK and ELIZABETH L. BJORK, *University of California, Los Angeles*—Kornell and Bjork (2008) demonstrated that interleaved presentation of category exemplars led to better inductive learning of the categories than did blocked presentation of the category exemplars. Kang and Pashler (2012) found that study schedules facilitating contrast between categories (via temporal or simultaneous juxtaposition of different categories) enhanced learning, but spacing per se did not. The effects of varying spacing, however, have not been examined in conjunction with the benefits of between-category contrast. In the present research, we had participants learn sixteen species of butterflies, with the images presented in an interleaved manner; thus, creating temporal juxtaposition of exemplars from different species. Additionally, while we kept the number of between-category comparisons equated across conditions, we manipulated spacing between exemplars of the same species. Specifically, exemplars of a species were viewed either four or 16 items apart. We found that when combined with the benefits of interleaving, greater spacing was more beneficial to learning.
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(1095)

Paradoxes of Spacing: Effects of Mode of Second Presentation (Study or Test) and Retention Interval. MARY A. PYC and DAVID A. BALOTA, *Washington University in St Louis,* TIM TULLY, *Dart Neuroscience,* KATHLEEN B. MCDERMOTT and HENRY L. ROEDIGER III, *Washington University in St Louis*—We examined spacing effects under different conditions from most research and obtained a new pattern of results. Subjects learned face-name pairs to a 70% criterion and then received one further practice trial either immediately or after a one-day delay. The practice trial constituted either further studying or testing (without feedback) of all pairs. A final retention test was given either one day or one week after the final practice trial. Spacing had a larger effect at the long retention interval, but we observed an interaction of practice task (study or test) and spacing interval: Studying produced a greater benefit in the long spacing condition whereas testing was more beneficial in the short spacing condition. These results are unusual given the past literature yet can be readily interpreted within a distribution-based bifurcation model.
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(1096)

Goals Can Enhance Inductive Learning With Interleaved Study Schedules. MICHAEL C. FRIEDMAN, ALAN D. CASTEL and SHARON NOH, *University of California, Los Angeles*—While goal-based encoding strategies can enhance episodic memory, it is not known whether this approach can also facilitate inductive learning of categories, which is thought to involve more passive learning. We examined this using a value-based inductive learning task, in which participants studied different artists' "styles" in either blocked (one artist's paintings presented in sequence) or interleaved (exemplar paintings from the same artist spaced apart) learning schedules. Paintings were associated with different point values, and participants were instructed to remember the artists with higher point values. At test, participants were shown unstudied exemplars from the previously presented artists, and were asked to identify which artist painted the work. While no effect of point value was found in the blocked conditions, effects of value were found in the interleaved conditions. The results are discussed in terms of how goal-based processes can enhance inductive learning with certain types of distributed learning schedules.
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(1097)

Why Does Trying, and Failing, to Generate an Upcoming To-Be-Learned Response Facilitate its Later Recall? COURTNEY M. CLARK, ROBERT A. BJORK and ELIZABETH L. BJORK, *University of California, Los Angeles*—Successful generation of to-be-learned information bolsters memory, but error generation is usually thought to be harmful and is often discouraged in educational and training contexts. Recent findings (e.g., Kornell, Hays, & Bjork, 2009), however, have demonstrated that generating responses that turn out to be wrong can potentiate subsequent learning. Guessing wrongly, for example, that "toad" is the to-be-learned associate of "frog" facilitates, rather than impairs, the subsequent learning of the pair "frog-pond." In two experiments we explored the dominant interpretation of this effect—namely that generating a guess activates semantic features of the cue, which then facilitates associating the actual target to that cue. Consistent with that interpretation,

we found that generating errors on a non-semantic basis, such as rhyming, did not facilitate learning of the correct pairing. We also manipulated the response strength of generated errors via depth-of-processing tasks to determine whether strengthening errors makes them more or less competitive with the correct responses.
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(1098)

Could the Benefits of Trying, but Failing, to Predict a To-Be-Learned Response be an Artifact of the Experimental Materials? MICHAEL A. GARCIA, VERONICA YAN, YUE YU, ROBERT A. BJORK and ELIZABETH LIGON BJORK, *University of California, Los Angeles*—Using cue-target word pairs, Kornell, Hays, and Bjork (2009) found that asking participants to predict what would be the target for a given cue—rather than being allowed to spend the whole time studying the to-be-learned cue-target pair—actually enhanced later recall of the target, even when the prediction was incorrect. How can (a) reducing study time and (b) creating the conditions for proactive interference actually enhance recall? We examined whether a feature of the authors' experimental materials—namely, that the pairs were chosen so that participants' predictions were almost always wrong—could have contributed to participants being able to recall correct targets on the final test. Could they, for example, have been able to draw on the knowledge that their first guesses were always incorrect and that correct answers were always weak associates? In Experiment 1, we eliminated the potential rule that correct answers are never strong associates by intermixing weakly and strongly associated word pairs. In Experiment 2, we eliminated the rule that a generated guess is always incorrect by rigging half of the guesses to be correct. Neither change, however, eliminated the benefits of generating errors.
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• SELECTIVE ATTENTION I •

(1100)

Target Detection, but Not Reward, Enhances Memory for Concurrent Background Images. KHENA M. SWALLOW and YUHONG V. JIANG, *University of Minnesota*—Despite increasing attentional demands, detecting a target (such as an X) in a stream of distractors enhances memory for concurrently presented images. Although this advantage could reflect temporal selection, it could also result from reward associated with successfully finding a target. We examined whether rewarding stimuli influence memory for concurrently presented images. Participants counted targets presented in a stream of symbols. They also encoded concurrent images into memory. Critically, participants received a small cash award whenever a particular symbol appeared. Target detection enhanced memory for concurrently presented images. However, there was no evidence of a similar effect of rewarding symbols. This was true when the rewarding symbols were targets, when they were distractors, and when they signaled a monetary loss rather than gain. Reward did little to modulate the encoding of the background images, suggesting that the memory enhancement reflects attentional processes triggered by the occurrence of a goal-relevant event.
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(1101)

Object-Based Attention and Prioritization Examined by the Temporal Order Judgment Method. IAN DONOVAN, *The George Washington University,* JAY PRATT, *University of Toronto,* SARAH SHOMSTEIN, *The George Washington University* (Sponsored by Anew Leber)—Studies demonstrating object-based guidance of attention have mostly relied on spatial cuing, making it unclear the extent to which object representations, in the absence of attentional biases, guide attentional selection. Here, we address this issue by employing a novel method, measuring prior entry effects within a cueless temporal order judgment task. Results indicate that in the absence of spatial cuing, and when objects are task-irrelevant (targets appear equally on same- and different-objects), objects do not influence prior entry. However, when stimuli appear in the same-object more frequently, prior entry effects emerge for same-object trials only. These effects are due to object representations, and not biases in spatial attention, since prior entry is unaffected when different-object trials are more frequent. Importantly, these results suggest that objects do not guide attention in the absence of a spatial cue, providing further constraints on the mechanisms of object-based selection.
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(1102)

Picking a Flavor: Do Attentional Processing Strategies Abolish Oculomotor IOR? GREGORY H. MACLEAN, MATTHEW D. HILCHEY and RAYMOND M. KLEIN, *Dalhousie University*—Participants can preferentially filter events presented outside of task-relevant space. This filter, termed an "attentional control setting", has been shown to modulate the inhibitory aftereffects of cueing (Inhibition of Return or "IOR"). Further, IOR can be dichotomized into two semi-distinct "flavors"; one attentional and the other motoric. In the present study, peripheral targets requiring manual responses appeared on one axis (fostering a spatial ACS), and eye movements commanded by central arrow targets were used to measure the effects of cues presented on and off that axis. By mixing saccadic and manual target trials within blocks and presenting more manual than saccade trials, the effects of attentional control and global attentional processing strategies were tested. It was found that participants invoked a global attentional flavor of processing, shutting down the oculomotor system and abolishing saccadic IOR.
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(1103)

Implicit Learning and Inhibition of Return. JANICE J. SNYDER and SALMA KHEIRAVAR, *University of British Columbia, Okanagan*—Inhibition of return (IOR) is fundamentally considered to be a reflexive mechanism that increases search efficiency of the environment. However, there is considerable disagreement concerning whether IOR

can be modulated and if so, the degree to which it can be modulated. A recent debate concerns the degree to which IOR can be modulated with several studies reporting that implicit learning can modulate IOR (Decaix et al., 2002; Wolf et al., 2009; Wright & Richard, 2000). In these studies, cue predictiveness was manipulated such that target occurrence was not equiprobable at all locations. We assessed the extent to which implicit learning can affect IOR when the cues are non-predictive of target location but the target does not appear equally often at all locations. In a 4-location paradigm, the probability of target onset was lower at one of the locations by a factor of five relative to the other locations. IOR was not affected despite the fact that our manipulation worked – as evidenced by increased response times for target occurring at the low probability location and that most subjects were unaware of the manipulation. This finding demonstrates the primarily reflexive nature of IOR.
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(1104)

Revealing Visual Statistical Learning With Implicit Measures. ELIZABETH MUSZ, MATTHEW J. WEBER and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Is selective attention required for learning statistical regularities in a temporal sequence? Studies of attentional effects on learning have yielded mixed results, which may depend on the nature of the learned information. Here, we focus on the nature of the assessment of learning. We compared visual statistical learning of both attended and unattended stimuli using both explicit familiarity judgments and an implicit test that measures reaction times. The explicit measure showed the dissociation reported in prior literature, with attended regularities judged as more familiar than unattended ones. However, the implicit measure showed learning of both attended and unattended regularities across four variations of the paradigm. Our results suggest that, along with being an implicit, automatic learning phenomenon, visual statistical learning is not strongly constrained by selective attention. Furthermore, choice of dependent measure is important when assessing learning; familiarity judgments may not reflect the full extent of retained information.
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(1105)

Exploring Localized Attentional Interference in the Context of a Multiple Location RSVP Task. GARRETT S. SWAN and BRAD WYBLE, *The Pennsylvania State University*—Localized attentional interference (LAI) occurs when one stimulus in the visual field makes it more difficult to attend to a nearby stimulus. This effect is greatest at separations of one degree, and falls off with increasing separation (Mounts, 2000). LAI has not been extensively studied in paradigms involving temporal search, such as RSVP. In a series of 4 experiments, LAI was systemically measured in a multiple location RSVP paradigm. In Experiment 1, separation between targets varied from 1 to 8 degrees of visual angle in a design adapted from (Visser, Zuvic, Bischof, & Lollo, 1999). The results showed highest accuracy at proximal separations indicating that LAI was not present. In Experiment 2, we attempted an exact replication of Visser et al. (1999) and failed to replicate lag 1 data. In Experiment 3 the target size was increased in proportion to its distance from the fovea to compensate for reduced perceptual acuity in the periphery. The results demonstrated lag 1 sparing up to a separation of 7 degrees between T1 and T2. Experiment 4 included all conditions within the same block to minimize expectation effects. The data from Experiments 1-4 indicate that LAI is not present for categorically defined RSVP targets.
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(1106)

The Effects of Extended Practice on the Attentional Blink. GREGORY SIMMONS and JACQUELINE C. SHIN, *Indiana State University*—Cognitive control theories of the attentional blink (AB) phenomenon emphasize its malleability. Practice, attentional load, and meditation have been associated with a reduced attentional blink magnitude. The goal of the current study was to provide a detailed analysis of the way in which AB changes with extended practice. Participants performed 900 trials of a standard version of the AB task over the course of three consecutive days. Results will be presented with respect to effects of block and day on the identification of the two targets and their relative attentional weighting. Of particular interest is the time course of change for different components of the AB profile, namely, lag 1 sparing at the inter-target stimulus-onset asynchrony (SOA) of 100 ms, the "blink" at 200-400 ms SOAs , and "recovery" at 500-600 ms SOAs. The theoretical implications of these results will be discussed.
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(1107)

How Does Memory Search Interact With the Attentional Blink? TRAFTON DREW, ASHLEY M. SHERMAN and JEREMY M. WOLFE, *Brigham and Women's Hospital* (Sponsored by Todd Horowitz)—In Rapid Serial Visual Presentation (RSVP) tasks, observers typically look for a target (e.g. cow) in sequences of images. Suppose observers hold several distinct targets in memory (e.g. cow, spoon, or key). Observers must perform a hybrid search of memory and the RSVP stream. The SOA required to reach a criterion target detection rate increases linearly with the log of the memory set size (Drew & Wolfe, 2012, VSS). Suppose there are two targets, as in attentional blink (AB) paradigms. Here observers viewed streams of objects, looking for a member of the memory set and identifying another object, marked by a red frame. When the memory item was T2, larger memory set sizes decreased T2 performance at all lags, independent of the blink. If T1 was the memory item, larger memory set size produced bigger blinks. Memory search interferes with subsequent target identification.
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(1108)

Examining the Influence of a Spatially Irrelevant Working Memory Load on Attentional Allocation. GERALD P. MCDONNELL and MICHAEL D. DODD, *University of Nebraska, Lincoln*—The present study examined the influence of holding irrelevant gaze cues in working memory on attentional allocation. Gaze cues have been shown to shift

attention in the gaze-consistent direction, even when they are irrelevant to a primary detection task. It is unclear however, whether gaze cues need to be perceived on-line to elicit these effects. Across three experiments, participants encode a face (looking left/right) at the beginning of each trial, and then perform an unrelated target detection task, after which memory for the encoded face was tested via forced-choice recognition. Surprisingly, participants exhibited an inhibition-of-return effect at the longer cue-target SOAs, with responses to targets appearing at the non-gazed at location being faster than responses to targets at the gazed-at location. Given that gaze cues commonly lead to facilitation but not IOR, the present experiments provide an important dissociation between perceiving irrelevant spatial cues on-line vs. holding them in memory.
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(1109)

Failures of Selection Can Account For Color Flanker Effects. SERAP YIĞIT-ELLIOTT and JOHN PALMER, *University of Washington,* CATHLEEN M. MOORE, *University of Iowa*—To isolate attentional phenomena, we have been studying a version of the color flanker paradigm in which the target and flanker are both presented in the periphery and are distinguished by only an attentional cue. Under these conditions, there is a large "distance effect" in which the flanker effect occurs only for small separations between the target and flanker. We also manipulate the contrast of the stimuli and show that this flanker effect can be modeled as a failure of selection with no interactive processing such as response interference. Thus far, we have found these results for accuracy and are now investigating response time.
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• COGNITIVE CONTROL I •

(1110)

The Moderating Role of Mind Wandering in the Relationship between Physiological Stress and Cognition. THAD MEEKS and CHRISTOPHER B. ROSNICK, *Southern Illinois University Edwardsville*—Stress levels are often negatively related to cognitive performance. There are many factors, however, that could moderate this relationship. In the current study, we examined whether participants' levels of mind wandering moderated the relationship between physiological stress and cognition. Using an age-diverse sample, we administered various cognitive measures and asked the participants to rate how much their mind wandered specifically for each task. In addition, we collected saliva samples to assess two common physiological markers of stress (cortisol and alpha amylase). The results demonstrated that participants reporting high levels of task-specific mind wandering showed a negative relationship between physiological stress and processing speed/working memory performance. Participants that reported low levels of mind wandering did not show this same pattern. Thus, a lack of attentional focus is a key factor in the relationship between physiological stress and cognition, but only when the task is attentionally demanding.
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(1111)

Heavy Breathing Helps: Evaluating Two Brief Interventions for Overcoming Math Anxiety. TAD T. BRUNYÉ, CAROLINE R. MAHONEY and GRACE E. GILES, *Tufts University; U.S. Army,* DAVID N. RAPP, *Northwestern University,* HOLLY A. TAYLOR and ROBIN B. KANAREK, *Tufts University*—For individuals with math anxiety, regulating feelings of fear and tension in anticipation of math-demanding situations places substantial burdens on the ability to effortfully control attention. We ask whether two brief interventions targeted at reducing negative affect and enhancing attentional control would reduce the typical math testing deficits characteristic of those with high math anxiety. Participants with low versus high math anxiety performed a high-pressure arithmetic task after performing one of three short-term breathing exercises promoting focused attention, unfocused attention, or worry, and after consuming either 0 or 200 mg L-theanine. As expected, those with high math anxiety underperformed their low anxiety peers on: SAT/ACT math (but not verbal) subtest scores, the OSPAN working memory capacity test, and the high-pressure arithmetic task. This latter effect, however, was largely alleviated by the focused breathing exercise (but not by L-theanine supplementation). We propose that focused breathing exercises can be a useful, practical tool for overcoming math anxiety.
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(1112)

Survival Processing: The Effect of a Survival-Based Prime on Two-Back Performance. STEPHANIE A. KAZANAS and JEANETTE ALTARRIBA, *University at Albany, SUNY*—We investigated the effect of reading a survival passage prior to performing a two-back task. Studies have used this type of task to examine working memory and cognitive control (Gray, 2001; Lavric, Rippon, & Gray, 2003). Similarly, researchers investigating survival processing have reported a performance advantage for explicit memory-based tasks (Tse & Altarriba, 2010), but have not examined whether a survival-based prime can enhance both attention and memory. After reading a brief prime passage, participants determined whether a current letter's identity or position was the same as the one that appeared two letters ago. We predicted that participants reading a survival-based prime would perform better on the spatial two-back than the verbal two-back because of the relationship between spatial information and survival needs (e.g., the location of food, water, and predators). Effects are discussed with reference to survival processing and the demonstrated advantage to processing information within a survival context.
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(1113)

Effects of Fixation Duration and Working Memory Capacity on Exogenous and Endogenous Saccade Performance. CHAD MOFFITT and KEITH A. HUTCHISON, *Montana State University*—In the antisaccade task, a centrally located fixation point is presented for a variable duration prior to a peripheral distractor cue to prevent participants from predicting the distractor's temporal onset. However, the fixation point's duration could influence alerting, preparatory attention, and vigilance processes. Two experiments tested the prediction that increasing the fixation duration during saccade tasks will differentially impact performance for individuals higher and lower in Working Memory Capacity (WMC). In both experiments, correlations between WMC and antisaccade accuracy increased across delay. In Experiment 1, high span individuals increased antisaccade accuracy with increasing fixation duration whereas low spans showed no such benefit. In Experiment 2, we included prosaccade trials. Both groups reached asymptotic performance faster for prosaccade than antisaccade trials. However, high spans' prosaccade performance remained stable from medium to long delays whereas low spans' performance decreased. The necessity of attentional control in generating and maintaining planned prosaccade and antisaccade responses over a delay are discussed.
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(1114)

Electrophysiological Evidence for Increased Response Competition. TIM P. MORAN, JASON S. MOSER and ERIK M. ALTMANN, *Michigan State University*—Working memory is thought to be necessary for actively maintaining task priorities in the presence of task-irrelevant distractors that are strong competitors for the control of action. Behavioral studies examining distractor interference under working memory load have generally been consistent with this hypothesis. However, behavioral responses are limited in their ability to shed light on those specific processes affected by working memory load due to their poor temporal resolution. The current study examined two ERP measures during performance of a flanker task interleaved with a working memory task with variable load. The N2, an index of response competition, revealed a greater effect of incongruent distractors in the high load condition relative to the low load condition, suggesting increased response competition under high load. Slow-wave potentials, an index of memory retention, predicted the degree to which working memory load enhanced the N2. Thus, these data directly link working memory operations to processes that manage response competition.
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(1115)

Block-Wise Conflict Adaptation of Visual Selectivity: Role of Hemisphere-Dependent and General Location-Specific Mechanisms. KEI KURATOMI, *Aichi Shukutoku University,* JUN KAWAHARA, *Chukyo University,* KAZUHITO YOSHIZAKI, *Aichi Shukutoku University*—Two experiments examined the existence of the hemisphere-dependent mechanism of visual selectivity. In each experiment, sixteen participants completed the flanker task with compatible/incompatible arrays presented to the left, center, or right visual-field. The relative frequency of conflict trials in a block varied as function of visual-field. In Experiment 1, the conflict frequency in the lateral visual-fields was manipulated (75%/25%), whereas it was constant in the central visual-field (50%). Results showed that, in the lateral visual-fields, the RT difference in compatible/incompatible trials was larger in the low conflict condition than in the high conflict condition. In Experiment 2, conflict frequency in the central visual-field was manipulated and was constant in the lateral visual-fields. Results showed that the block-wise adaptation appeared in both the central visual-field and the lateral visual-fields. These findings suggest that visual selectivity adjustment dependent on conflict frequency is associated with hemisphere-dependent as well as location-specific mechanisms.
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(1116)

Measuring Hemispheric Interaction During an Inhibitory Task. ANDREY MARKUS and ZOHAR EVIATAR, *University of Haifa*—The accepted view within the schemata-driven behavior hypothesis (Shallice & Burgess, 1993; Stuss, 1995) is that a cross-domain cognitive inhibitory mechanism acts as part of a high level supervisory system. It was further suggested (Aaron & Poldark, 2004) that a major component of a general inhibitory mechanism is situated in the right hemisphere. The current work challenges this view. A combination of Logan's (1984) Delayed Stop Signal Task and Divided Visual Fields was used to examine a possible Right Hemisphere advantage in responding to a stop signal. The first experiment showed no right hemisphere advantage in stop signal processing. The second experiment indicated that a short-term shift in the inhibitory ability of each hemisphere can be caused by a failure to inhibit a response in a preceding trial. These findings are consistent with the view that response inhibition is caused by schemata competition rather than by a dedicated mechanism.
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(1117)

What Can You Expect From Boosting Prefrontal Cortex? NAZBANOU NOZARI and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Anodal transcranial direct cortical stimulation (A-tDCS) can modify behavior by enhancing cortical excitability. We investigated the scope of the effects of left prefrontal A-tDCS using a working memory (N-back task, N=1-3) and a verbal selective attention task. In the verbal task, participants recited 4-word tongue twisters, with one or none of the words highlighted. Errors were specifically discouraged on the highlighted words. Results were compared to sham and a different stimulation site (M1). Prefrontal A-tDCS decreased response latencies in all levels of the N-back task, and reduced errors on the 2-back. In the verbal task, error rates were decreased on the highlighted words. A-tDCS, however, did not change error rates on tongue-twisters with no highlighted words or on the 1 or

3-back levels. We conclude that boosting prefrontal cortex is beneficial only when the task poses clear executive demands, so long as those demands are not too high.
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(1118)

Why Don't Stroop-Like Measures Correlate? Ask a Monkey. DAVID A. WASHBURN, NATASHA B. SCHULTZ, HOLLY A. PHILLIPS and JESSICA BRAMLETT, *Georgia State University*—Stroop-like tasks measure the capacity to maintain attentional set and to select one stimulus or dimension despite competition from other prepotent cues. However, the important derived measures of how responding is compromised by incongruous conditions tend to correlate only modestly across color-word, spatial, numerical, and similar Stroop-like tasks. Research using Stroop-like tasks with rhesus monkeys shows that incongruity is not a categorical variable, but rather is a continuous function of stimulus and contextual variables. Additional variance is accounted for when separate measures of Stroop-like incongruity effects are calculated for these contextual contributions to response time, increasing the overall correlation between Stroop-like tasks significantly. When these same computations were used to examine the relation between multiple Stroop-like responses by human participants, the correlation between the measures of attention control was similarly improved. These data suggest that disruption in Stroop-task responses from incongruous conditions is a better index of cognitive control if one takes into account the contributions to variability by the executive, environmental, and experiential constraints of the tasks.
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(1119)

A Comparison of PTSD and Normal Adults Using Whole Brain Network Science Based Analyses of Resting State fMRI. PAIGE L. ROSEMAN, *Wake Forest University,* JENNIFER STAPLETON, *Wake Forest University School of Medicine,* JARED A. ROWLAND, *W.G. (Bill) Hefner VA Medical Center,* DWAYNE GODWIN, *Wake Forest University School of Medicine,* KATHERINE TABER, *W.G. (Bill) Hefner VA Medical Center,* PAUL LAURIENTI, *Wake Forest University School of Medicine,* DALE DAGENBACH, *Wake Forest University*—The default-mode network, a set of brain regions that exhibit functional connectivity at rest, may be altered in individuals with post-traumatic stress disorder (PTSD). Prior functional connectivity studies have employed a region-of-interest approach to identify a specific region of the default-mode network such as the posterior parietal cortex (PPC), and examined functional connections between that region and all other nodes in a 90-node network. Bluhm and colleagues (2009) used this approach to find that in seventeen patients with chronic early life PTSD, PCC/ precuneus connectivity was significantly decreased in brain regions previously associated with PTSD, including the right amygdala and the hippocampus. In the current study, we examined functional connectivity across the entire brain during resting state in veterans with PTSD and healthy controls sampling from 20,000 nodes. Among other differences, we found that whole-brain mean global efficiency varies between the groups.
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• SPEECH PERCEPTION I •

(1120)

Attentional Grouping Affects Rate Normalization: Priority of Speech over Nonspeech Precursors. NATHAN R. LARGE, JAMES T. MANTELL and JAMES R. SAWUSCH, *University at Buffalo, SUNY*—The classification of initial stop consonants varying in voice onset time (VOT) is influenced by the speaking rate of preceding speech (Summerfield, 1981). Rate normalization effects have also been demonstrated with preceding nonspeech tone patterns (Wade & Holt, 2004; Mantell & Sawusch, 2010). Whalen and Liberman (1987) proposed that the effect of a nonspeech context is reduced or eliminated by preceding natural speech. The present study examined the relative effects of two successive precursors (distal and proximal) on a VOT test series. Using natural speech as the distant precursor and tones as the proximal precursor context, only the rate of the distal natural speech had a direct effect on phonetic classification. In contrast, for two successive talkers, the proximal speech rate had the major influence on listener perception. These results are discussed as reflecting effects of perceptual grouping, including an effect of attention to speech over nonspeech auditory stimuli.
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(1121)

Combining Cues to Recognize Speech: Acoustic Measurements of Phonetic Cues to Word-Medial Voicing. JOSEPH C. TOSCANO, *University of Illinois at Urbana-Champaign,* BOB MCMURRAY, *University of Iowa*—A critical issue in perception involves understanding the nature of the perceptual cues used for categorization. This is particularly evident in speech perception where a large body of work has argued that invariant acoustic cues do not exist, leading many researchers to conclude that specialized representations, such as talkers' intended gestures, are used instead. Here, we propose that variability in speech can be overcome by combining multiple cues. We recorded talkers producing six different stop consonants (/b,p,d,t,g,k/) in the context of four different vowels (/a,ae,i,u/) in non-sense two-syllable words (/sVCVs/) and asked how well listeners could potentially distinguish between voiced and voiceless sounds on the basis of a set of 12 cues. We found that talkers used multiple cues to distinguish these categories and that a classifier trained on the cues was able to categorize the sounds accurately. We argue that by harnessing information from multiple cues, listeners can handle ambiguity in individual cues in specific utterances, allowing them to recognize speech across a range of talkers and phonological contexts.
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(1122)

Distributional Learning in Categorization of Speech and Non-Speech Sounds. MEGAN M. KITTLESON and JESSAMYN SCHERTZ, *University of Arizona,* RANDY DIEHL, *University of Texas,* ANDREW J. LOTTO, *University of Arizona*—Listeners learn sound categories in language through exposure to distributions of exemplars varying on multiple dimensions and must learn to use one or more acoustic features to categorize stimuli into discrete categories. However, what listeners pull from the distributional information and how they weight different acoustic dimensions are not well established. We initially investigated what strategies participants used to categorize arbitrary, overlapping distributions of "chirp-like" non-speech sounds. Listeners were able to establish near optimal categorization boundaries rapidly and demonstrated a remarkable ability to shift these boundaries when the underlying distributions changed – even when these changes were not explicitly signaled. In further work, we examined categorization in two dimensions, which requires learners to properly "weight" the two dimensions in the final categorization decision. This kind of dimension weighting is necessary for learning novel sound distinctions in a second language. The present work demonstrates the importance of the structure of variability in the training distributions on the ability to of learners to derive the most efficient weightings.
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(1123)

Predicting the Effects of Carrier Phrases in Speech Perception. A. DAVI VITELA, K. NICO CARBONELL and ANDREW J. LOTTO, *University of Arizona*—It has been known for over 50 years that listeners will change their identification of a constant target word when it is preceded by a carrier phrase produced by different talkers. This phenomenon has been taken to be diagnostic of processes that tune perception to the specific vocal characteristics of the speaker. However, it is still not clear what information listeners are extracting from the carrier phrase and whether this information is essential for accurate perception. In a first set of experiments, carrier phrases were created using a vocal tract synthesizer that allowed precise control over the characteristics of the speaker. The "speakers" and carrier phrases were varied to determine whether target perception was indeed a function of speaker. A second set of experiments utilized degraded speech to investigate the importance of carrier phrases on accurate phoneme perception. The results of these experiments suggest that, while the presence of carrier phrases can enhance perceptual accuracy, the shifts in target perception are not strongly tied to speaker differences and that the effects may be due to more general aspects of the acoustic signal. [Work Supported by NIH-NIDCD.]
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(1124)

The Influence of Phonotactic Probability on Lexical and Sublexical Processing. ELENI PINNOW, ALEXANDER WOLDEN and JENNA OSTERLAND, *University of Wisconsin, Superior*—Two experiments addressed the role of phonotactic probability in speech perception. The first experiment used multi-syllabic words with an initial syllable that varied by two factors: phonotactic probability (high or low) and lexical status (words or fragments). In a cross modal priming task, word initial high phonotactic probability syllables produced equivalent priming regardless of the syllable's lexical status. Initial low phonotactic probability syllables differentially influenced recognition: fragments inhibited subsequent recognition while words yielded a large priming effect. In Experiment 2, two sets of stimulus pairs were formed; stimuli varied by word-initial phonotactic probability and lexical status. One set contained pairs of words (cap/gap) another contained pairs of nonwords (caz/gaz). Participants were asked to identify the initial phoneme, which had been overlaid with noise. More low phonotactic probability phonemes were identified in the nonword/nonword pairs. In contrast, in the word/word pairs showed elevated rates of high phonotactic probability phoneme identification. These results suggest that phonotactic probability has significant influence at both a sublexical and lexical level.
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(1125)

What's That, Doc? Memory for Medical Information Presented With a Foreign Accent. JESSICA E.D. ALEXANDER, KRISTEN E.T. MILLS, KELLY B. ELLISON and CHANNING D. DANIELS, *Concord University*—Difficulties in perception can result in benefits for memory. In a previous study, we found that foreign-accented speech functions as a desirable difficulty, increasing recognition memory for words spoken by accented speakers compared to those spoken by native speakers. However, when listeners are required to remember more difficult information, accented speech may be less desirable. In the current study, listeners heard native and foreign-accented speakers reading information about medical diagnoses and treatments. Accented speakers were rated as less educated and trustworthy, and participants indicated that they would be less likely to follow their directions than those of native speakers. Additionally, listeners remembered fewer details of the information read by the accented speaker. However, there were no memory differences for detailed, but non-medical, instructional passages. Doctors and patients who do not share the same language background may have communication problems that can interfere with patients understanding and remembering information about their conditions and treatments.
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(1127)

The Role of Training Structure on Perceptual Learning of Accented Speech. CHRISTINA Y. TZENG and LYNNE C. NYGAARD, *Emory University*—The present study examined the role of training structure on perceptual learning of accented speech. During training, native speakers of American English transcribed sentences spoken in English by four Spanish-accented speakers. Training stimuli were grouped by speaker, sentence, or randomized with respect to sentence and speaker. When grouped by speaker, the order in which listeners heard sentences spoken by high- and low-

intelligibility speakers was also manipulated. At test, listeners transcribed novel sentences produced by four unfamiliar Spanish-accented speakers. Transcription performance at test varied as a function of the organization of training materials such that transcription was more accurate when sentences were randomized during training than when sentences were grouped by speaker. Performance when materials were grouped by sentence was intermediate. Trial-to-trial variation across speakers and sentences during training seemed to facilitate the perceptual learning of accent-general properties of speech, allowing generalization of learning to unfamiliar accented speakers and sentences.
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(1128)

Both Speech Rhythm and Speech Rate Affect Word Segmentation and Lexical Recognition. TUULI H. MORRILL, LAURA C. DILLEY and J. DEVIN MCAULEY, *Michigan State University,* MARK A. PITT, *The Ohio State University*—Lexical segmentation and recognition require chunking phonetic material into candidate words, processes which are affected by context speech rate (Dilley & Pitt, 2010, Psychological Science). We investigated whether speech rhythm, a salient chunking cue, influences the recognition of monosyllabic function words (FWs). Experimental items were sentences containing a critical FW, which was grammatically non-obligatory (e.g., "our" in Leave some cake for those guests who are our friends). Speech resynthesis was imposed on each item to create (1) five levels of context speech rate and (2) two levels of context speech rhythm (an alternating high-low, binary pitch pattern or an alternating high-low-low, ternary pitch pattern). The acoustics of the critical FW-containing region were constant across resynthesized manipulations. Thirty-one participants transcribed each item. Results revealed that speech rhythm affects reports of the function word independently of context speech rate. Findings support a role for linguistic speech rhythm in word recognition.
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(1129)

Can Listeners Use Creaky Voice to Constrain Lexical Interpretation? ALISON M. TRUDE and SARAH BROWN-SCHMIDT, *University of Illinois at Urbana-Champaign* (Sponsored by Kara Federmeier)—Creaky voice is a phonation type prevalent among young women. Because creakiness is non-contrastive in English, listeners may not encode the contexts of use; thus, information about when a talker creaks might not be used to constrain speech perception. To test this hypothesis, 34 participants heard a female talker who either never creaked, or only creaked on words ending in –ag. Eye gaze was monitored as participants viewed pictures of an –ag-word (bag), –ack-word (back), and two fillers. If participants in the creaky condition learn the creak context, on –ack-target trials, they should rule out the –ag-competitor more easily than participants in the no-creak condition because of the different phonation types used. Despite a baseline preference for the –ag-competitor, participants ultimately fixated the target more in the creaky condition than the no-creak condition, suggesting listeners track creaky voice in a context-specific manner and use it to guide spoken word recognition.
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• PSYCHOLINGUISTICS I •

(1130)

ERPs Reveal Individual Differences in Syntactic Processing Strategies. DARREN TANNER and JANET G. VAN HELL, *The Pennsylvania State University* (Sponsored by Wouter Duyck)—Although many studies using event-related potentials (ERPs) have shown that morphosyntactic violations elicit robust P600 effects in native speakers, grand-mean analyses typically used in these studies obscure individual variation in response profiles. Here we use ERPs' multidimensional sensitivity to investigate individual differences in syntactic processing strategies. Participants read sentences, which were either grammatically correct or contained a subject-verb agreement violation. Violations were realized lexically via a suppletive auxiliary verb (e.g., is/are), such that both syntactic (agreement features) and lexical (wordform) cues signaled the violation. Whereas grand mean results showed only a reliable P600 effect, the true distribution of brain responses varied along a continuum between N400- and P600 dominant effects. Correlations with behavioral measures implicate lexical processing speed and cognitive control in predicting relative dominance of lexically (N400) and syntactically dominant (P600) brain responses across individuals. We discuss our results in terms of monolingual and bilingual sentence processing models.
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(1131)

Syntactic Priming of Noun-Attached Modifiers. MATTHEW J. TRAXLER, MEGAN A. BOUDEWYN, MEGAN ZIRNSTEIN and TAMARA Y. SWAAB, *University of California, Davis*—Eye-tracking and ERP experiments investigated syntactic priming during comprehension of temporarily ambiguous sentences. Previous studies indicate that processing of reduced relative, modifier-goal, and prepositional-object/double-object dative sentences is facilitated by a structurally related prime sentence. These experiments demonstrated similar facilitation for sentences containing "verb-noun" attachment ambiguities. In an eye-tracking experiment, reading times for sentences containing a "verb-noun" attachment ambiguity were shorter when the target sentences followed a structurally identical prime. In the first ERP experiment, "noun" attached modifiers generated a larger N400 than did "verb" attached modifiers. In the second ERP experiment, "noun" attached target sentences following "noun" attached primes elicited a smaller P600. In the third ERP experiment, similar effects were obtained for "modifier-goal" ambiguities. These results show that syntactic priming effects in comprehension extend to sentences containing noun-attached prepositional-phrase modifiers.
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(1132)

Language is Automatically Activated When Viewing Pictures. SARAH CHABAL and VIORICA MARIAN, *Northwestern University*—We examined whether visual objects automatically activate their linguistic labels. English-speaking participants completed a visual search task in which no overt linguistic information was provided (i.e., all cues were pictorial). Participants were shown an image of a target object (e.g., a chair), and were asked to locate that object among an array of four images while their eye-movements were tracked. In Competitor trials, the search display contained an item whose name overlapped phonologically with the name of the target (e.g., chair-chain); in Control trials, no items in the display overlapped phonologically (e.g., chair-bone). Results demonstrated that participants looked more often and for a longer duration of time at competitor items whose names overlapped phonologically with the target than at items that did not overlap phonologically. Because competitor and target items shared only word-initial phonological overlap, and because this phonological overlap was never overtly presented, these results suggest that the linguistic labels of visually presented objects are automatically activated. Our results demonstrate the pervasiveness of language activation and illustrate the tight coupling of language and sensory processing.

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(1133)

Small Elephants and Big Needles: Can Perceptual Information Affect Memory and Semantic Judgments about Words? NATALIE A. KACINIK, *Brooklyn College,* CUNY, KENDALL J. ESKINE, *Loyola University, New Orleans,* LOLLY STARR-GLASS and ISABEL RODRIGUEZ, *Brooklyn College, CUNY*—There is considerable evidence that representations of word meaning are "embodied" and grounded in our perceptual and motor experiences (Barsalou, 2008; Glenberg, 2010; Hauk et al., 2004; Zwaan et al., 2002). The majority of this research has relied on priming and interference procedures, or on measuring or manipulating brain activity. The present study involved manipulating the perceptual appearance of words, specifically font size, to be congruent or incongruent with an object's actual size (e.g., elephant presented in a large or small font, respectively). Participants were presented with the words prior to engaging in a recognition memory test and property judgment task, in the same session and after a 2-week delay, to see if the perceptual information like would be incorporated into the representations of words to potentially alter participants' memory and judgments. The font size manipulation generally did not have significant effects on how participants represented and processed the words. Hence, these results present a challenge for embodied accounts of word meaning, but some potential issues and explanations will be discussed.

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(1134)

Lexical and Semantic Processing in Healthy Aging and Early Stage Alzheimer's Disease. ANDREW J. ASCHENBRENNER and DAVID A. BALOTA, *Washington University in St. Louis,* CHI-SHING TSE, *The Chinese University of Hong Kong,* MELVIN J. YAP, *National University of Singapore,* ROGER RATCLIFF, *The Ohio State University*—University students, middle aged, young-old, old-old, and early stage Alzheimer's disease (AD) individuals participated in a lexical decision task, LDT, and/or a semantic verification task, SVT. Ex-Gaussian analyses of the LDT indicated that age influenced both the modal portion and the slow tail of the RT distribution, whereas, AD status primarily influenced just the tail. In contrast, analyses of the SVT indicated that age and AD status influenced both parameters. Diffusion model analyses of the LDT indicated that drift rate was relatively uninfluenced by age, but was influenced by AD status, whereas, boundary separation was strongly influenced by both age and AD status. In contrast, SVT produced a large influence of age and AD status on drift rate, and a relatively small effect on boundary separation. Discussion focuses on different influences of age and AD status on lexical, semantic, and attentional control processes.

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(1135)

The Effects of Semantic Richness on Word Recognition. STANISLAV SAJIN and CYNTHIA CONNINE, *Binghamton University, SUNY*—Lexical access of spoken words has largely been assumed to happen before a listener extracts the meaning of words. Four experiments show that semantic richness, defined as the number of properties associated with a concept, plays a role in word recognition. In two lexical decision experiments, subjects showed faster reaction times for words that are semantically rich relative to less semantically rich words. Two subsequent experiments using the Visual World Paradigm (VWP) showed that word recognition is modulated by semantic richness during the process of selecting among onset competitors. That is, semantic richness influences are found early in word recognition when one is presented with input that creates ambiguity.

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(1136)

Distinctive Neural Correlates of Morphosyntactic Processing of Chinese Nouns and Verbs. XI YU, *University of Hong Kong,* ZAIZHU HAN, YANCHAO BI and CHAOZHEN ZHU, *Beijing Normal University,* SAM PO LAW, *University of Hong Kong*—Identifying distinct neural correlates of nouns and verbs processing at semantic and morpho-syntactic levels is difficult in languages rich in inflection morphology as each lexical item carries both semantic and morphological properties. Chinese has little inflection and its morphosyntactic operations mainly involve morphosyllables including aspect markers for verbs and nominal classifiers for nouns. Yu et al. (2011) found greater activation for verbs than nouns in LpSTG&MTG across semantic tasks and the current study explored neural substrates of Chinese morphosyntax by contrasting these two types of processes. In a sentence grammaticality judgment task, aspect markers induced greater activation in LIFG (boundary between BA45 and BA47) and right precentral, in addition to LpSTG&MTG, while processing of classifiers was associated with two LIFG regions (BA 45, BA 47) as well as bilateral calcarine and lingual gyri. These results thus reveal distinctive neural bases underlying Chinese noun and verb processing at different linguistic levels.
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(1137)

Cognitive Motivation for Word Senses Shared across Chinese and English. HUICHUN ZHU and BARBARA C. MALT, *Lehigh University*—Polysemy refers to the phenomenon of one word possessing different but related senses (e.g., head in "person's head," "head of the company," and "head of the table"). We examined the cognitive motivation behind polysemy using a cognitive and cross-linguistic approach. Participants performed property and association listing tasks for 36 common words. We tabulated the number of times each property or association was listed to determine which are most salient. We then investigated the extent to which polysemous senses of those 36 words are shared in English and Chinese, two historically unrelated languages. For each of the 36 words, native speakers of each language freely sorted 30 short sentences in their native language into clusters representing unique word senses. English-Chinese bilinguals then judged the extent to which the identified senses are shared between the languages. Outcomes from the cognitive tasks predicted those of the linguistic tasks. Shared senses between the languages are more likely to be motivated by properties/associations that are listed by more participants. We propose a cognitive model for polysemy, which explains and predicts word sense extensions within languages and sense sharing across languages.
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(1138)

Lexical Integration Without Meaning or Sleep. EFTHYMIA KAPNOULA, STEPHANIE PACKARD, KEITH APFELBAUM, BOB MCMURRAY and PRAHLAD GUPTA, *University of Iowa*—Previous work on word learning has highlighted the importance of sleep-based consolidation (Gaskell & Dumay, 2003; 2007) and meaning (Leach & Samuel, 2007) for novel words to start interacting with other words and phonology. In this study we examined word-form learning by looking at lexical competition between novel and known words. Following a 15 min nonword training session, we evaluated whether newly learned words can compete with previously known words during online word recognition. Participants heard word stimuli that were made by cross-splicing novel with known words (e.g., nept) and the activation of the target word was assessed using the visual world paradigm. We found that meaningless novel word-forms can engage in competition with previously known words with as little as 15 minutes of training. These results indicate that lexical integration is initiated very early in learning and does not require associations with semantic representations or sleep-based consolidation.
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• CONCEPTS AND CATEGORIES I •

(1139)

Hysteresis in Categorization: Fuzzy Logic Makes Fuzzy Boundaries. THOMAS M. CRAWFORD, JUSTIN FINE and DONALD HOMA, *Arizona State University*—The present experiments sought to provide some evidence that category boundaries may be affected by method in which stimuli are presented to the participant. An initial experiment trained participants on a single category defined by a single continuous dimension. They were then shown stimuli, which differed along that single dimension, however, the method of presentation began from one extreme of the relevant dimension and subsequent stimuli gradually altered along that dimension towards the alternate extreme. At each presentation, participants responded whether or not the stimulus belonged to the trained category. A secondary experiment built upon this initial experiment, but allowed a random stimulus presentation method for comparison. Multiple stimulus sets, which differed across unique, single, continuous dimension were used. Two stimuli were shown to define the two responses and were then presented the test stimuli in several methods: two methods started from one extremes of the dimension and slowly progressed to the other while the last method was random. A third experiment copied the second, save that participants gave graded responses. In general, responses were biased as a result of the method of presentation.
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(1140)

Interest-Relative Extension. STEVEN VERHEYEN, WOUTER VOORSPOELS and GERT STORMS, *University of Leuven*—Which items one selects from among a set of candidates may differ from individual to individual. The question we aim to answer is how to determine the interests individuals had in deciding to select particular items. To this end, we propose to use a computational model that assumes that inter-individual selection differences arise from two sources. (i) Individuals can have different interests,

which make them employ different criteria for inclusion. (ii) Individuals who have the same interest may differ in the extent to which they require items to meet these criteria to be selected. The model is tested with respect to inter-individual differences in the extension of 10 ad hoc and goal-derived categories. We find that the model carries far in accounting for the inter-individual extension differences that were observed for the categories. Moreover, we are able to interpret the model parameters by relating them to criteria that are frequently thought of in the context of these categories. In sum, these results suggest that the proposed model allows one to infer from mere choice behavior the interests individuals had in selecting/discarding items.
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(1141)

Visually Evoked Potentials Sensitive to Perceived Fat Content of Food Items. MARY BRODHAGEN and SARAH BJORK, *University of Wisconsin, Stout,* MICHAEL P.W. DONNELLY, *Unaffiliated,* RYAN KUCKSDORF and DESIREE BUDD, *University of Wisconsin, Stout* —We explored how a person's belief about the fat content of a given food item, previous dieting behavior, and intrinsic motivation (measured by the BIS/BAS scale) influences their neuro-cognitive processing of food items as measured by visually evoked potentials. Participants saw 120 food items preceded by a descriptive label. Thirty food items were each seen twice, once preceded by a label indicative of high fat content (e.g. cookies) and once preceded by a low fat label (e.g. low fat cookies). Participants rated each food item for liking and desirability. High fat labeled items were generally liked and desired more. Two VEP components correlate with these ratings, one beginning ~300 msec post stimulus and another component at ~165 msec post stimulus. Our contention is that these reflect alterations in fairly early perceptual processing.
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(1142)

Skipping Probability of Orthographically Familiar Words Depends on Word Length. MICHAEL ESKENAZI and JOCELYN R. FOLK, *Kent State University*—An eye tracking experiment was conducted to examine the influence of word length and orthographic familiarity on the probability of word skipping during silent reading. Previous studies have found no effect of varying orthographic familiarity on word skipping, but those studies did not systematically vary word length. There is also contrasting evidence as to the role of foveal load on skipping probability. The current study varied orthographic familiarity (high and low), word length (three and five letters), and foveal load (high and low) and examined their effects on word skipping probability. An interaction was observed indicating that orthographic familiarity does not affect the skipping probability of five letter words, but three letter words are skipped more often in the high orthographic familiarity condition. Foveal load did not affect the skipping rates of the target words. We also observed differences on several eye movement measures between skilled and less-skilled readers.
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(1143)

Tapping Conceptual Representations of Object Shape and Size via Repetition Priming. ROBYN T. OLIVER, JASMINE L. RAYMAN-KINNEY, SAM T. MACY, NICHOLAS F. HARTLEY, TARA S. TRESSEL, and LEXI A. CARLILE, *Roosevelt University* (Sponsored by Irene Kan)—Sensorimotor-based distributed models suggest that conceptual information is stored with the sensory and motor processors used during acquisition. Although object shape and size may seem to be visual attributes, these attributes could be learned partly through spatial processing, tactile processing and processing integral to appropriately grasping objects. Given that object shape and size could be acquired similarly, these attributes may share part of their representation. However, another possibility is that these attributes may rely differentially on each of these processors and are, therefore, more distinct. In this study, repetition priming was employed to assess the overlap in the representation of object shape and size. Subjects were asked to respond to verbal questions about the sizes and shapes of a series of objects during an initial exposure phase and a later test phase of the experiment. Cross-attribute priming was observed between object shape and size, suggesting that these attributes share representation.
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(1144)

Social Categorization and the Cross-Race Effect: A Dual Process Exploration. SARAH B. DAILEY and CURT A. CARLSON, *Texas A&M University, Commerce*—We tested the categorization-individuation model (CIM) of the cross-race effect (CRE), comparing both recognition accuracy and estimates of recollection for same-race (SR) and other-race (OR) faces that belong to either a social in-group (IG) or out-group (OG). The IG/OG manipulation was achieved by displaying faces in front of a classroom (IG) or prison cell (OG). Each face was also paired with a name, in order to uniformly encourage individuation of the faces, and provide us with a richer measure of recollection than previously used. Based on the CIM, which theorizes that the automatic categorization of faces reduces the encoding of individuating information, we predicted that an interaction would occur, reflecting both a recognition advantage and greater recollection of individuating information for SR, IG faces. Results supported this hypothesis, but only for white participants. The data were also submitted to ROC analysis, as an alternative means of illustrating the CRE.
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(1145)

A Snake Wiggle of Reaction Time Functions to Indicate Holistic Perception. MARIO FIFIC, *Grand Valley State University*—We analyzed the underlying fundamental processes engaged in forming holistic perceptual representations. The subjects participated in a face categorization task over multiple sessions. We applied the systems factorial technology (SFT) to analyze the properties of the observed response time (RT) distributions. The key statistic was a survivor interaction contrast function (SIC). Over the course of extensive practice, the observed SICs

exhibited a specific pattern of shape transformations that could be described as a "snake wiggle". The observed SIC signature indicated that the processing mechanism behind holistic perception relies on strong positive facilitation between feature detectors, within the parallel mental network. The converging evidence is provided by the additional qualitative RT test (Fific, Little & Nosofsky, 2010).
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• LETTER AND WORD PROCESSING I •

(1146)

Semantic Processing of Unattended Words in the Periphery. YAAKOV HOFFMAN and ARI ZIVOTOFSKY, *Bar Ilan University*—In the gender congruency task (a Stroop-like task), subjects are shown either a male or a female stick figure together with either a congruent or incongruent word ("male" or "female"). Subjects were required to name the figure via a button press as accurately and quickly as possible, while ignoring the word. The visual stimulus appeared for only 180 ms, which is well before the subjects could have saccaded to the image. Figures appeared in one of four locations, and the word could appear on either side of it, for a total of 7 locations (center, parafoveally x 2, and peripherally). Both behavior and eye-tracking data were recorded. Results reveal that incongruent unattended words were processed differently than congruent words at center, parafoveal and peripheral locations. Data indicate that unattended words can be read and processed peripherally and that the conflict may be identified already at fixation.
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(1147)

Think Before You Speak: Pre-Stimulus Preparation for Word Recognition. SYLVAIN MADEC, ARNAUD REY, PIERRE COURRIEU, RÉMI KONIECZNY and JONATHAN GRAINGER, *Université de Provence*—When does the processing of the same visual information start to differ depending on task demands? To address this issue, event-related potentials (ERPs) were recorded for 53 participants who had to read aloud a set of 200 target words in four different task contexts (naming, lexical decision, semantic categorization and one-back tasks). In naming, they simply had to read aloud the target words while in the remaining tasks, reading aloud was conditioned by a decision process. We found an early divergence in the ERPs in simple naming compared to tasks requiring a decision. The earliest differences even started before stimulus onset. This result suggests that pre-stimulus brain activity is already shaped by task demands. This finding is consistent with the old functionalist view according to which visual processing is an active process, "the real beginning is with the act of seeing" (Dewey, 1896).
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(1148)

Reconsidering the Automatic Spreading Activation Process in Semantic Priming. BIANCA DE WIT and SACHIKO KINOSHITA, *Macquarie University*—It is widely assumed that automatic and strategic processes underlie semantic priming effects. These processes were investigated using a semantic categorization ("Is it an animal?") task with masked and unmasked primes, manipulating the relatedness proportion (.25, .50, .75 related). For unmasked primes the SOA was manipulated, creating a short (240 ms) and long (1014 ms) SOA condition. Contrary to the prediction of the two-process model, a relatedness proportion effect was found at the supposedly automatic short SOA, which did not differ in magnitude from the relatedness proportion effect at the long SOA. The masked prime experiment showed a robust semantic priming effect, but no relatedness proportion effect. These results challenge the concept of automatic spreading activation as a mechanism to explain semantic priming effects with unmasked primes at a short SOA. An alternative account, based on the concept of evidence accumulation and discounting is suggested.
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(1149)

Lexical and Semantic Processing of Abstract Words. LENKA ZDRAZILOVA and PENNY M. PEXMAN, *University of Calgary*—Semantic richness effects in visual word recognition have been well established. Words associated with richer semantic representations are recognized faster and more accurately (e.g., Pexman et al., 2008). In this study, we examined the extent to which the effects of semantic richness extend to abstract nouns. We collected ratings to assess the degree of variability in the information associated with 207 abstract nouns. We investigated the effects of several semantic richness dimensions that have been proposed to be relevant to abstract word meanings, in two separate tasks: lexical decision (LD) and semantic classification (SC). Results showed that sensory experience ratings and context availability were significant predictors in SC, whereas age of acquisition was a significant predictor in LD. This suggests that semantic richness effects extend to abstract nouns and that these effects are modulated by task demands.
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(1150)

Do Readers Obtain Preview Benefit From Transposed Words in English? BERNHARD ANGELE, KEITH RAYNER, ELIZABETH R. SCHOTTER and KLINTON BICKNELL, *University of California, San Diego*—Angele and Rayner (2012) found that, in English, readers obtained preview benefit from a preview in which the morphemes within a compound word were transposed (e.g. "boycow" as a preview for "cowboy"). However, it is unclear whether such transposition effects also occur across two words. We used the boundary paradigm (Rayner, 1975) to manipulate the preview for a two-word target region (e.g. meat rare in "The chef cooked the meat rare for the couple"). Readers received an identical (meat rare), transposed (rare meat) or unrelated preview (moon wood). Go-past time in the target region was shortest (522 ms) in the

identical condition and significantly shorter in the transposed condition (567 ms) than in the unrelated condition (647 ms). This transposed preview benefit only appeared on the first word of the target region, suggesting that this effect may be caused by plausibility differences rather than by identifying words out of order.
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(1151)

Foveal-Parafoveal Overlap Does Not Cause Facilitation Beyond Word N+1. RANDY TRAN, BERNHARD ANGELE and KEITH RAYNER, *University of California, San Diego* (Sponsored by Alexander Pollatsek)—Angele, Tran, and Rayner (2012) found that parafoveal repetition can facilitate word identification in reading. Using the gaze-contingent boundary paradigm (Rayner, 1975), they manipulated the parafoveal information that subjects received while fixating a target word (e.g. "news") within a sentence. Specifically, a reader's parafovea could contain a repetition of the target ("news"), a correct post-target ("once"), an unrelated word ("warm"), a nonword neighbor of the target ("niws"), a semantically related word ("tale"), or a nonword neighbor of that word ("tule"). They found shorter fixation times on the target word when there was orthographic overlap between the target word and subsequent word (N+1). Previous research has suggested that, apart from N+1, readers can also obtain information from the second word to the right of fixation (N+2). We tested whether parafoveal repetition has the same facilitatory effect when it occurred on N+2. There was no evidence for facilitation from repetition on N+2.
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(1152)

Masked Translation Priming With Japanese-English Bilinguals: Interactions Between Cognate Status, Target Frequency, and L2 Proficiency. MARIKO NAKAYAMA, *Waseda University,* CHRISTOPHER R. SEARS, *University of Calgary,* YASUSHI HINO, *Waseda University,* STEPHEN J. LUPKER, *University of Western Ontario*—Masked translation priming effects for cognate and noncognate translation equivalents were examined. In Experiment 1, L1 primes and L2 targets were used to examine translation priming effects as a function of target frequency and bilinguals' L2 proficiency. Translation priming effects for cognates were significantly larger than for noncognates, replicating the cognate priming advantage previously reported with different-script bilinguals (Gollan et al., 1997; Voga & Grainger, 2007). In addition, translation priming effects were significantly larger for low- than for high-frequency targets and for less than for more proficient bilinguals, whereas the size of the cognate priming advantage was unaffected by either target frequency or L2 proficiency. In Experiment 2, cognate translation priming effects were tested in the L2-L1 direction. There was a significant cognate translation priming effect regardless of L2 proficiency. Taken together, these results are most consistent with the phonological account of the cognate priming advantage (Voga & Grainger, 2007), which proposes that cognate translation priming effects for different-script bilinguals are due to the additive effects of phonological and conceptual factors.
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(1153)

Semantic Processing in a Categorization Task: Do the Hemispheres Differ? CASEY E. TURNER and RONALD T. KELLOGG, *Saint Louis University*—We examined brain laterality effects in an explicit category membership task. Findings with implicit priming tasks have suggested that the left hemisphere (LH) uses fine semantic fields to strongly select closely related features of a word, while the right hemisphere (RH) uses coarse semantic fields to weakly select distantly related features of a word. Participants viewed category names centrally and decided whether target words (closely related, distantly related, or unrelated to the category), presented to either the left visual field/RH or the right visual field/LH, were members of the category. Distant items took longer to categorize than close items in both hemispheres. Importantly, the distant items were reliably slower in the RH compared with the LH, a finding consistent with weak activation of coarsely coded RH semantic fields. For close items, both hemispheres were equally fast, possibly because broad semantic field overlap of words close to the category name compensated for weak RH activation.
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(1154)

Lexical Access is Not a Bottle-Neck to Semantics. STÉPHANIE MASSOL, NICOLA MOLINARO and MANUEL CARREIRAS, *Basque Center of Cognition, Brain and Language*—The present study aims at defining the influence of orthographic neighbors activation on visual word recognition by using unmasked priming paradigm that enhances the influence of the prime on a target at lexical level of processing. Targets were preceded either by the same word, or by lower-frequency orthographic word neighbor, or by orthographic pseudoword neighbor. In the 300-400ms time-window, repetition and pseudoword neighbor primes generated less negativity than unrelated primes, while word neighbor primes produced no effect. Starting at 400ms, neighbor primes produced a less negativity than unrelated primes whatever the lexical status of the prime. A classic effect was found from repetition priming, with less negativity when prime and target were the same word compared to unrelated pairs. This pattern of effects is taken as evidence for lexical delayed stable state of lexical representations caused by the word neighbor priming and for orthographic bottom-up influences on semantic representations activation.
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(1155-1156)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION II

Friday Noon,
Minneapolis Convention Center, Ballroom A
Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• PERCEPTION II •

(2001)

What Do You See, Duck or Rabbit? Directional Biases in Bistable Figure Perception. JYOTSNA VAID and SUMEYRA TOSUN, *Texas A&M University,* ANATOLIY KHARKHURIN, *American University of Sharjah,* ZOHRA ESLAMI, *Texas A&M University*—Biases in object facing in representational drawings of animals, vehicles, or other common figures have been shown to be influenced by object type, biomechanical variables associated with hand dominance, and leftward or rightward scanning tendencies arising from reading/writing habits (see Vaid, 2011). Directional biases have also been observed in object perception: leftward facing line drawings of common objects are identified at lower thresholds than rightward facing objects by right-handed individuals, whereas the opposite is observed for left-handers (Viggiano & Vannucci, 2002). The present study sought to extend inquiry into perceptual biases in figure perception by examining bistable figures, which were selected such that one of the figures faced to the left and the other to the right (e.g., a duck or a rabbit). Participants were simply to report what figure they saw first. We hypothesized that right-handers would show a bias for left-looking figures more so than left-handers and further, that left-to-right readers would see left-looking figures more often than right-to-left readers. Preliminary results support our expectations but also show variation by figure type.
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(2003)

The Hole Picture: Surrounded Regions and Their Complements. ROLF A. NELSON, XUE GONG and JASON REISS, *Wheaton College*—Traditional literature on figure/ground organization suggests that when a region is perceived as figure, it is seen as being in front and as having shape, while the ground lies shapelessly behind. More recently, this unity has been called into question with the example of holes – surrounded regions that are perceived as behind in depth, yet are imparted shape (Nelson & Palmer, 2001; Palmer, Davis, Nelson, & Rock, 2008). We extend previous findings by investigating the relationship between hole and object perception. Participants completed two experiments. They first made a speeded 2AFC comparison between either an object, a hole, or the complement (i.e., a shape that shared the contour, but in which the figure/ground assignment was reversed) and its associated shape. Next, they categorized surrounded regions as either holes or objects. Results indicated that while holes were easily differentiated from objects, their shape was perceived more like their object counterparts than like ground. In other words, the shape of holes may be perceived better than the shape of their complements (which share the same contour). It is concluded that the opposite of a hole, perceptually, is quite different from the shape that fills it in.
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(2004)

Quantifying the Organizational Principles in Figure-Ground Segregation. MINHONG YU and MICHAEL KUBOVY, *University of Virginia*—It is known that configural cues like relative area, convexity, and symmetry are important in figure-ground perception. The current study quantified those three cues and examined how these cues work together. In each trial the experiments, the participants saw a circle filled with red and green strips in the center of the screen. The participants were asked to report whether they see the green or red strip as the foreground. Bumps were added to the strips of one color so that they look convex while the strips of the other color look concave. The widths of the strips were manipulated to quantify the cue of relative area; the height of the bumps were manipulated to quantify the cue of convexity; and the alignment of the strips were manipulated to quantify the cue of symmetry. We fitted probabilistic models for the data and examined whether these cues are additive or not when they are applied to one configuration simultaneously.
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(2005)

Perceptual Grouping by Similarity of Surface Roughness in Haptics. KRISTA E. OVERVLIET, VANJA VAN AARSEN, JOHAN WAGEMANS and RALF TH. KRAMPE, *University of Leuven*—Previous research has shown that grouping by similar edge orientation speeds up haptic search (Overvliet, Krampe, Wagemans, in press). In the current study we investigate whether this effect is also present for similarity in surface roughness, a typical haptic material characteristic. Participants searched for a target in two columns of stimuli, that were either the same or different in roughness, with two fingers simultaneously. We manipulated target saliency by using two target-distractor pairs that differed in roughness ratio (easy or difficult to detect). We found that the easy target-distractor pair yielded faster search times as compared to the difficult pair. Moreover, we found that the effect of grouping by similarity in roughness was found only in the difficult target-distractor pair, indicating that grouping by similarity is beneficial only when the target does not pop-out. We conclude that haptic grouping by similarity also holds for surface roughness.
Email: Krista Overvliet, krista.overvliet@gmail.com

(2006)

Testing Saccadic Reaction Times to Visual-Auditory Stimuli for Oscillatory Phase Resetting. ADELE DIEDERICH, *Jacobs University*, HANS COLONIUS, *Oldenburg University*—There is growing support of the hypothesis that coherence of oscillatory responses at the level of primary sensory cortices

may play a crucial role in multisensory processing. According to the hypothesis, if two stimuli occur with a certain time lag, the first stimulus can reset an oscillation to its ideal phase; after reset, inputs that arrive within the ideal (high-excitability) phase, even within another modality, evoke amplified responses, whereas the responses to inputs that arrive slightly later during the worst phase are suppressed. Here we probe whether this putative mechanism leaves its marks in the pattern of saccadic reaction times to visualauditory stimulus pairs in a focused attention paradigm. An auditory nontarget stimulus was presented via loudspeaker, followed by a visual. Interstimulus intervals ranged from zero to 202 ms in increments of 2 ms resulting in about 10 000 responses per subject (48 data points/ISI). Response facilitation, relative to the unimodal visual condition, of up to 70 ms was observed for the ipsilateral presentations. Spectral analysis suggests the existence of multiple temporal windows of high and low excitability.
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(2007)

Is Calibration of Perception Modality Independent? JEFFREY B. WAGMAN and DREW H. ABNEY, *Illinois State University*—Perception becomes increasingly scaled to environmental properties when feedback is provided about perception of a given property. Understanding the process of calibration requires understanding more about the stimulation patterns to which perceivers become calibrated to as result of such feedback. Recent investigations using transfer of calibration paradigms have shown that recalibration of perception of length transfers from audition to touch. Such results provide preliminary evidence that calibration is modality independent (that feedback about a given property calibrates perceivers to a modality independent stimulation pattern). The experiment reported here provided a stronger test of this claim by demonstrating that perception transfers in both directions (i.e., from audition to touch, and vice versa). The results provide further evidence that calibration is modality independent and are also consistent with the more general proposal that the stimulation patterns that support perception are also modality independent.
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(2008)

Age-Related Changes in Peripersonal Space: Evidence From the Rubber Hand Illusion. EMILY K. BLOESCH and RICHARD A. ABRAMS, *Washington University in St. Louis*—The rubber hand illusion (RHI) occurs when synchronous tactile stimulation is applied simultaneously to both a person's occluded real hand and a visible fake hand, causing feelings of ownership of the fake hand. The RHI arises from the multisensory integration of visual, tactile, and proprioceptive information, which can occur only if the fake hand is within the real hand's representation of peripersonal space (perihand space). Because of this, the RHI can be used as a behavioral measure of the spatial boundaries of perihand space. In the present experiment, we varied the distance between the fake and real hands and then induced the RHI. Young adults experienced the illusion significantly more and at greater distances than older adults. This indicates that older adults may have reduced or degraded perihand representations, a factor that may explain hand movement problems commonly seen in aging.
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(2009)

Linguistic Experience Alters the Processing of Sound Symbolism. MICHIKO ASANO, *Keio University,* KEIICHI KITAJO, *RIKEN Brain Science Institute,* GUILLAUME THIERRY, *Bangor University,* SOTARO KITA, *University of Birmingham,* HIROYUKI OKADA, *Tamagawa University,* MUTSUMI IMAI, *Keio University*—Sound symbolism refers to a non-arbitrary relationship between linguistic sounds and meanings. Sound symbolism has been discussed in relation to the ontogenesis of language. Our previous ERP study revealed that preverbal infants who are just about to start word learning show the N400 response to sound symbolically mismatched speech sound-visual shape pairs, suggesting that the infants detected semantic anomaly in this case. Most of lexical words are, however, not sound-symbolic, and sound-meaning correspondence does not necessarily provide reliable information for semantic processing. In this study, we tested adults using the same sound-symbolically matched/mismatched stimuli as in our previous infant study. Adults showed no N400 effect, but showed a response resembling the P600, which is said to reflect violations of expectancy in general, to sound-symbolically incongruent pairs. The results suggest that linguistic experience alters the processing of sound symbolism; adults do not process sound symbolism in a regular semantic network.
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• SPATIAL COGNITION II •

(2010)

Cue Integration During Navigation. LORI A. SJOLUND and JONATHAN W. KELLY, *Iowa State University,* TIMOTHY P. 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 room shape. This project explored whether humans combine path integration and room shape 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 room shape were both available during the outbound path, but experimental manipulations created single- and dual-cue conditions during the return path. Virtual room size was also manipulated. Response variance when returning to the path origin was reduced when both cues were available, but only when navigating in the smaller room. Variance reduction occurred primarily in the dimension aligned with the long-axis of the room. These findings indicate that humans integrate multiple spatial cues during navigation, but that integration depends on room size.
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(2011)

Getting Physical With Mental Rotation. AARON L. GARDONY, HOLLY A. TAYLOR and TAD T. BRUNYÉ, *Tufts University,* GEORGE L. WOLFORD, *Dartmouth College*—Mental rotation performance is often assumed to indicate an individual's potential to efficiently manipulate real-world objects. An extensive literature on mental rotation indicates that the initial orientation and dimensionality of the object and individual differences, such as gender and working memory capacity, influence mental rotation performance. It is unknown, however, whether these factors impact the physical rotation of objects. In the present study, participants used virtual reality software and a handheld rotational sensor to mentally and physically rotate 3-dimensional block figures, modeled after Shepard and Metzler's (1971) classic objects. Results demonstrated higher accuracy but slower response times for physical versus mental rotation. Further, items analyses revealed stimuli attributes that impaired task performance and interacted with manipulability. Results suggest both shared and distinct processes for mental and physical rotation, and contribute to theoretical advances in understanding the processes underlying mental rotation performance.
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(2012)

Are Allocentric Memory Representations Constructed From Vector or Image Representations? KATY VARNER, HYOUN PYOUN and STEPHEN DOPKINS, *The George Washington University*—An observer must often construct an allocentric memory representation of a domain on the basis of egocentric views of the domain. Two different sorts of egocentric representation have been discussed in past work. In a vector representation, the spatial relationships of a domain are indicated by a set of observer-object vectors, each of which gives the distance and direction from the observer's vantage point to an object. In an image representation, the spatial relationships of a domain are recorded in the two-dimensional image that is available to the observer at a certain vantage point. In a series of experiments, we obtained evidence that allocentric memory representations are constructed from image rather than vector representations.
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(2013)

The Roles of Beacons and Surface Features on the Use of Local and Global Geometric Cues for Reorientation. KENT D. BODILY and ZACHARY A. KILDAY, *Georgia Southern University,* CAROLINE K. EASTMAN, *Tufts University,* KATHERINE A. GASKIN, APRIL GRAVES and JONATHAN E. ROBERTS, *Armstrong Atlantic State University,* BRADLEY R. STURZ, *Georgia Southern University*—We trained eight groups of participants to respond to a location in a trapezoid-shaped enclosure uniquely specified by both local and global geometric cues. To explore the role of beacons on geometric cues use, half were trained in the presence of uniquely colored beacons whereas the other half were trained in their absence. To explore the role of surface features, we recolored the walls at the correct location and/or added a line on the floor corresponding to the principal axis. All groups were tested in the absence of unique beacons, recolored walls, and added line in novel-shaped enclosures. Testing assessed the use of global geometry in isolation, in alignment with local geometry, or in conflict with local geometry. Participants utilized both local and global geometric cues for reorientation, but beacons and surface features differentially influenced reliance on these geometric cues. Implications for existing theoretical accounts of geometry learning are discussed.
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(2014)

To Err is Human: Landmark vs. Turn Reliance Under Conditions of Route Ambiguity. STEPHANIE A. GAGNON and TAD T. BRUNYÉ, *Tufts University/U.S. Army NSRDEC,* THORA T. TENBRINK, *Universität Bremen,* NIKHIL L. GOPAL, AARON L. GARDONY, PHILLIP J. HOLCOMB and HOLLY A. TAYLOR, *Tufts University*—If you ask a stranger for directions, the information may be inaccurate. We explored how participants respond to route directions containing conflicting landmark and turn information. Participants read route directions and then selected either a landmark-consistent or a turn-consistent location for the goal destination on a map. When an anonymous source provided directions, participants (n=60) relied on a mix of turn and landmark information. In contrast, when participants (n=60) knew details about the source, they more strongly relied on landmark information, especially if participants had lower survey spatial preferences. Participants (n=20) similarly favored landmark information when navigating to destinations in a virtual environment, particularly when turns were farther apart. Together, these results demonstrate that people favor landmarks over turn information in relatively realistic situations; these findings stem from the belief that human memory for landmarks (involving visual imagery) is more reliable/salient than memory for turns (dependent on body axes).
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(2015)

Neural Correlates of Early and Later-learned Relational Judgments. NICOLE SCOTT, APOSTOLOS GEORGOPOULOS and MARIA SERA, *University of Minnesota*—Children learn above/below earlier than right/left, but there is no explanation for this phenomenon. Relational judgments also exhibit congruency effects. For example, encoding above is easier at the top part of the screen than at the bottom – where it is incongruent. We investigated the neural correlates of encoding these relations in adults using magnetoencephalography. When comparing these dimensions during the period of stimulus presentation we found the greatest difference in activity in the right parietal areas: an area associated with spatial reasoning. This finding indicates that one dimension requires more activation than the other when reasoning about the spatial relation being represented. We also looked at congruency effects (across dimensions) during this period and found the greatest difference in activation in the prefrontal areas: the areas associated with executive functioning. Congruency may

elicit stronger responses from this region because a prepotent response must be overcome to select the correct answer.
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(2016)

The Role of Language in Spatial Reference Frame Selection over Development. HILARY E. MILLER, VANESSA R. SIMMERING and REBECCA PATTERSON, *University of Wisconsin, Madison*—Spatial reference frames are selected differentially depending on our goals, for example, whether we need to remember, describe, or reach for a location. We explored the developmental trajectory of this ability by testing 4- and 5-year-old children's use of references frames when describing, recalling, or following a description for locations defined within an intrinsic reference frame (i.e., an array of cups and landmarks on a rotating table). Performance in the description task differed dramatically between 4 and 5 years, with 4-year-olds rarely producing proximity terms or naming landmarks. When following descriptions, however, 4-year-olds performed near ceiling. We also compared recall performance under conditions in which alignment of reference frames was disrupted, with and without verbal cues provided. Four-year-olds performed much better with versus without cues, whereas 5-year-olds performed well overall, suggesting that developmental changes in language skills may help explain improvements in spatial recall performance during the same period.
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(2017)

Degraded Viewing During Navigation of Novel Paths Impairs Global Spatial Representation. KRISTINA M. RAND, WILLIAM B. THOMPSON and SARAH H. CREEM-REGEHR, *University of Utah*—Global spatial representations allow for flexible understanding of a space, making it possible to take shortcuts and reorient if lost. In the current study, we compared the ability to form internal representations of novel indoor environments for individuals navigating with normal vision or severely degraded vision. Participants were guided along two multiple-leg paths through a building with normal vision or wearing goggles reducing acuity and contrast. Along each path, six landmarks were encountered. To assess spatial representations, participants performed a series of test trials where they were instructed to imagine they were positioned in front of one of the landmarks, and provide a straight-line direction estimate to another landmark on the path using a verbal quadrant-pointing task. Results revealed a significant effect of vision condition, with greater errors when wearing the blur goggles compared to with normal vision. These results suggest a disruption to global encoding when navigating with degraded visual information, with current research exploring potential mechanisms for these differences.
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(2018)

Representational and Communicative Constraints Shape the Organization of Spatial Memories. ALEXIA GALATI and MARIOS N. AVRAAMIDES, *University of Cyprus*—Do representational constraints (e.g., one's learning viewpoint, the layout's symmetry) influence how the conversational partner's viewpoint is incorporated in memory? In Experiment 1, Directors learned randomly configured arrays while knowing their Matcher's misaligned viewpoint or not. Memory tests preceding descriptions revealed that, when Directors didn't know their Matcher's viewpoint they used their own to organize spatial locations; when they knew it they represented it, but without using it as an organizing direction. In Experiment 2, the alignment of the array's symmetrical structure with either partner also varied. When aligned with the structure, Directors used their viewpoint as the organizing direction. When misaligned with it, the Matcher's viewpoint mattered: Directors used the structure's axes as an organizing direction more frequently when knowing that Matchers would be aligned with it than when their viewpoint was unknown. Thus, people strategically incorporate in memory their partner's viewpoint when available and reinforced by representational cues.
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(2019)

When Route Selection Meets a Hill: Route Planning With Terrain Change. QI WANG and HOLLY A. TAYLOR, *Tufts University,* TAD T. BRUNYÉ, *Tufts University; U.S. Army NSRDEC*—Route planning results (Brunyé et al. 2010) suggest people use heuristics, particularly an unfounded preference for southern-going routes, with a perception that northern routes are "uphill." What happens when route choices actually involve a hill? Motivated by Brunyé et al., here we explore pedestrian route preferences involving terrain changes. Undergraduates described routes between campus buildings. Building pairs involved roughly equidistant routes, half of which involved a hill. Results suggest that internal heuristics, experience, and external environment interact. With flat terrain, participants preferred northern to southern routes, but had no preference between eastern/western routes. With sloped terrain, participants elected routes allowing for flat travel before encountering the hill. This heuristic appeared whether traveling up or down hill, but also interacted with where most student activities occur (eastern section of campus). Additionally, this heuristic contributed to asymmetric route choices wherein paths taken between locations going uphill differ from those taken between the same locations going downhill.
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• COGNITIVE SKILL ACQUISITION II •

(2020)

Dose-Response Relationship of Working Memory Training and Improvements in Fluid Intelligence: A Randomized Controlled Study in Old Adults. HANA STEPANKOVA and JIRI LUKAVSKY, *Prague Psychiatric Center,* MARTIN BUSCHKUEHL, *University of Maryland, College Park,* MILOSLAV KOPECEK and DANIELA RIPOVA, *Prague Psychiatric Center,* SUSANNE M. JAEGGI, *University of Maryland, College Park*—There is accumulating evidence that training on working memory (WM) results in improvements

that go beyond an improvement in the trained task extending even as far as to measures of fluid intelligence (Gf). However, although prevalent in young adult and children populations, such transfer effects have been difficult to demonstrate in old adults. In this study, we investigated whether we can improve Gf on a latent variable basis by means of an adaptive WM training. We randomly assigned healthy old adults to train on a verbal n-back task over the course of a month for either 10 or 20 sessions. Their performance change was compared with that of a no-contact control group. Our results revealed reliable training-related improvements in non-trained standard clinical measures of WM and Gf. We also observed a dose-response effect, that is, a positive relationship between the amount of training and the gain in visuospatial reasoning. The improvements in visuospatial reasoning were obtained even though the intervention was restricted to the verbal domain. Our work has important implications in that our data provide further evidence for plasticity of cognitive functions in old age.
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(2021)

Specificity and Transfer of Training in Following Navigation Instructions in Different Spaces. VIVIAN I. SCHNEIDER and ALICE F. HEALY, *University of Colorado,* IMMANUEL BARSHI, *NASA Ames Research Center*—This experiment examined whether learning to follow navigation instructions is specific to the space in which movements are made. College students followed navigation instructions for movement in grids on a computer screen by mouse clicking on the grids. Three grid configurations were compared, differing in the number of grids and the number of cells in each grid: five 3x3 grids, four 4x4 grids, and three 5x5 grids. Students were trained to make movements in one configuration, given a distractor task, and then tested in either the same or a different configuration. The presence of transfer or specificity of training depended on grid configuration. Specificity was found for 5x5 grids, whereas transfer was found from the other configurations to 4x4 grids. The same pattern was evident for instructions presented auditorily or visually. The results were interpreted in terms of the similarity and uniqueness of the procedures used for the grid configurations.
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(2022)

Beyond Bilingual: The Interpreter Advantage. BROOKE MACNAMARA and ANDREW R.A. CONWAY, *Princeton University*—The bilingual advantage refers to enhanced cognitive control in bilinguals relative to monolinguals (Bialystok, 1988) and is interpreted as evidence that bilinguals learn to efficiently switch task sets according to context. However, bilinguals typically function within one linguistic environment at a time. In contrast, simultaneous interpreters work in bilingual environments where they concurrently process both languages and need to switch target languages within one environment. Given the increased demands to resolve conflict, interpreters should demonstrate cognitive control advantages beyond those observed among non-interpreter bilinguals. The current study measured cognitive abilities among students in beginning and advanced American Sign Language (ASL) courses and among students in advanced ASL-English interpreting courses. We find that beginning and advanced ASL students perform similarly on tasks measuring cognitive abilities. However, we find that advanced interpreter students perform better than both beginning and advanced ASL students on tasks of cognitive control suggesting an interpreter advantage.
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(2023)

Measuring up AGL Paradigms Against Individuals' Language Abilities. ETHAN JOST, JENNIFER B. MISYAK and MORTEN H. CHRISTIANSEN, *Cornell University*—Artificial grammar learning (AGL) paradigms have been used for decades to study our ability to learn complex structures such as those thought to underlie language. However, there has not been an attempt to psychometrically validate either the standard paradigm or newer versions. This study assesses the reliability of both the standard AGL and the more recent AGL with serial response time (AGL-SRT; Misyak, Christiansen & Tomblin, TopiCS, 2010), and also examines each one's ability to predict specific language abilities. This is the first attempt to compare how well such paradigms actually tap into the cognitive processes thought to underlie language learning ability. Considering the online nature of language processing, we predict that the AGL-SRT will be a better predictor of language ability. Analyses include test-retest reliability as well as an examination of the relationship to natural language processing while controlling for verbal working memory performance.
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• EYEWITNESS IDENTIFICATION •

(2024)

Revisiting Absolute and Relative Judgments in the WITNESS Model. DUSTIN A. FIFE, COLTON PERRY and SCOTT D. GRONLUND, *The University of Oklahoma*—The WITNESS model (Clark, 2003) provides a theoretical framework with which to investigate the cognitive processes involved in eyewitness lineup decisions. Previous studies disagree on the importance of the decision weight parameters designed to account for the contributions of relative and absolute processes. We conducted a systematic exploration of the WITNESS model's parameter space to determine the fungibility (Waller, 2008) of these parameters while comparing it to an alternative model that does not include the decision weights. This exploration revealed that WITNESS can fit data equally well by setting the decision weights to any value and compensating with a criterion adjustment. The more parsimonious alternative model (WITNESS-C) also can fit data sets at least as well as WITNESS. While we do not suggest that relative and absolute decision processes do not exist in eyewitness identification, they may be empirically confounded with criterion adjustments.
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(2025)

Showups Versus Lineups: An Evaluation Using ROC Analysis. CURT A. CARLSON, *Texas A&M University, Commerce,* CHARLES A. GOODSELL, *Canisius College,* STACY WETMORE and SCOTT D. GRONLUND, *The University of Oklahoma,* JEFFREY S. NEUSCHATZ, ALEX WOOTEN and MICHAEL GRAHAM, *University of Alabama, Huntsville* (Sponsored by Mike Toglia)—It is generally accepted that showups—a one-person identification—are more suggestive than lineups, although the empirical evidence is inconclusive. Our goal was to compare showups to both simultaneous and sequential lineups across variations in lineup fairness and the position of the suspect in the lineup. We reanalyzed data from a study by Gronlund, Carlson, Dailey, and Goodsell (2009) that included simultaneous and sequential lineups, and collected new data using a showup identification. Performance was compared using ROC analyses, which are superior to traditional measures such as correct identification, false identifications, and probative value measures. ROC analyses demonstrated that simultaneous lineups are consistently superior to showups, but sequential lineups are sometimes no better than showups. These results support prior suppositions regarding the inferiority of showups, but also reveal a misconception about the superiority of the sequential lineup. Future research should avoid misleading probative value measures and utilize a technique with proven reliability.
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(2026)

Individual Differences Predict Eyewitness Identification Performance. SHANNON M. ANDERSEN, *The University of Oklahoma,* CURT A. CARLSON and MARIA CARLSON, *Texas A&M University, Commerce,* SCOTT D. GRONLUND, *The University of Oklahoma*—Although much research has focused on performance differences in lineup identifications due to sequential versus simultaneous presentation, little has been done to examine why such differences arise. We examined how individual differences influence the identification process and which factors can lead to different outcomes contingent upon the chosen presentation method. In particular, we found that individual differences in facial memory ability (Cambridge Face Memory Test), working memory capacity (Automatic Operational Span Task), need for cognition, and levels of autistic traits (Autism Spectrum Quotient-AQ) lead to differential performance in lineup tasks. Interestingly, higher scores on the AQ's excessive attention to detail subscale resulted in more correct identifications in simultaneous lineups and fewer correct rejections in sequential lineups, contrary to findings by Jones, Scullin, and Meissner (2011). Our findings suggest that differences in lineup performance are due to a combination of individual differences and presentation method.
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(2027)

Influences of Familiarity and Recollection on Memory for Event Roles. JULIE L. EARLES and ALAN W. KERSTEN, *Florida Atlantic University*—Our previous research has shown that observers often falsely remember having seen a familiar person perform actions that had in fact been performed by somebody else. The present research tested whether this error reflects false recollection of having seen the person perform those actions, or whether it reflects the familiarity of the person and action in the absence of recollection of contextual information. Participants viewed a series of brief events, each involving two actors playing different roles. Participants' memory was then tested using the Remember-Know procedure. Participants made more Remember and more Know responses to conjunction items, in which a familiar actor performed an action previously performed by somebody else, than to new actor and action items. This suggests influences of both familiarity and recollection on false recognition. Participants were especially likely to falsely recognize conjunction items in which an actor played the opposite role within the same event in which she had appeared earlier. The increased rate of false recognition of this type of conjunction item was exclusively associated with Remember responses, suggesting that participants falsely recollected having seen the actor play this role.
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(2028)

Effects of Neighborhood Similarity on Eyewitness Identification Decisions: It's Good to Have Good Neighbors (Sometimes). MOLLY B. MORELAND and STEVEN E. CLARK, *University of California, Riverside*—Neighbors, lineup members flanking the suspect, affect underlying similarity relations between the description and appearance of the suspect in the mock witness paradigm (Gonzalez, Davis, & Ellsworth, 1995). The present study investigates neighborhood effects in an eyewitness identification task. Participants viewed lineups that differed in suspect guilt or innocence, similarity of neighboring foils, and suspect position. Similar neighbors flanked the suspect in the good-neighbor condition and dissimilar neighbors flanked the suspect in the dud-neighbor condition. Results showed that the correct identification rate increased with good-neighbors compared to dud-neighbors when the suspect was in the outer (second and forth) positions in the lineup. The inverse effect was obtained with the suspect in the centermost position—the correct identification rate increased with dud-neighbors relative to good-neighbors. The results suggest a complex interplay between the configuration of foils around the suspect, underlying similarity relations, and suspect position.
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(2029)

False Reports of Not Seeing Event Details. AZAD TANJEEM and D. STEPHEN LINDSAY, *University of Victoria*—We studied the effect of suggesting to subjects that they could not have seen details that had in fact been displayed to them. Subjects watched a video and 2 days later read three simulated witness testimonies. Each 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. In a follow-up study, we examined the subjective experiences accompanying such omission errors using a modified memory test in which subjects first indicate if they believe that a detail had or had not been witnessed and then report on the subjective phenomenology accompanying that belief.
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(2030)

A Distinctiveness-Driven Reversal of the Weapon-Focus Effect. CURT A. CARLSON, MARIA A. CARLSON, NATALIE SALADINO and DAWN R. WEATHERFORD, *Texas A&M University, Commerce*—The presence of a weapon during a crime can reduce the accuracy of eyewitness identification, known as the Weapon-Focus Effect (WFE). We hypothesized that the effect could be eliminated if the perpetrator has a distinctive facial feature. Participants (N = 600) watched a mock crime video from a first-person point-of-view in which a perpetrator appeared to assault them with either his fists, a beer bottle, or pointed a shotgun at them. The perpetrator either had a distinctive facial feature (a large sports sticker) or not. After a distractor task, participants viewed a perpetrator-present or –absent simultaneous lineup. The WFE was replicated in the shotgun condition in terms of probative value of a suspect identification, but only when there was no distinctive feature. Adding the feature created a probative value advantage in the shotgun condition. ROC analysis further elucidated findings beyond typical eyewitness identification measures.
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(2031)

Contributions of Commitment and Familiarity to Lineup Identifications Following Mugshot Exposure. CHARLES A. GOODSELL, *Canisius College,* SCOTT D. GRONLUND, *The University of Oklahoma,* JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville,* STACY A. WETMORE, *The University of Oklahoma,* RYAN M. MCADOO, *Canisius College*—The present study manipulated mugshot search instructions to reveal when witnesses make commitment or familiarity-based lineup errors. In support of previous research, we found a robust commitment effect. However, when participants were required to choose several foils that resembled the perpetrator from the mugbook, rather than searching for a single perpetrator, no differences were found in correct identification rates between the mugbook and no-mugbook control. Following lineup decisions, participants were asked to make source judgments for all lineup members. We found evidence that errors were due to conscious inference: Participants who chose a previously seen or selected mugshot foil indicated that that foil was familiar from both the mugshot and lineup phase. These participants also made source monitoring errors by indicating that the perpetrator was familiar from the mugbook rather than the lineup.
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(2032)

Confidence and Eyewitness Identification: Does the Type of Scale Matter? DAVID G. DOBOLYI, *University of Virginia* (Sponsored by Chad S. Dodson)—Eyewitness identification often provides a critical piece of evidence in criminal cases, and jurors typically place high emphasis on eyewitness confidence. While many eyewitness lineup studies collect confidence ratings, variability frequently occurs regarding the choice of scale type (e.g. numeric vs. verbal) and scale range (e.g. 50 to 100 vs. 0 to 100 for numeric scales). The present study investigates the importance of scale choice using a lineup identification task incorporating both black and white lineup faces. Confidence ratings were collected using a total of nine confidence scales including half- vs. full-length numeric and verbal variants, along with a quasi-continuous slider. Half of the verbal and numeric scales were labeled across the entire range, while the other half were labeled only at endpoints. Ultimately we seek to answer the question of whether or not the choice of confidence scale matters, and how lineup race and accuracy interact with eyewitness confidence.
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• RECOGNITION MEMORY I •

(2033)

Variability Due to Study-Test Lag in Recognition Memory. MELISSA PRINCE, LEE AVERELL and ANDREW HEATHCOTE, *The University of Newcastle*—Explanations of the latent structure underlying recognition memory performance are often based on signal detection models, where old and new items are represented as two Gaussian distributions located on a single memory strength dimension. The old distribution is commonly found to be more variable than the new distribution (zROC slope=0.8). Ratcliff Sheu and Gronlund (1992) suggested this greater variance might in part be due to variation in the time between study and test positions (lag) for old items. We examined this explanation by manipulating variability in lag through the order in which old items were tested relative to their study order, either minimizing (same order), maximising (reversed order), or producing intermediate levels (random order) of lag variability. Data were analysed with Bayesian hierarchical models that accounted for variability in lag, items and participants. Two simpler models assumed either the same (equal variance signal detection theory; SDT) or functionally related new and old variance, whereas two more complex models (unequal variance SDT and dual-process SDT) estimated the relationship. We discuss the results in terms of posterior parameter estimates and different approaches to model selection.
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(2034)

Optimizing Recognition Decisions Under Uncertainty. JUSTIN KANTNER, BRIAN A. LOPEZ, AMY FRITHSEN and MICHAEL B. MILLER, *University of California, Santa Barbara*—Optimal responding in a recognition memory test requires knowledge of (or sensitivity to) the base rate of old items, yet heuristically distributing responses according to this base rate is a suboptimal strategy for nearly all recognizers. Past research indicates that, even in the presence of corrective feedback, participants neither set criterion

appropriately when base rates are unequal nor shift criterion adequately when base rates change over the course of a test. To maximize their proportion of correct responses, individuals should calibrate response bias with recognition sensitivity, exercising a more extreme bias when sensitivity is poor. We report experiments testing whether participants can be trained to respond optimally with novel forms of feedback that emphasize criterion appropriateness rather than response accuracy. We also report evidence that an individual's shifting behavior in a recognition task predicts shifting in a perceptual discrimination task, suggesting that feedback-based improvements could potentially generalize across decision-making domains.
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(2035)

Pattern Separation is Not a Threshold Process. KATHERINE M. INGRAM and JOHN T. WIXTED, *University of California, San Diego*—Computational models hold that pattern separation (the ability to appreciate that a stimulus differs from a very similar stimulus presented earlier) is a hippocampus-based threshold recollection process. The signature feature of a threshold process is that an above-threshold memory signal is never achieved by foils. We investigated this issue using a recognition memory test for simple objects. The "old" targets on the test were either the same as a studied item (Same) or very similar to a studied item (Similar), whereas the "new" foils were not similar to a studied item (New). Participants first made an old/new decision using a 6-point confidence scale (where "old" was the correct response for both Same and Similar items) and then made a Same vs. Similar decision for each item that was declared to be "old" (i.e., for each item that received a confidence rating of 4, 5 or 6). Very few foils received a rating of 6. For targets that received a rating of 6, Same vs. Similar accuracy (i.e., pattern separation) was well above chance. Quite a few foils received a rating of 5. For targets that received a rating of 5, Same vs. Similar accuracy was still above chance. These results suggest that pattern separation is not a threshold process.
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(2036)

In Support of the Continuous Dual-Process Model of Recognition Memory. CHEN DIDI-BARNEA, ZIV PEREMEN and YONATAN GOSHEN-GOTTSTEIN, *Tel-Aviv University* (Sponsored by Daniel Algom)—The Continuous Dual Processing model of recognition memory (CDP, Wixted & Mickens, 2010) proposes that recognition is based on two distinct processes: Recollection (of episodic details) and Familiarity (of items). Unlike other dual-process models (e.g., Yonelinas, 1994), CDP suggests that like Familiarity, Recollection is continuous and is best conceptualized by a unique signal-detection distribution. In this study, we asked participants to provide both confidence ratings and a Remember-Know (R-K) judgment for each test item (Yonelinas, 2001). Both the R and K response distribution and the accuracy of the conditions—created by crossing confidence level (4-6) with response type (R-K)—are better interpreted by CDP than by either single-process (Donaldson, 1996) or dual-process models. Furthermore, the increase of zROC slope to unity when selectively excluding R responses (Yonelinas (2001), was replicated also when excluding strong responses, providing ruther support to the CDP model.
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(2037)

Modeling the Availability of Item, Associative, and Position Information During Recognition. DARRYL W. SCHNEIDER and JOHN R. ANDERSON, *Carnegie Mellon University*—In this study we investigate when and how different types of information (item, associative, and position) become available during the time course of recognition. We discuss when information becomes available by examining speed–accuracy tradeoff functions obtained using the response signal procedure in two previously published experiments and in a new experiment, explaining how nonmonotonicities in the data can be used to infer the availability of new information. We explore how information becomes available by articulating the processes involved in recognition in a computational model that provides satisfactory fits to the empirical speed–accuracy tradeoff functions, yielding important insights into fundamental memory dynamics.
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(2038)

Speeded Versus Self-Paced Recognition: Evidence of Different Mechanisms for Part-Set Cuing and Retrieval-Induced Forgetting. WILLIAM J. MUNTEAN and DANIEL R. KIMBALL, *The University of Oklahoma*—Retrieval practice of category exemplars typically impairs memory for unpracticed category exemplars from practiced categories, as compared to those from unpracticed categories. Similarly, part-set cues typically induce impairment of memory for non-cue exemplars. Bäuml and Aslan (2004) compared recall in these two paradigms within a single experiment and observed similar impairment for both conditions; they took this as evidence that a similar mechanism underlies the two paradigms. Within a single experiment, we compared yes-no recognition in the two paradigms using speeded versus self-paced testing. Previously, Verde and Perfect (2011) observed retrieval-induced forgetting with self-paced testing, but not with speeded testing; Oswald, Serra, and Krishna (2006) observed part-set-cuing-induced impairment with speeded testing, but did not include a self-paced testing condition. We observed retrieval-induced forgetting with self-paced testing but not with speeded testing, replicating previous results; however, we observed the reverse pattern for part-set cuing impairment. These results suggest that different mechanisms underlie the two paradigms.
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(2039)

Assessing the Role of Recollection in the Mirror Effect. ANGELA M. PAZZAGLIA and CAREN M. ROTELLO, *University of Massachusetts, Amherst*—Low-frequency (LF) words have higher hit rates and lower false alarm rates than high-frequency (HF) words in recognition memory, a phenomenon termed the mirror effect by Glanzer and Adams

(1985). The current experiments contrast two models of the mirror effect, the Source of Activation Confusion (SAC; Reder et al., 2000) model and the unequal variance signal detection theory (UVSDT) criterion shift model (e.g., DeCarlo, 2002). Experiment 1 incorporated divided attention and speeded responding manipulations designed to remove the contribution of recollection in the SAC model, thereby eliminating the LF hit rate advantage. Experiment 2 manipulated the salience of the frequency classes, as the UVSDT criterion shift model requires that subjects are aware of the frequency classes in order to shift their criteria. Across both experiments, model simulations and direct fits of the SAC model demonstrated systematic errors in prediction, while the UVSDT model accurately predicted the general pattern of effects in all cases. Finally, state-trace analyses provided compelling evidence in favor of a single process underlying the mirror effect, casting doubt on any dual process account of the mirror effect.
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(2040)

Output Interference and List Strength in Recognition Memory. ASLI KILIC and AMY H. CRISS, *Syracuse University,* KENNETH J. MALMBERG, *University of South Florida* (Sponsored by Marc W. Howard)—The strength based mirror effect (SBME) in recognition memory refers to higher hit rates and lower false alarm rates for strongly encoded items compared to weakly encoded items. Some item-noise models explain this empirical phenomenon by a differentiation mechanism wherein as target items are better encoded, they become less similar to a randomly chosen set of foil items. The result is an increase in memory strength for the target distribution and a decrease for the foil distribution for a strongly encoded list relative to a weakly encoded list. Recently a SBME has also been observed when study lists were mixed in strength but the test list consisted of only strong targets or only weak targets. This was interpreted as evidence that differentiation does not underlie the SBME. We dispute this and evaluate whether such data can be accounted for by incorporating encoding during the test. If items are encoded during test, then differentiation may also take place at retrieval and cause a SBME. Participants studied either a pure or a mixed list in which items were strengthened via a levels of processing manipulation. The theoretical implications of the results will be discussed.
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(2041)

Item-by-Item Criterion Shifts in Recognition Memory: All You Need is an Extra Button. JAMES E. OLCHOWSKI and JEFFREY J. STARNS, *University of Massachusetts, Amherst*—In recognition memory, participants often fail to systematically shift their criterion from one trial to the next, even when given obvious cues to support these shifts (e.g., Stretch & Wixted, 1998). We show that a minor change in procedure can produce robust item-by-item shifts. In our experiments, participants learned a list of words with half studied once (weak) and half studied five times (strong). At test, strong targets always appeared in red and weak in green, with lures evenly divided between the two colors (Stretch & Wixted, 1998). The critical variable involved how responses were mapped onto keys. All participants used a single key to respond "not studied." Some participants also used a single key to respond "studied" regardless of color (2-key condition), and other participants had one key to respond "studied" for red test items and another for green items. For the 2-key participants, false-alarm rates did not change for lures presented in red versus green. For the 3-key participants, false alarm rates were substantially lower for lures presented in red versus green. We discuss the implications of these results for signal-detection theory and for the decision model proposed by Turner, Van Zandt, and Brown (2011).
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(2042)

Conservative Response Bias in Recognition Memory for Paintings. D. STEPHEN LINDSAY, *University of Victoria,* JUSTIN D. KANTNER, *University of California, Santa Barbara,* MARIO J. BALDASSARI, PRIYA ROSENBERG and JORDANNA L. FREEMAN, *University of Victoria*—Across many experiments we observed that yes/no recognition memory response bias for masterwork paintings is conservative, with most subjects making fewer hits than correct rejections. Here we used 2AFC tests to find new evidence that this conservatism is independent of old/new discrimination. We also show that the tendency to be conservative on paintings is larger when paintings are mixed with words than when only paintings are used. We had hypothesized that subjects' exaggerated expectations as to the memorability of paintings causes the conservative bias. Our data do not support that hypothesis. Finally, we describe a test of the new hypothesis that (a) a study stimulus sometimes reminds subjects of a prior study stimulus, (b) subjects are more often aware of such remindings for paintings than for words, and (c) this leads them to suspect that familiar-seeming test paintings may merely be similar to (rather than the same as) studied paintings.
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(2043)

Recognition Memory Models and Binary-Response ROCs: A Comparison by Minimum Description Length. DAVID KELLEN and KARL C. KLAUER, *Universität Freiburg,* ARNDT BRÖDER, *Universität Mannheim*—The comparison of measurement models of recognition memory (Yonelinas & Parks, 2007) traditionally relies on Receiver Operating Characteristics (ROC) data obtained with confidence-rating responses, which are known to have limited diagnostic value (Malmberg, 2002). Furthermore, these comparisons usually focus on particular subsets of models, and are based on model selection indices such as AIC and BIC (Burnham & Anderson, 2002), which fail to quantify model flexibility in an accurate manner. The present work attempts to overcome these limitations by comparing an extended set of models using binary-response ROC data, and assessing model performance in terms of Normalized Maximum Likelihood (NML), an index coming from the Minimum-Description Length (MDL) framework (see Grünwald, 2007). Overall, NML results show that the models vary considerably in terms of their flexibility

to fit ROC data in general, and indicate a preference for a dual-process model which assumes that a mixture of two memory processes - one that is affected by response bias and one that is not - underlies recognition memory judgments.
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(2044)

Confidence Accumulation or Variable Criteria? How Biasing Can Affect zROC Slopes. ADAM J. DEDE and JOHN T. WIXTED, *University of California, San Diego* (Sponsored by Laura Mickes)—According to signal detection theory, participant bias should not affect the parameters of the receiver-operating characteristic (ROC). The reason is that, theoretically, manipulating bias should simply shift the operating points along the same ROC curve. Thus, the ROC curve itself, as well as the corresponding z-transformed ROC (zROC), should remain unchanged. However, previous studies have found that the slope of the zROC changes under different biasing conditions. The reported effects, which appear to be systematic and replicable, call into question the vast research literature utilizing ROC analysis to study memory. Here, we investigate the possibility that asymmetric criterion variability (e.g., greater variability for the leftmost confidence criterion relative to the rightmost confidence criterion) may lead to variations in the zROC slope when bias is manipulated. Such asymmetric effects may reflect an interaction between what a biasing manipulation asks the participant to do and what the participant has learned about criterion placement prior to participating in a laboratory experiment.
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• IMPLICIT LEARNING AND MEMORY •

(2045)

Implementing Flexibility in Automaticity: Evidence From Context-Specific Implicit Sequence Learning. MARIA C. D'ANGELO, *McMaster University,* LUIS JIMÉNEZ, *Universidad de Santiago de Compostela,* JUAN LUPIÁÑEZ, *Universidad de Granada,* BRUCE MILLIKEN, *McMaster University*—Attention is often dichotomized into controlled versus automatic processing, where controlled processing is slow, flexible, and intentional, and automatic processing is fast, inflexible, and unintentional. In contrast to this strict dichotomy, there is mounting evidence for a form of context-specific automatic processes that are rapid yet also flexible. We extend this idea to the domain of implicit learning by showing that participants can learn implicitly two complementary sequences that are associated with distinct contexts. Our results point to the role of context-specific processes in the acquisition of implicit sequence knowledge, and speak to the age-old debate of whether implicit learning operates on abstract representations of rules and grammars where the episodic details are left behind. The context-specific effects we report indicate that episodic details are in fact represented in sequence knowledge. These results suggest that flexibility in the use of automatic processes may be implemented through reliance on contextual factors.
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(2046)

Neuromuscular Tuning Underlies Grammaticality Judgments in Visual Artificial Grammar Learning (AGL). ELIZABETH R. MARSH and ARTHUR M. GLENBERG, *Arizona State University*—Can discrimination between grammatical and ungrammatical strings be based on low-level neuromuscular information instead of rules or probabilities? According to neuromuscular tuning (NMT), watching spatiotemporally distributed visual AGL sequences tunes eye movements to follow transitions between stimuli in grammatical sequences; thus grammatical sequences can be followed fluently at test. In contrast, ungrammatical sequences have unpracticed transitions that are followed less fluently. Therefore, fluency in following discriminates between grammatical and ungrammatical sequences. In two experiments, we tested this idea by shifting the orientation of the head relative to the computer screen so that tracking the stimuli required either the same (tuned) or different eye movements at learning and at test. When different eye movements were required, discrimination performance was disrupted for visually presented sequences but not for aurally presented sequences. These findings demonstrate that effector-specific NMT significantly contributes to visual AGL over and above any putative contributions from learning higher-order conditional probabilities.
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(2047)

Resilience in Human Sequence Learning: Persistence of the Hebb Effect Despite Irregular Repetition Intervals. MARIE-ÈVE ST-LOUIS and ANAÏT BAGRAMYAN, *Université Laval,* JEAN SAINT-AUBIN, *Université de Moncton,* SÉBASTIEN TREMBLAY, *Université Laval*—In serial recall, when one sequence of items is repeated throughout the experimental session, recall for that sequence improves compared to the recall of nonrepeated sequences. This well replicated phenomenon, known as the Hebb repetition effect, has been found when a fixed, regular interval is used for the presentation of the repeated sequence (e.g., every third trial). However it is yet unknown whether sequence learning would occur without regular intervals. In animal learning, some studies showed that the random presentation of stimuli does not induce conditioning. Here, 20 participants performed a verbal serial recall task for sequences of nine letters in which the repeated sequence appeared every fourth trial while 20 participants were exposed to repetitions at random intervals within a block of four trials. Results clearly show sequence learning of similar amplitude for both groups of participants. This finding contradicts what is observed in classic animal learning experiments.
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(2048)

The Role of Procedural Memory in Adult Second Language Acquisition. KATHERINE A. BRILL and KARA MORGAN-SHORT, *University of Illinois at Chicago* (Sponsored by Gary Raney)—This study examines the role of procedural learning ability in adult second language development. Twenty-six native English speakers were randomly assigned to either implicit (immersion-like provision of meaningful examples) or explicit (classroom-like provision of grammatical rules) training conditions to learn an artificial language. Participants completed explicit or implicit training, comprehension and production practice, and a grammaticality judgment task (GJT), which assessed linguistic development at earlier and later stages of training/practice. Participants also completed measures of procedural learning ability – the Alternating Serial Response Task and the Weather Prediction Task. Results showed a significant correlation between procedural learning ability and GJT scores at later stages of training/practice for implicitly trained participants. Additionally, an ANOVA revealed that, at later stages of training/practice, high procedural ability participants in the implicit condition outperformed other learners. These findings suggest that high procedural learning ability paired with language learning in implicit training conditions produces optimal second language development.
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(2049)

The Role of Apparent Motion and Perceived Animacy in Sequence Learning. JOHN L. JONES and MICHAEL P. KASCHAK, *Florida State University*—When participants are asked to respond to the locations of a series of stimuli their latencies decrease more when there are predictive dependencies between stimulus locations (i.e., there is a repeating sequence of locations). The standard task, called the Serial Reaction-time Task (SRT), has been used to study the role of role of attention and implicit/explicit process in sequence learning. We focus more on the role of the specific perceptual/cognitive process of motion perception. Previous work from our lab indicates that cognitive processes that serve to integrate representations of stimuli in a dependency are necessary for learning such dependencies. Motion perception requires an integration of an object's current and last location. Our data show that masking cues to motion perception disrupts learning in the SRT. Furthermore, a stimulus that is perceived as animate strengthens the effect of learning.
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(2050)

Facilitation of Cognitive Operations Predict Skill Acquisition. CHRISTOPHER A. WAS and FRANCIS X. SMITH, *Kent State University*—This investigation examined the relationship between performance on the ALTM task (Was, 2010, Woltz and Was, 2006, 2007) and improvement in Stroop task performance across trials. Prior research has indicated that the ALTM task may be capturing individual differences in facilitation of procedural memory but has often been confounded with long-term semantic priming due to the nature of the task. The Stroop task was chosen because related semantic information is largely irrelevant to performance. Results indicated that performance on the ALTM task did not correlate with initial performance on the congruent trials of the Stroop task. It did, however, correlate with improvement in performance across incongruent trials. We argue that this was due to a change in procedural memory for color naming. The results of this study support the conclusion that the ALTM task is representative of individual differences in individual's ability to strengthen memories for specific prior cognitive operations.
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(2051)

The Effect of Continuous Word Frequency, Context Variability and OLD Across Memory Tasks. PERNILLE HEMMER, *Rutgers University,* AMY H. CRISS, S*yracuse Univsity,* ERIC JAN WAGENMAKERS, *University of Amsterdam*—Understanding the properties of words that contribute to successful memory is an important empirical and theoretical question. However, progress has been difficult in part because continuous properties of words have often been treated as discrete categories (low and high) and because the same property often has opposite effects in different memory tasks. For example, low frequency words are better recognized but poorly recalled compared to high frequency words. The goal of this project was to understand the complex relationship between task characteristics and word properties that lead to successful memory. To do so, we developed a large stimulus set including 924 words (from the Touchstone Applied Science Associates (TASA) corpus) and identified the normative word frequency, context variability, and OLD (orthographic Levenshtein distance 20) values for each word. We then collected data from 396 subjects in each of 5 memory tasks (single item recognition, associative recognition, cued recall, free recall, and lexical decision). Our analysis focuses on identifying factors across tasks, across word properties, and across participants that best predict performance. The data will be used to inform models of memory.
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(2052)

The Influence of Incidental Encoding and Levels of Processing on the Spacing Effect. GEOFFREY B. MADDOX, FAN ZOU, DUNG C. BUI and SANDRA HALE, *Washington University in St. Louis*—The spacing effect has been obtained with intentional and incidental learning. Evidence suggests, however, that the spacing effect and the optimal amount of spacing between repeated study trials are reduced with incidental learning relative to intentional learning (e.g., Shaughnessy, 1976; Verkoeien, Rikers, & Schmidt, 2005). With one exception (Challis, 1993), levels of processing under incidental encoding has been relatively unexplored in past research. In the current experiments, participants incidentally encoded words (either shallowly or deeply) that were repeated after short and long spacing intervals. Stem completion tests were administered after short (30 seconds) and long (10 minutes) retention intervals. Although a benefit of deep encoding over shallow encoding was obtained on both tests, results indicated greater forgetting for items separated by the

long spacing interval relative to the short spacing interval. Discussion considers the implications of these results for theoretical accounts of the spacing effect.
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(2053)

Does Group Composition Matter? Partner Characteristics and Social Contagion. JESSICA J. ANDREWS and DAVID N. RAPP, *Northwestern University* (Sponsored by Panayiota Kendeou)—When people incorrectly recall information while working in a group, those inaccuracies can contaminate the memories of other group members on subsequent tasks (e.g., Roediger, Meade, & Bergman, 2001). We investigated whether perceived differences among group members would influence the likelihood of this social contagion. In Experiment 1, participants worked with a confederate perceived as having high or low cognitive ability. They completed a standard memory task used to assess social contagion. Contagion was reduced when participants worked with a partner of low as compared to high ability. In Experiment 2, a minimal-groups paradigm was used to instantiate similarities and differences among group members. Participants showed less social contagion when they worked with out-group as compared to in-group partners. These findings indicate that knowledge about the characteristics of group members can influence whether the information generated in a collaborative task is encoded and/or relied upon for later retrieval.
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(2054)

When Do Christmas Songs Pop Into Your Mind? Testing a Long-Term Priming Hypothesis. LIA KVAVILASHVILI and SUE H. ANTHONY, *University of Hertfordshire*—Mind-pops refer to fragments of semantic knowledge that come to mind unexpectedly, often without any obvious triggers. Their content varies and includes isolated words or phrases, visual images and songs/melodies (Kvavilashvili & Mandler, 2004). The present study tested a long-term priming hypothesis as a potential mechanism underlying the occurrence of mind-pops in everyday life. Seventeen volunteers kept a diary of musical mind-pops for one week in each of three consecutive months. On average, participants recorded about eight musical mind-pops per week. However, while virtually no Christmas songs were noted in November or February, 20% of mind-pops recorded between 15-22 December were Christmas songs. Participants were also more likely to indicate hearing a song in the recent past in December than in the other two periods, indicating that incidentally hearing Christmas songs in December increased the activation levels of song representations to a point that they later popped into their minds.
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(2055)

Does Sleep Enhance Visual Discrimination Performance? DREW E. WALKER and TIMOTHY C. RICKARD, *University of California, San Diego*—There is accumulating research suggesting that visual discrimination performance is enhanced by sleep. We investigated that hypothesis using the methodology employed by Rickard et al. (2008) to explore sleep and motor learning. Subjects were trained in either a massed condition or a spaced condition and then were tested after a 24-hour delay containing sleep. Spaced training produced higher task vigilance and led to substantially better contrast discrimination than did the typically employed massed training. A subset of high vigilance spaced subjects showed a significant discontinuity between the end of training and the beginning of test, suggesting sleep enhancement. However, among subjects that maintained target task accuracy throughout training, no sleep enhancement was observed. Methodological and theoretical implications for sleep consolidation research are noted.
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(2056)

Effects of Exposure and Predictability on Liking. DANIEL DE ZILVA and BEN R. NEWELL, *University of New South Wales,* CHRIS J. MITCHELL, *University of Plymouth*—The mere exposure effect refers to the phenomenon in which exposure to an initially neutral stimulus leads to more positive evaluations of that stimulus. Experiments examined the extent to which evaluations of target stimuli are affected by exposure and by the familiarity of their pairings with neutral non-target stimuli. Participants were repeatedly exposed to pairs of target and non-target stimuli (e.g. a face and a nonsense word) and, on test, they rated the pleasantness of the target stimuli (faces). Compared to novel faces, familiar faces were preferred when they were presented with the same word with which they had been repeatedly exposed. The preference for familiar faces was disrupted, however, when the exposed face-word pairings were rearranged. Thus, familiar faces were preferred to novel faces only when the face-word pairings were familiar. Changes between exposure and test that result in novelty in the stimulus pairings disrupt the mere exposure effect.
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(2057)

Learning Nonadjacent Dependencies Using Simple Recurrent Networks. JON A. WILLITS, *University of Wisconsin, Madison,* DARAGH SIBLEY, *Haskins Laboratories,* MARK S. SEIDENBERG, *University of Wisconsin, Madison*—Nonadjacent dependencies are ubiquitous in language and contribute to language's complexity. It has been shown that people learn nonadjacent dependencies more easily when the situation is made more naturalistic by retaining some of the cues present in natural language. In three simulations, we show that the Simple Recurrent Network (SRN) also demonstrates this property. In Simulation 1, we show that SRNs learn distance-invariant representations of nonadjacent dependencies, but only when they are exposed to the nonadjacent dependencies at a variety of distances. In Simulation 2, we show that SRNs learn nonadjacencies more easily when the items share a consistent similarity structure. In Simulation 3, we show that extremely simple, localist SRNs can learn abstract, rule-like dependencies (contra Marcus, 1998), when they are not artificially constrained to suppress their ability to demonstrate that knowledge. These simulations demonstrate that statistical learning models such as SRNs are formally capable of learning

to represent nonadjacent dependencies. Further, the similarity between the SRN and behavioral data provides evidence that the SRN is a plausible model of how people learn some higher-order linguistic structures.
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• WORKING MEMORY II •

(2058)

High Variance in Visual Displays Leads to Overestimation in Mean Size Estimation. YELDA SEMIZER and AYSECAN Z. BODUROGLU, *Bogazici University*—Previous research has shown that the visual system forms accurate statistical summary representations, but little research to date has directly investigated the types of biases and the effects of group variance on ensemble statistics. In the present study we presented viewers with either a single circle or with displays that had nine circles, and asked them to estimate the mean size of these circles by adjusting the size of a test circle. Across conditions we manipulated variance in the displays while keeping mean size constant. Participants were equally accurate in estimating the mean size of nine same-size circles and a single circle. More critically, in high variance displays participants were more likely to overestimate mean size compared to low and no-variance displays suggesting that variance affects mean size estimations. Finally, we demonstrated that working memory capacity moderated these biases especially when displays were presented for shorter durations.
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(2059)

Visuospatial Working Memory: The Roles of Rehearsal, Decay, and Interference. LINDSEY LILIENTHAL, SANDRA HALE and JOEL MYERSON, *Washington University in St. Louis*—Most forgetting research uses verbal items, but some issues may be more tractable with spatial items because rehearsal can be blocked without necessarily diverting attention. Participants in Exp. 1 performed a simple spatial span task. When environmental support for spatial rehearsal was provided between item presentations, a 4-s inter-item interval resulted in better recall than a 1-s interval. When there was no support, the opposite pattern was observed. Participants in Exp. 2 performed a simple spatial span task with and without rehearsal support and a complex spatial span task with spatial and verbal secondary tasks. Recall was best on the simple span task with rehearsal support. When attention was diverted by a verbal secondary task, recall was poorer than when there was no secondary task and no rehearsal support. Finally, the spatial secondary task resulted in the poorest recall. Our results are consistent with a multifactor model of spatial forgetting in which forgetting is minimized by rehearsal (although some active maintenance is possible without rehearsal so long as there is sustained attention) and forgetting is maximized when attention is diverted to spatial processing of non-memory items.
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(2060)

Orientation of Objects in Memory Influences Motor Responses. SAMANTHA BURNS, SÉBASTIEN LAGACÉ and KATHERINE GUÉRARD, *Université de Moncton*—A number of researchers have suggested that the motor system is recruited during retention. For instance, there is increasing evidence that verbal retention relies on the language production architecture. The objective of the present study was to examine the role of the motor system in memory for object location. In each trial, a list of objects oriented either to the left or to the right, was presented successively on the computer screen. After presentation, one object – the probe – appeared in an orientation that was either compatible or incompatible with the list items. Participants had to touch the screen where the probe had been presented. The results showed that participants' responses deviated toward the handle of the object in the list. This suggests that object orientation is retained in memory and can be used to guide hand movements to interact with this object.
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(2061)

One Probe, Two Probe, Old Probe, New Probe: Switching Location and Color in a Change-Detection Paradigm. AMANDA L. GILCHRIST and PAUL VERHAEGHEN, *Georgia Institute of Technology*—What happens to working memory representations of a simultaneous visual array when single-item probes switch from trial to trial? In a modification of the change-detection paradigm, participants were presented with arrays of two or four colored squares to maintain in working memory, followed by a sequence of single-item probes. These probes could potentially switch to different array locations or change to a new color across trials. Participants were instructed to keep track of the most recent color at each array location and to update these representations as needed. The effect of switching a probe's array location significantly affected both accuracy and response time (RT) in this task, accounting for more variance than any other variable. However, switches to local features such as color only affect performance when location is held constant. These results suggest that, when single items in visual representations change from trial to trial in this task, spatial location was more salient to participants than identity information. To determine if these findings are specific to updating instructions, these results will be compared to a similar task where participants do not have to update representations. We contend that this research shows that, with a simple modification, tasks that support maintenance of multiple items in working memory can be changed into ones that shrinks the functional focus to a single item.
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(2062)

On the Resources Involved in Binding in Working Memory. NAOMI LANGEROCK, EVIE VERGAUWE and PIERRE BARROUILLET, *University of Geneva* (Sponsored by Dirk Kerzel)—Single feature maintenance in working memory has been shown to depend both on domain-general (attentional) as well as domain-specific (verbal/visuo-spatial)

resources. Recent research has started to study the resources involved in bound information maintenance. Studies on binding within the visuo-spatial domain have shown the attentional (domain-general) involvement to be of no more importance than for single feature maintenance while feature overwriting (domain-specific) might play a larger role in the loss of bound information. The present study aimed to verify whether these results can be generalized to binding between different domains. Binding was investigated through the maintenance of cross-domain information (i.e. verbal and spatial). The results only partly confirmed the results obtained for binding within the visuo-spatial domain. As for bound visuo-spatial information, the maintenance of cross-domain information depends as much on attention as single feature maintenance. However no evidence was found for the involvement of domain-specific resources in the maintenance of cross-domain information. This study questions whether the results for binding within the visuo-spatial domain can be generalized to binding per se.
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(2063)

Cognitive Backward Masking: A Window Into the Formation of a Short-Term Memory Trace. MARK R. NIEUWENSTEIN, *University of Groningen,* BRAD WYBLE, *Syracuse University*—Working memory consolidation denotes the process that enables sensory information to be stored in short-term memory. What is currently unclear is how long this process takes and whether it continues after a stimulus has been masked. Here, we address these matters by examining whether the consolidation of visual stimuli can still be disturbed even after they have been masked. Participants viewed brief and masked displays of letters or Kanji characters that had to be memorized and that could be followed at varying stimulus onset asynchronies (SOA) by a visual or auditory discrimination task. Memory performance improved as SOA increased from 100 to 1000 ms, revealing what may be called a "cognitive backward masking effect" caused by the discrimination tasks. Taken together, the results show that working memory consolidation is a time-consuming but volatile process that continues after a stimulus has been masked and that can be disrupted by executing another task.
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(2064)

Visual Short-Term Memory Always Requires General Attention. CANDICE C. MOREY and MALTE BIELER, *University of Groningen*—The role of attention in memory for the binding of visual features remains controversial; while some evidence suggests that memory for binding demands no more attention than memory for the same features, other evidence indicates mnemonic benefits of explicitly attending to binding. We attempt to reconcile these two findings by examining how memory for binding, features, and features during binding is affected by a concurrent attention-demanding task. We demonstrate that performing a concurrent task impairs memory for as few as two visual features, even when item-location binding is irrelevant at test. We argue that this pattern of results reflects an essential role for domain-general attention in visual memory, regardless of the complexity of the to-be-remembered stimuli. We discuss the implications of these findings for theories of visual short-term memory.
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(2065)

Increased Executive Control Demands Reduce Precision of Spatial Working Memory. MICHAEL D. PATTERSON and SHANSHAN YANG, *Nanyang Technological University*—Labels that do not transparently map onto an item require executive control (Miyake et al., 2004). Increasing executive control demands by manipulating label transparency may also result in reduced precision of spatial visual working memory. Labels were manipulated at either the encoding or response phase. At encoding, either 6 colors or shapes in random locations were displayed and an auditory cue indicated the stimulus to-be-maintained. Cues mapped more transparently to colors than shapes and mapped to one or three stimuli. Four seconds later all but one target stimulus were displayed. Responses to the target's location were completed by moving a cursor via a mouse, or by typing using a grid system with labeled columns and rows. Participants selected locations further from the target for conditions using executive-demanding labels at either encoding or response phases. These effects were additive, supporting the existence of interference between executive control and spatial memory processing.
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(2066)

Resource Allocation in Visual Working Memory for Structural Information is Affected by Exposure Duration. HIROYUKI TSUDA and JUN SAIKI, *Kyoto University*—Recent studies have investigated the fidelity of visual working memory for basic features such as color and orientation, but less is known about the precision of memory for complex information. We investigated the precision of memory for structural motion information. The task was to recall the direction-of-heading of point-light walkers with variable exposure durations. Precision of recall decreased as the set size increased to 3 items, at which point precision reached an asymptote when display time was short (500ms) but no such asymptote was found when duration was prolonged to 2500ms, reflecting an encoding or consolidation limit at shorter duration. However, at a longer duration (5000ms), precision asymptote was observed again. This pattern of data suggests that when memory items are rather complex, memory precision appears to be more susceptible to presentation duration, which causes an apparent switch in style of resource allocation.
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(2067)

Common Phonetic but Not Semantic Radicals Decrease Short-Term Memory Performance of Chinese Characters. HSIANG-YU CHEN, *National Central University, Taiwan,* ESTHER Y.-C. LIN, *National Yang-Ming University, Taiwan,* OVID J.L. TZENG, *National Yang-Ming University, Taiwan; Academia Sinica,* DAISY L. HUNG, *National Central University,*

Taiwan; Academia Sinica, DENISE H. WU, *National Central University, Taiwan*—Our previous studies revealed that short-term memory (STM) of Chinese characters is affected by both phonological and orthographic similarity among to-be-remembered materials. Sharing phonetic radicals in a list of characters, whose phonology might be similar or different, resulted in lower memory performance. In the present study, we further examined whether sharing semantic radicals on the left or right side of horizontal characters had the same effect. We also manipulated the transparency of the meanings between the semantic radical and the whole character. In contrast to the robust contribution of phonetic radicals to Chinese STM, the present results showed that sharing semantic radicals did not hinder STM. Such findings suggest that the orthographic similarity effect demonstrated in Chinese STM is not simply caused by the overlap of visual word forms among the to-be-remembered materials, but is due to common phonetic radicals, which serve important function for character recognition and retention.
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• TESTING EFFECTS I •

(2068)

Semantic Mediators and the Testing Effect in Cue-Target Pairs: Investigating the Role of Mediator-Cue Association Strength. LEONORA C. COPPENS, PETER P.J.L. VERKOEIJEN and REMY M. RIKERS, *Erasmus University Rotterdam*—According to the elaborative retrieval hypothesis, retrieving cue-target pairs (MOTHER-CHILD) activates semantically related mediators (FATHER) more than restudying. Hence, the mediator-target (FATHER-CHILD) association should be stronger for tested than restudied pairs. Indeed, Carpenter (2011) found a better memory performance for tested than restudied targets when participants received mediators (FATHER) as final test cues. However, this effect could be caused by a strong mediator-cue association, because this association enables participants to recall the target via the original cue. To investigate this, we created two lists of 16 cue-target pairs: one list in which each mediator was strongly associated with the cue and one in which there was no mediator-cue association. Participants learned the pairs in one list through restudy or testing and completed a final cued recall test in which the cue was either a target-related word or a mediator. The results are not in line with the semantic mediator hypothesis.
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(2069)

Effects of Free Recall Testing on Immediate and Delayed Recognition. KURT A. DESOTO, JOHN F. NESTOJKO and HENRY L. ROEDIGER, *Washington University in St. Louis*—Most testing effect research has shown that intermediate free recall tests benefit a later criterial free recall test. Surprisingly, however, intermediate free recall tests do not always influence the hit rate on later criterial recognition tests. Chan and McDermott (2007) suggested that the testing effect should be revealed when the final test draws heavily on processes of recollection. We replicated and extended their prior research by comparing the effects of intermediate free recall tests on immediate and delayed final source recognition tests. Although we did not obtain testing effects in immediate hit rates, we found that testing enhanced both immediate and delayed source memory judgments (as well as hit rates on the delayed tests). Critically, source recollection is better when intermediate free recall tests occur after each list.
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(2070)

Testing Potentiates New Learning in the Misinformation Paradigm. LEAMARIE T. GORDON and AYANNA K. THOMAS, *Tufts University,* JOHN B. BULEVICH, *Richard Stockton College of NJ*—Retrieval Enhanced Suggestibility (RES) is the finding that the misinformation effect is exacerbated when a test precedes misleading post-event information (Chan, Thomas, & Bulevich, 2009). In the present study we tested possible explanations for the RES effect. We compared three groups of participants in two experiments. Two groups of participants received a test before and after misleading post-event information. The first group received identical tests, while the second received related tests. These repeated test groups were compared to a standard single test control. By comparing related and identical test groups we were able to test how the initial test modified the processing of the post event information. By comparing the repeated test groups to the control, we were also able to examine whether testing impaired access to memory for the original event. Results from reading time of the narrative and performance on an MMFR test indicated that both kinds of preceding tests affected attention allocation given to the post-event narrative. We proposed that changes in attention allocation resulted in enhanced learning of misinformation. That is, testing potentiated learning of new information.
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(2071)

Diminished Testing Benefits in Young Adults With ADHD. NICOLE M. DUDUKOVIC, *New York University,* JACKIE L. GOTTSHALL and PATRICIA A. CAVANAUGH, *Trinity College*—Memory retrieval enhances the long-term retention of tested material (e.g., Roediger & Karpicke, 2006). However, recent research suggests that limiting attention during retrieval can significantly decrease the benefits of testing memory (Dudukovic, DuBrow, & Wagner, 2009). The present study examined whether testing benefits are reduced in young adults with attention-deficit hyperactivity disorder (ADHD). College students with and without ADHD read three short prose passages, each followed by a free recall test, a restudy period, or a distractor task. Two days later participants recalled the passages. Testing benefits were diminished in participants with ADHD such that they did not show any advantage of testing over restudying, whereas participants without ADHD did exhibit significant testing effects, with greatest recall in the test condition. Further analyses revealed that the absence of a testing effect in the ADHD group was due in part to diminished recall on the initial test but also to reduced benefits

for information that was successfully retrieved. These findings further confirm the importance of attention in retrieval processes and have implications for improving educational practices among individuals with ADHD.
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(2072)

Neuroimaging Evidences of the Testing Effect. ATTILA KERESZTES, *Budapest University of Technology and Economics,* DANIEL KAISER and GYULA KOVÁCS, *University of Regensburg,* MIHÁLY RACSMÁNY, *Budapest University of Technology and Economics*—Retesting a material can be more efficient in memorizing it for the long run than restudying it, a phenomenon called testing effect. We asked participants (n=28) to learn the meaning of 60 suaheli words in their native language. Half of the words were then repeatedly retested, the other half were repeatedly restudied. A final test was administered for all words either 30 minutes or a week later in a functional magnetic resonance imaging scanner. We measured the blood oxygen level dependent signal of participants using an event-related design. Successful retrieval was accompanied by different activation patterns for retested versus restudied words. Specifically, left parietal areas (identified in a separate working-memory functional localizer run) were differently activated for previously restudied vs. retested stimuli during successful recall after both short and long delay. Our results support the suggestion that retest and restudy conditions lead to anatomically distinct processes of memory consolidation.
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(2073)

The Effects of Enactment and Testing on Predicted and Actual Memory Performance. VEIT KUBIK, *Stockholm University,* HEDVIG SÖDERLUND, *Uppsala University,* LARS-GÖRAN NILSSON and FREDRIK U. JÖNSSON, *Stockholm University*—We investigated the combined effects of two robust memory phenomena, the testing effect and the enactment effect, in 80 university students. The study-only groups learned a list of 36 action phrases six times (e.g., "lift the glass"), either by motorically performing them or by reading them aloud. The testing groups studied and were tested on the action phrases in an alternating fashion. Cued recall tests were given to all groups after 18 minutes and again after one week. Enactment led to better memory performance compared to verbal encoding after both retention intervals, but did not affect the forgetting rate. Testing, on the other hand, led to less forgetting over a week than only studying action phrases. To conclude, a dissociation was found between the effects of enactment and testing. Enactment only improved the absolute memory performance, whereas testing instead mitigated forgetting. Additionally, global judgments of learning were analyzed. Participants' memory predictions modestly reflected the enactment effect, but the participants did not seem to be aware of the effect of testing on memory. The results are discussed in the item-specific/relational and item-integration framework.
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(2074)

Is Working Memory Capacity Related to the Magnitude of the Testing Effect? TYLER L. HARRISON, *Georgia Institute of Technology,* JOSHUA W. WHIFFEN, *Furman University,* TAMARA M. WARE and RANDALL W. ENGLE, *Georgia Institute of Technology* (Sponsored by Gilles O. Einstein)—The finding that testing improves long-term retention compared to additional studying has received a fair amount of attention in recent years. However, little is known about which individuals benefit the most from the testing effect. In the present study, we examined whether the magnitude of the testing effect was the same for individuals with high and low working memory capacity (WMC). Using the paradigm of Roediger and Marsh (2005), subjects read passages, answered multiple choice questions concerning the passages, and finally answered some cued recall questions after a brief delay. The results indicated that all participants benefited from the multiple choice testing; however, subjects with high WMC benefited more than subjects with low WMC. The number of multiple choice lures impaired both groups of participants to the same extent.
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(2075)

Testing Effects, Strategy Selection and Working Memory. SHU-HUA TSAI and YUH-SHIOW LEE, *National Chung-Cheng University*—Despite the well-established benefit of testing, students often preferred re-reading over retrieving while studying on their own (Karpicke et al., 2009). In a verbal paired-associate learning paradigm, we found that when given a chance to test or restudy the weakly associated word pairs, participants of high operation span were more willing to choose testing than those of low span. However, their final recall performance was not better than those who chose to re-study. We hypothesize that such a result is because participants with higher working memory capacity gained less from testing. This account is supported by another within-subject experiment using the same testing materials: In this experiment a testing effect was observed in both the immediate and the 24H delay cued recall. More importantly, the effect was larger for low-span participants as compared to those of high span. These findings highlight the importance of examining individual differences in the testing effect.
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(2076)

Fragile and Mysterious Effects of Interim Tests on Learning Text Material. KATHRYN T. WISSMAN and KATHERINE A. RAWSON, *Kent State University*—Interim tests over studied word lists facilitate the learning of subsequent word lists, and these effects persist over time (Szpunar, McDermott, & Roediger, 2008). The current experiments evaluated whether interim tests also facilitate learning and retention of more complex text material. Learners studied expository text one section at a time, either with an interim free recall test after each section or text recall only after the last section. Recall during the study phase was substantially greater for the interim test group than for the control group. However, the effect was minimal or non-existent on a final free recall test 20 minutes later. Secondary analyses ruled out the possibility that

the temporary gain was due to enhanced recall of low-level detail information that was forgotten across the short delay. In sum, interim tests facilitate the learning of text material but these effects are more fragile than with word lists.
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(2077)

Examining the Benefits of Testing With Mathematical Learning. NICOLE J. BIES-HERNANDEZ, DAVID E. COPELAND, NATHAN O. RUDIG, ALEX M. MOORE and MARK H. ASHCRAFT, *University of Nevada, Las Vegas*—Previous research has shown that testing can improve long-term learning of word lists or texts (Roediger & Karpicke, 2006). However, it is not clear whether testing has the same benefit for learning a procedure, such as mathematics. In this study, we examined whether practice testing is beneficial when learning a unique mathematical procedure (i.e., modular arithmetic) or memorizing mathematical facts. We also examined whether math anxiety (AMAS, Hopko, Mahadevan, Bare, & Hunt, 2003) would influence the potential benefits of testing. This was investigated using a standard testing effect paradigm that compared restudying to a practice test condition. Performance on the final test was significantly higher with practice testing (i.e., the testing effect) for both math conditions, regardless of level of math anxiety. These results provide initial evidence that practice testing can be used to enhance mathematical learning in the laboratory, even for people who are high math anxious.
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• SELECTIVE ATTENTION II •

(2078)

Hypothesis Generation Supports Visual Search: The Influence of Alternative Outcomes and Working Memory Capacity. DANIEL R. BUTTACCIO, *The University of Oklahoma,* NICHOLAS D. LANGE, *University of London,* RICK P. THOMAS and SOWON HAHN, *The University of Oklahoma,* MICHAEL R. DOUGHERTY, *University of Maryland*—We have previously proposed that hypothesis generation underlies visual search when potential target features must be retrieved from LTM. Here we demonstrate two consequences of this perspective. Participants reported the orientation of a rotated "T" amongst rotated "L's within a search array. Prior to (and accompanying) the search array, a background cue was presented that provided varying degrees of diagnostic information regarding the target color. In Experiment 1 we found that targets were detected faster when their color was high in posterior probability given the background cue. In Experiment 2 participants high in WM capacity detected targets (with low-probability colors) faster than participants with low capacity, suggesting that high WM participants are able to generate and maintain more hypotheses (i.e., potential target colors) in WM. These results provide additional support for the claim that visual search is influenced by hypothesis generation when target information can be inferred from contextual cues.
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(2079)

Distracter Similarity, Attention, and Contextual Cueing Effects. EDWARD C. MERRILL and YINGYING YANG, *The University of Alabama*—Contextual cueing involves an attentional guidance effect that uses previously experienced visuo-spatial regularities in the environment to facilitate search for a target. Typically, the same objects that are NOT the target appear in the same locations in the display and predict the location of the target. In this research, half of the nontargets predicted the location of the target and half did not. We varied the degree of similarity between predictive and nonpredictive distracters (and also the target). Somewhat surprisingly, contextual cueing effects were observed when the predictable and nonpredictable distracters were similar to each other and the target but not when they were different. Other conditions (e.g., when all distracters predicted the target location) suggested that when the nonpredictive distractors were dissimilar, they may have pulled attention from the predictive distracters and interfered with the development of contextual cueing.
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(2080)

Linking Perceptual Animacy to Attention: Evidence From the Chasing Detection Paradigm. HAUKE S. MEYERHOFF, *Knowledge Media Research Center Tübingen,* MARKUS HUFF, *University of Tübingen,* STEPHAN SCHWAN, *Knowledge Media Research Center Tübingen*—Perceptual animacy describes the tendency of human observers to interpret spatio-temporal contingencies between motions of simple shapes in anthropomorphic terms, such as social causation or intention. Recent studies established a chasing detection paradigm that allows a psychophysical measurement of animacy. This line of research has argued that a chase is perceived efficiently among distractors. Here, we present several variants of the chasing detection paradigm in order to investigate the link between perceptual animacy and attention. In Experiments 1a and 1b, we show that detection accuracy and response latency depend on the physical set size, suggesting that chasing detection is inefficient. Experiment 2 replicates these findings with an attentional set size manipulation. Finally, Experiment 3 combines the chasing detection task with an attentional cueing paradigm in order to directly guide attention. Valid cues enhanced chasing detection, indicating that chasing detection requires effortful visual search through subsets of all possible items.
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(2081)

Evidence for the Use of Cognitive Aspects of Numbers in Visual Search. PATRICK CONLEY, PADMANABHAN SUDEVAN, MADELINE M. DAVID, JONATHON M. WUTKE, DENISE CALHOUN and IAN K. EVANS, *University of Wisconsin, Stevens Point*—Visual search tasks are almost exclusively based on visual characteristics of the target that distinguish it from distractors in the same array. Our previous experiments have demonstrated that the abstract qualities of numbers, such as magnitude and parity, can also be used as a basis for discrimination in a visual search task. We

have extended these findings in the current research in several ways: we have demonstrated these effects within-subjects, showing that the same individuals will behave differently when prompted with different cognitive cues for search. We have also shown these cognitive effects when the numerical stimuli are combined with congruous and incongruous color cues (i.e., either the correct target or an incorrect target is shown in red). Finally, we have found these cognitive effects even at the smallest set sizes, in target arrays from 2 digits (one target, one distractor) to 16 digits. These results further support our hypothesis that the abstract qualities of numbers, and not their physical characteristics, are guiding search in these experiments.
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(2082)

Integrating Working Memory and Perception: The Precision of Attentional Guidance in Visual Search. CARLY J. LEONARD, NANCY B. CARLISLE and STEVEN J. LUCK, *University of California, Davis*—Context-appropriate behavior requires the rapid integration of sensory input, control processes, and action. During search, visual working memory (VWM) can provide a "target template" that is maintained over time to facilitate selection of potentially relevant objects until the target is found. Our experiments directly compare the precision of a color in VWM with the selectivity of saccadic behavior during search for a color target. We designed pairs of experiments with nearly identical displays. In the memory task, a color is encoded into VWM and precision is measured after a short delay via a memory-matching decision. In the search task, a target color is encoded into VWM and the likelihood of visiting distractors at different distances from the target in color space is measured. We show that the precision of VWM is not directly translated into attentional guidance. Results are discussed in terms of perceptual acuity, decision-noise, and speed-accuracy tradeoffs.
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(2083)

Speed-Accuracy Trade-Offs in the Flanker Task. MICHAEL DAMBACHER, KAI ROBIN GRZYB and RONALD HÜBNER, *University of Konstanz*—Processes underlying speed-accuracy tradeoffs (SATs), i.e., the positive correlation of response times and accuracy, have been plausibly delineated for simple perceptual decisions. However, SATs are not fully understood for more complex tasks involving, for instance, conflicting sensory information. We therefore assessed SATs in a flanker task. Participants performed parity judgments on target numerals in the presence of response-incongruent or neutral distracters. Three deadlines were used to modulate time pressure. As a result slopes of conditional accuracy functions steepened with time pressure. Further, the dynamics of the flanker congruency effects differed between deadline conditions. These results cannot be fully explained by classical SAT accounts for simple decisions, such as adjustments of decision criteria or deadline-dependent guessing rates. Rather our data suggest that processing rates are also sensitive to time pressure, a finding that is supported by fits of a recently developed dual-stage two-phase model of selective attention.
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(2084)

On the Identification of Irrelevant Flankers: Dilution vs. Load vs. Slippage. NICHOLAS GASPELIN, ERIC RUTHRUFF, KYUNGHUN JUNG and EMMA CRANE, *University of New Mexico*—Is unattended information processed semantically? Theorists have posited that certain factors, such as low perceptual load or low dilution, cause unattended information to leak through the attentional filter and therefore be processed semantically (Benoni & Tsal, 2010; Lavie & Torralbo, 2010). These leakage accounts are supported by the finding that irrelevant flanker letters interfere with target identification. Although these so-called flanker compatibility effects are often assumed to reflect semantic identification without attention (i.e., leakage), insufficient precaution has been taken to prevent attentional allocation to the flanker (i.e., slippage). In the current study, we assessed whether slippage is in fact the primary cause of compatibility effects under low dilution and low perceptual load. We discuss whether concepts such as load and dilution are needed to explain the pattern of data.
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(2085)

Hierarchical Attentional Cuing Effects With Central Arrows: Global Dominance Early, Local Dominance Late. MARK MILLS and MICHAEL D. DODD, *University of Nebraska, Lincoln* (Sponsored by John Flowers)—The present study examined e the visual temporal dynamics in the processing of hierarchical structures in a target detection task following the presentation of an irrelevant central cue. The cues were small "local" arrows arranged to form a large "global" arrow. Importantly, the direction of the global and local arrows was either consistent (both directed at same location) or inconsistent (each directed to opposite locations) so that global or local dominance could be assessed at various cue-target SOAs. Across three experiments, global cuing effects (faster target detection in the direction of the global arrow) were observed at early SOAs, whereas local cuing effects (faster target detection in the direction of the local arrows) were observed at later SOAs. As the same pattern was observed even when one of the local arrows was salient (Experiment 2-3), these results suggest that the temporal processing sequence (global-to-local) is fixed for symbolic stimuli.
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(2086)

Does Learning of Contextual Regularities Require Attention? ALEXIS DEFER, GILLES UHLRICH and FRANÇOIS MAQUESTIAUX, *University Paris-Sud, Orsay,* ANNABELLE GOUJON, *University of Provence, Marseille,* ANDRÉ DIDIERJEAN, *University of Franche-Comte and Institut Universitaire de France, Besancon* (Sponsored by Fabien Mathy)—In two experiments, the contextual cueing paradigm was applied to repeated real-world scenes. All the scenes were repeated across the search task but half had a fixed target

location and half had a randomly shuffled target location. The target was an uppercase letter. In Experiment 1, the target was embedded within the real-world scenes. In Experiment 2, the target was more salient and was embedded within a consistent configuration of Ls, thus reducing attention to the predictive context. In both experiments, the search task was performed under divided or full attention. Our results showed a stronger contextual cuing effect in Experiment 1 than Experiment 2, showing a crucial role of selective attention in learning regularities. However, reducing available attention with a concurrent task did not influence the contextual cueing effect. We discuss the role of attention in learning and the critical distinction between selective and divided attention.
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(2087)

Interactions Between Working Memory and Perceptual Load. HIDEYA KOSHINO and PILAR OLID, *California State University*—We investigated relationships between working memory (WM) and perceptual load (PL). Lavie and colleagues reported that PL decreases distractor processing, whereas WML increases distractor processing. We manipulated verbal and visual WML, and contents of WM in visual search tasks. There was an interaction between verbal WML and PL. Compatibility effects remained the same between WM and no WM conditions for low PL, whereas compatibility effects were observed only for the WM condition for high PL. For visual WML, however, compatibility effects were obtained only for low PL, regardless of WML. When a response compatible/incompatible distractor is held in WM, there was a compatibility effect for high PL but not for low PL. These results suggest that effects of WM on distracter processing depend on the relationship between the type of WM (e.g., verbal vs. visual) and attentional requirements in visual search.
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(2088)

Contingent Capture by a Broadly Tuned Filter. BOYOUNG KIM, SOO MIN KIM and YANG SEOK CHO, *Korea University*—Previous spatial cuing studies have shown that attentional control setting can be set for two target-defining features simultaneously (Folk & Anderson, 2010; Irons, Folk, & Remington, in press). However, because two distant colors were used as the target-defining feature in the previous study, it is unclear whether attentional control setting is determined at a specific value or by a broadly tuned filter. To investigate this issue, participants searched for a red or yellow target following a color cue that was red, yellow, orange, or blue in Experiment 1. The orange color cue caused a significantly large validity effect, comparable to the effect with the red and yellow cue, but the blue cue did not. The same pattern was obtained when the singleton search mode was hindered by varying the nontarget color in Experiment 2. These results suggest that attentional control is set for a color by a broadly tuned filter.
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(2089)

Interaction Between Scene-Based and Array-Based Contextual Cueing. GAIL M. ROSENBAUM, *University of Minnesota; Temple University,* YUHONG V. JIANG, *University of Minnesota*—Contextual cueing refers to the cueing of spatial attention by repeated spatial contexts. Previous studies have demonstrated distinctive properties of contextual cueing by a background scene and an array of search items. The former is supported primarily by explicit learning, whereas the latter is supported primarily by implicit learning. This study investigates the interaction between scene-based and array-based contextual cueing. Participants searched for a target that was predicted by both the scene and the array. We tested three possible patterns of interaction: i) scene and array are learned independently, in which case cueing should be expressed even when only one cue is preserved; ii) scene- and array- are learned jointly, in which case cueing should occur only when both cues are preserved; iii) learning of the stronger cue blocks learning of the weaker cue. In several experiments we manipulated the nature of cues present during training and testing. We also tested explicit awareness for scenes, scene-target associations, and arrays. Results support the associative blocking account: Scene-based contextual cueing blocks array-based contextual cueing when both are predictive of the target.
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(2090)

Reward History Influences Search Efficiency by Enhancing Distractor Filtering. JEONGMI LEE and SARAH SHOMSTEIN, *The George Washington University*—Recently we demonstrated that search for a target feature previously associated with higher reward becomes more efficient, and that reward modulates attentional guidance even when reward contingency is no longer relevant. Here, we investigated whether the reward based increase in search efficiency is due to facilitation of the target or efficient filtering of distractors. Target search among neutral or previously rewarded distractors was compared, while systematically manipulating reward and the proportion of the previously rewarded distractors. Results showed that presence of distractors previously associated with low reward increased search efficiency as compared to neutral baseline, regardless of the proportion of the rewarded distractors. Interestingly, the effect of distractors previously associated with high reward varied with the proportion of the rewarded distractors present, such that low proportion of distractors resulted in a less efficient search, while high proportion of distractors resulted in a more efficient search. These results suggest that presence of previously rewarded feature increases search efficiency via enhanced distractor filtering, unless attention is captured by rare high-rewarded distractors.
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• COGNITIVE CONTROL II •

(2091)

Examination of the Boundaries of the Buffering Effect of Control on Emotion Processing. SIMONA BUETTI and ALEJANDRO LLERAS, *University of Illinois*—In the past we have documented that a high subjective experience of control

can substantially alter how emotion and cognitive processes interact. For example, we have shown that under conditions of low perceived control, the perception of time is strongly modulated by the emotional content of events, while these emotionally driven time distortions vanish under conditions of high perceived control. Here we examine the boundary conditions of this effect. We hypothesized that although high levels of agency can be induced in undesirable situations, a sense of cognitive dissonance may prevent the buffering effect of control from occurring. We asked participants to try to maximize the occurrence of negative images in the experiment by selecting one of two buttons at the beginning of each trial. Independent of their choice, 75% of images were negative, inducing a sense of success and control in this task. However, when judging the duration of those images, participants experienced strong temporal distortions induced by the emotionality of the image. In sum, experiencing a high level of perceived control provides a buffering effect on emotion processing only when task goals are aligned with the participants' own goals for wellbeing.
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(2092)

Media Multi-Taskers and Evaluation of Waiting-Time. ETSUKO T. HARADA, SUMARU NIIDA and YUKI KASE, *University of Tsukuba*—As the variety of mobile services increases, human in current society is continuously exposed to a temptation to do something under spontaneous divided attention condition, e.g. media multitasking. Previous studies investigated relationship between behavior of media multitasking and characteristics in attention, implicating an interesting picture that multi-media circumstances made people with poor attentional ability to do more multitasking. Why this happen? As one possible answer, we tested a hypothesis that high media multitaskers are less patient for waiting, and they welcome to use a simultaneous stimulus for their pastime. The experimental results showed that high media multitasking participants showed drastic increasing of waiting-time evaluation, when they are given an additional reading material while they are sending e-mail. Some additional data about multi-tasking in face-to-face communication, as a ripple effect of media multitasking, will be discussed, too.
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(2093)

Sustained Attention and Dispositional Motivation: Top-Down Influences on Cognitive Performance. DAVID VAZQUEZ, ADAM FELTON and CHRISTINE CHIARELLO, *University of California, Riverside*—Despite recognition of participants' motivations as factors in cognitive experiments, few studies have examined the role of dispositional motivation on cognitive performance. An information-processing framework that incorporates Deci and Ryan's (1985) differing levels of motivation (intrinsic, extrinsic, amotivated) would suggest that motivation mediates top-down resource allocation in sustained attention, response inhibition, and selective memory encoding. We measured participants' (n=102) performance on various cognitive tasks, including the Sustained Attention to Response Task (SART), self-report on the Academic Motivation Scale, as well as performance IQ. Results indicate a negative trending relationship between extrinsic motivation and error on the SART, $r = -.18$, $p = .06$, that was not moderated by PIQ, indicating an influence of dispositional motivation on sustained attention. A follow-up experiment considers other dispositional factors and examines the role of top-down motivational influences on selective memory encoding. These experiments offer insights for building cognitive profiles of differently motivated individuals.
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(2094)

Support for Multiple Inhibition Factors: Evidence From Dissociations in Aging. CORINNE M. ALLEN and RANDI C. MARTIN, *Rice University*—Inhibitory control has often been considered a unitary construct, though some have suggested that inhibitory control actually consists of multiple components. For example, on the basis of a factor-analytic approach, Friedman and Miyake (2004) distinguished between response-distractor inhibition (the ability to resist interference from distractors in the environment) and resistance to proactive interference (the ability to resist interference from no-longer-relevant information in memory). We investigated the separation of these two inhibitory mechanisms in an aging study by testing 102 younger and 60 older adults on multiple tasks tapping each type of inhibition. Older adults relative to younger adults showed consistent evidence of exaggerated interference effects on resistance to proactive interference tasks, but not on response-distractor inhibition tasks. Their selective difficulty with one type of inhibition provides support for the separability of the two types of inhibition and further provides evidence regarding the nature of inhibitory deficits associated with cognitive aging.
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(2095)

The Interaction of Inhibition, Working-Memory, and Task-Switching in a Auite of Executive Function Tasks. AARON T. BUSS, TIM WIFALL, JOHN P. SPENCER and ELIOT HAZELTINE, *University of Iowa*—A group of 17 participants completed a set of executive function measures including versions of go-no-go, Simon, change detection, and rule switching tasks. The inhibitory, working memory or switching demands were manipulated across these different tasks. Robust relationships among tasks were found. For example, high working memory capacity was associated with faster performance on rule-repeat trials, but was also associated with higher switch costs on rule-switch trials. This suggests that robust working memory can speed up the execution of task rules, but this efficiency also makes task switching more difficult. Strong inhibitory control in the go-no-go task was associated with larger increases in the Simon effect when the number of the stimuli and, therefore, the working memory demands were increased. Thus, subjects with efficient inhibitory control were impaired more strongly by increased

working memory demands. We interpret these results within the context of a computational neurocognitive framework, dynamic field theory.
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(2096)

What Makes Serial Recall Insensitive to Switch Costs? CINDY CHAMBERLAND and SÉBASTIEN TREMBLAY, *University Laval* (Sponsored by Francois Vachon)—The cost of switching between cognitive tasks is a robust phenomenon that has been reproduced with several task switching paradigms. In contrast with that finding, recent work showed no detrimental effect of switching between serial memory tasks (Chamberland & Tremblay, 2011). In the present study, we wish to further explore the source of such an absence of cost on serial memory tasks by examining which parameters of the task make it resistant to task switching. A series of three experiments showed that the insensitivity of serial memory tasks to switching costs do not arise from the time frame of the task (slack time). Rather, the key factor was whether or not the memory task required the processing of serial order information. Such a finding is discussed in the light of short-term memory models.
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(2097)

Trainability and (Selective) Transferability of Interference-Resolution Skills. ERIKA K. HUSSEY, J. ISAIAH HARBISON, ALAN MISHLER, SUSAN TEUBNER-RHODES and JARED M. NOVICK, *University of Maryland*—Recent findings suggest promise in training cognitive functions to improve high-level abilities. The extent to which performance increases generalize to novel tasks hinges on the degree of shared mechanisms across training and transfer measures (dubbed 'process-specificity'). We tested if training over eight hours on variants of the n-back task improves performance on 'interference' conditions of an untrained recognition-memory task, when a stimulus is familiar but does not match the target. The key manipulation was whether training included 'lures,' or memory competitors (recently presented items in non-n-back locations). An untrained recognition-memory task was administered pre-/post-training to evaluate transfer in interference and no-interference contexts. Subjects improving on n-back-with-lures demonstrated selective transfer: significant recognition-memory improvements under high, not low, interference-resolution demands. No-lures trainees exhibited no transfer despite comparable gains over the course of training. These findings suggest the importance of process-specificity: interference-resolution functions are trainable and mediate certain transfer effects.
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(2098)

Executive Control, Working Memory, and Action Planning: An Individual Differences Approach. KAITLIN M. REIMAN and CATHERINE M. ARRINGTON, *Lehigh University*—Logan's (2004) task span procedure allows for investigation of controlled behavior and manipulation of stored information by combining task switching and WM paradigms. Adapting this procedure, the current research sought to determine how volitional planning and execution of simple sequences of tasks were related to individual difference measures of working memory capacity (WMC; measured by the OSPAN) and executive control (measured by the ANT). Using the task span and memory span paradigms with volitional selection of sequences, we addressed the question of bias in participants' choice when task sequences were executed or simply recalled. Stronger executive control correlated with reduced bias against complex sequences in both voluntary task span and voluntary memory span. Higher WMC correlated with less complexity bias in the voluntary task span. An overall bias towards less complex sequences was common, suggesting that participants' goal is to limit cognitive effort expended.
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(2099)

Mechanisms Underlying Collaborative Inhibition: Evidence for Retrieval Blocking. SARAH BARBER, *University of Southern California,* CELIA HARRIS, *Macquarie University,* SUPARNA RAJARAM, *Stony Brook University* (Sponsored by Margaret Keane)—Collaborative inhibition is generally thought to be due to retrieval disruption. We examined two alternate mechanisms -- retrieval inhibition and retrieval blocking. To differentiate between these accounts, we tested how collaborative recall of unshared information influences subsequent individual recall and recognition memory. If collaborative inhibition is solely due to retrieval disruption, then items not recalled during collaboration should rebound on subsequent, individual tests. If it is due to retrieval inhibition, then the impairment should persist regardless of the type of test. Finally, if it is due to retrieval blocking, then the impairment should persist on free recall, but not recognition, tests. Later individual performance remained lower following collaboration compared to the non-collaboration (nominal group) condition on a free recall test (Experiment 1) but this deficit was eliminated on a recognition test (Experiment 2). Thus, retrieval blocking also plays a role in producing collaborative inhibition.
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(2100)

The Effects of Proportion Congruent on the Magnitude of Stroop Interference: Controlling for the Display Frequency Confound. JAEYONG LEE, ELIOT HAZELTINE and J. TOBY MORDKOFF, *University of Iowa*—It is known that the observed magnitude of the Stroop effect depends on the proportion of congruent trials. This holds when proportion congruence is manipulated between subjects, between blocks, or even between specific items within a block. The latter result has been taken as evidence that selective attention operates at the level of individual items, as opposed to only acting to gate or filter entire dimensions of stimulus information. However, the manner in which proportion congruence has been manipulated in the Stroop task creates a confound with display frequency; when proportion congruence is high, the frequency of congruent displays is also high. To correct for this

unavoidable confound, we developed methods for estimating the contribution of display frequency to the entire pattern of results. By subtracting the contribution of display frequency, we can determine whether proportion congruence really does alter the magnitude of the Stroop effect.
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• SPEECH PERCEPTION II •

(2101)

Identifying Talkers in Other Languages & Dialects: The Role of Language Rhythm. GIOVANNA MORINI, *University of Maryland,* ELIZABETH JOHNSON, *University of Toronto,* LEHER SINGH, *National University of Singapore,* ROCHELLE NEWMAN, *University of Maryland*—The average person is exposed to multiple speakers. One sentence conveys information about the linguistic message (e.g., meaning, phonology and rhythm of the language), as well as information about the speaker's identity (e.g., age, sex, emotional state). Previous work (Johnson et al. 2011) suggests that understanding the linguistic message is not a requirement for voice discrimination (i.e., speakers of English are able to discriminate between speakers of other languages) and that familiarity with the language instead, might be a contributing factor. Less is known about the role of other elements in the speech signal during voice discrimination. We examined the effect of rhythm by presenting American English speakers with sentences produced by speakers of: the same English dialect, German (also stress-timed), Hindi (syllable-timed), and Singaporean English (syllable-timed). Preliminary data (N=10, 5 males) suggest greater accuracy with the American, Singaporean, and Hindi speakers, and more difficulty discriminating between the German voices.
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(2102)

Allocation of Attentional Resources to Speech in Monolingual and Bilingual Listeners. LORI B. ASTHEIMER, MATTHIAS BERKES, MICHAEL RAKOCZY and ELLEN BIALYSTOK, *York University*—Attention is required during speech perception to focus processing resources on critical information. Previous research has shown that bilingualism modifies attentional processing in nonverbal domains. We used ERPs to determine whether bilingualism also modifies attention to linguistic structure during speech perception. The task assessed auditory attention to word onsets in spoken English for monolingual English speakers and Chinese-English bilinguals with varying degrees of English proficiency. Auditory probes were inserted into a continuous narrative in four conditions: concurrent with word onset, 100 ms before and after onset, and at random control times. Greater attention was indexed by an increase in the amplitude of the early negativity (NI). Among monolinguals, only probes presented after word onsets elicited a larger N1 than control probes, replicating previous studies. For high-proficiency bilinguals, probes before, at, and after word onsets elicited a larger N1 than control probes, but low-proficiency bilinguals showed no differences across probe times. These results show different attentional strategies as a function of bilingualism and English language proficiency.
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(2103)

Perceptual Learning in Optimal and Adverse Conditions. XUJIN ZHANG, *Stony Brook University,* ARTHUR G. SAMUEL, *Basque Center on Cognition, Brain and Language; IKERBASQUE*; *Stony Brook University* (Sponsored by Richard Gerrig)—Humans have remarkable abilities to understand spoken language despite the large amount of variability in the speech. Listeners can use lexical information to guide their interpretation of atypical sounds in speech, enabling them to adjust to the variations in utterances due to talker-specific characteristics, such as individual identity and dialect. The current studies investigated perceptual learning of ambiguous versions of /s/ and /f/ in two optimal conditions: normal/conversational speech vs. hyper-clear speech, and two adverse conditions: noise masking vs. cognitive load. Participants heard the /s/ or /f/ stimuli in separate sessions held one week apart. Perceptual learning occurred in both optimal conditions and under cognitive load, but not in the noise masking condition. However, perceptual learning occurred only in the first of the two sessions, and only for the atypical /s/ sounds. The pattern of learning and non-learning provides insight into listeners' reliance on lexical-semantic cues under different listening conditions.
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(2104)

Multiple-Talker Speech Processing: Cognitive Costs in Audio-Only and Audio-Visual Contexts. SHANNON L. HEALD, CHI-HYUN KIM, OLIVIER LESCOP and HOWARD C. NUSBAUM, *The University of Chicago*—Talker differences give rise to variability in the relationship between acoustic patterns and phonetic categories. Despite this complexity, listeners are adept at comprehending speech in multiple-talker contexts, albeit at a cognitive cost. This cost has been demonstrated only in audio-only speech. Other work in single-talker contexts have shown, that speech recognition is improved under adverse listening conditions when listeners are given face information. Does seeing a talker's face reduce the cost of recognition in multiple-talker contexts? We used a speeded word-monitoring task in which listeners make quick judgments about target-word identity in single and multiple-talker contexts. Results show slower recognition performance in multiple-talker conditions compared to single-talker conditions for both audio-only and audio-visual speech. We found this effect to be significantly more pronounced in the audio-visual condition compared to audio-only condition. Resolving talker variability does not seem to be made easier by face information, rather face information may represent an additional channel of information about talker-specific characteristics that need to be additionally resolved, increasing the overall cognitive costs.
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(2105)

Effect of Font Style on the Volume of Inner Speech. JORDAN R. WAGGE, SHAWNALEE CRISS and REBEKAH SEWING, *Avila University*—Inner speech, a form of speech imagery, frequently accompanies reading tasks. We hypothesized that, similar to visual imagery, inner speech might be manipulated by changing font style. In this study, we examined the effect of using regular-type versus all-capitalized fonts on participants' current or impending experience of a headache. Fifty student participants were given a survey masked as research on use of over-the-counter medications in college students. Half of the participants received the survey in all caps, and half received the survey in regular type. Font style had no effect on participants' ratings of the likelihood that they would take medication for a headache or would experience a headache in the next 24 hours; however, participants who received the regular-type survey were more likely than those who received the all-caps survey to state that they were currently experiencing a headache. This surprising result might indicate that people who are reading in all-caps might compensate by "turning down the volume" on their inner speech.
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(2106)

Real-Time Integration of Asynchronous Cues to Fricative Voicing and Place of Articulation. MARCUS E. GALLE and BOB MCMURRAY, *University of Iowa*—A fundamental issue in speech perception is the fact that information is spread over time. This raises the question of how listeners integrate acoustic information in real-time. One possibility is that cues are utilized as soon as they arrive to partially activate lexical candidates. Alternatively, input could be a buffered, until sufficient information is available to make a decision. Between these extremes, listeners may vary depending on the usefulness of a given cue, and whether it directly cues a phonetic contrast, or serves as context (e.g., talker identity) for interpreting other cues. We examined this in word-final and initial fricative contrasts using the visual world paradigm. Participants selected a visual referent of an auditory word (ship), and we used the likelihood of fixating lexical competitors (sip/ship) at each point in time to determine when various factors affected higher level decision making. Several studies contrasted the order and utility of the cues (strong vs. weak in different positions), and direct cues vs. information like talker used for compensation. In general, listeners appear to use acoustic information immediately as it becomes available in real-time to lexical candidates.
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(2108)

Can a Chairman Be a Woman? Speaker Gender Influences Comprehension of –Man Suffixes. MARY E. GODFREY and KATHERINE K. WHITE, *Rhodes College*—This research investigated comprehension of gender-biased language by examining associations to words with generic masculine (GM) suffixes (e.g., chairman). Participants listened to sentences containing primes with GM (-man) or neutral (-person) suffixes that were spoken by either a male or a female. Immediately following presentation of the prime, participants made a lexical decision response to a visually presented target that was a male name (e.g., Jacob), female name (e.g., Ellen), or place name (e.g., Berlin). Results showed that the speaker's gender influenced comprehension of primes: When a male spoke GM primes, responses were fastest to male target names, whereas when a male spoke neutral primes, responses were fastest to female names. In contrast, when the speaker was female, both male and female target names were responded to faster than place names, and this effect was similar for both GM and neutral primes. These findings suggest that a speaker's gender plays an important role in activating gender-biased meanings during listening comprehension.
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(2109)

The Phonetic Answer to the Canonical Form Bias. MEGHAN SUMNER, *Stanford University*—How listeners understand spoken words despite massive acoustic variation in the speech signal continues to be an issue central to theories of spoken word recognition. Evidence that canonical productions of words are superior to phonetically reduced counterparts has mounted. But, particular variants co-vary with word-level phonetic patterns. I show that the benefit of canonical forms results from the comparison of words that vary in the variant, but are uniform in phonetic composition. Using the semantic priming paradigm, I examine three prime conditions: (1) Phonetically unreduced, variant-present (ce[nt]er; 623 msec in duration); (2) Phonetically unreduced, variant-absent (ce[n_]er; 576 msec); and (3) Phonetically reduced, variant-absent (ce[n_]er; 369 msec). Priming was found for Condition1, but not Condition2, replicating past work. Critically, facilitation comparable to Condition 1 was found for Condition3. This work questions the nature of the canonical bias and suggests that it results from a mismatch between pronunciation variant and word-level phonetics.
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(2110)

Global and Local Contextual Influences on Speech-in-speech Recognition. SUSANNE BROUWER and ANN R. BRADLOW, *Northwestern University*—Speech-in-speech recognition typically depends on how well listeners can perceptually segregate target speech from background speech. Previous research showed that target-background similarity is a crucial determiner of target speech recognition and that this effect is modulated by listeners' familiarity with the background language (e.g. Van Engen, 2011). In the present study we investigate whether variation in the target-background relationship at the global level (across trials within a test session) and at the local level (within trials) influences speech-in-speech recognition. We assessed English sentence recognition (by native English listeners) in the presence of English, Dutch, or a mixed set of English and Dutch background speech. Our data show that low masking (English-in-Dutch trials) is more responsive to changes across trials, whereas high masking (English-in-English trials) is more affected by changes within trials. Thus,

stream segregation is sensitive to features that go beyond target-background acoustic similarity and the time-scale of individual targets.
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(2111)

You Say Tomato: Forming Speaker-specific Phonemic Boundaries through Audiovisual Perceptual Tuning. AARON D. MITCHEL, *Bucknell University,* MICHAEL T. STEVENSON, CHIP GERFEN and DANIEL J. WEISS, *The Pennsylvania State University*—One challenge for speech perception is between-speaker variability in the acoustic parameters of speech. Perceptual tuning, the use of contextual information to adjust phonemic representations, may help overcome this variability. To date, perceptual tuning research has focused on static, unidirectional adjustments to phoneme boundaries. Here we test whether visual contextual cues to speaker identity may facilitate the formation and maintenance of distributional representations for individual speakers, allowing listeners to adjust phoneme boundaries in a speaker-specific manner. We familiarized participants to an audiovisual continuum between /aba/ and /ada/. During familiarization, the "b-face" mouthed /aba/ when the ambiguous token was played, while the "d-face" mouthed /ada/. At test, the ambiguous token was more likely to be identified as /aba/ when paired with a stilled image of the "b-face" than with an image of the "d-face," providing the first demonstration, to our knowledge, that listeners form speaker-specific phonemic representations using facial identity cues.
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• PSYCHOLINGUISTICS II •

(2112)

Individual Differences in Sentence-Tense and Left-Right Response Compatibility Effects in Language Comprehension. RAYMOND B. BECKER, BRIDGETTE DECOT, ERNESTO GUERRA and PIA KNOEFERLE, *Bielefeld University,* ROLF ZWAAN, *Erasmus University Rotterdam* (Sponsored by Todd Ferretti)—Mental timeline research has reported compatibility effects on response latencies for past-tense sentences when sensibility judgments were given with the left hand (compared to the right hand), and the opposite pattern for future-tense sentences (Ulrich & Maienborn, 2010). However, full-sentence reading times could mask subtle differences between incremental comprehension and response preparation. Also, individual differences in working memory could mediate the compatibility effects. We recorded eye movements as participants read sentences either in the past- or future-tense and prepared a left- or right-handed response. Analyses revealed reliable compatibility effects at the initial and final regions of the sentences in total reading times. However, low-working memory readers showed a compatibility effect for future-tense sentences in the first region of the sentence, while high-working memory readers showed no effect in the future tense. These findings will be discussed with respect to conceptual metaphor theory, embodiment, and working memory.
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(2113)

Learning Nonadjacent Linguistic Dependencies: The Importance of Starting Complex. JON A. WILLITS, *Indiana University,* DARAGH E. SIBLEY, *Haskins Laboratories,* MARK S. SEIDENBERG, *University of Wisconsin, Madison*—Languages exhibit dependencies between nonadjacent elements separated by varying distances. Previous analyses (e.g., Marcus, 1998) suggested that such dependencies cannot be learned by Simple Recurrent Networks, greatly limiting their relevance to human language. We show that these putative limitations are overcome in models that are more realistic with respect to children's language learning experience. SRNs learn distance-invariant dependencies, generalizing to distances on which they were not trained, if exposed to variable distance dependencies during training. SRNs also learn nonadjacent dependencies more easily when the dependent items are also related along a correlated dimension (e.g., perceptually or semantically). Finally, we show that simple SRNs can learn abstract, rule-like dependencies when the model's training procedure more closely resembles the experience of infants in artificial language learning experiments. Thus, statistical learning models such as SRNs have sufficient power to learn and represent nonadjacent dependencies, and provide a close account of important behavioral phenomena. SRNs only fail when they are so pared down as to exclude information relevant to successful learning.
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(2114)

Individual Differences in Lexical Quality of Newly Learned Words. ASHLEE SHAW, *University of Connecticut; Haskins Laboratories*, ALEX P. DEMOS and DANA ARTHUR, *University of Connecticut,* JAMES S. MAGNUSON, *University of Connecticut; Haskins Laboratories*—The Lexical Quality Hypothesis (Perfetti & Hart, 2002) suggests that the difficulties exhibited by poor readers cascade from deficient (impoverished, fuzzy) representations of phonological, semantic, and orthographic dimensions in lexical memory. If so, readers, even as adults, should vary in their ability to acquire new lexical representations. In our study, we examine the role of cross-modal (visual to phonological) correlations and associations in lexical learning. By pairing an artificial lexicon with novel objects, we aim to see whether learning implicit associations between new words and visual features of novel objects can be predicted by participants' performance in a number of visual and language-related standardized assessments, as well as experimental tasks probing aspects of visual and auditory memory.
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(2115)

Effects of Domain-General and Domain-Specific Processing Constraints on Grammar Acquisition. REBECCA HAMMARLUND and JANET L. MCDONALD, *Louisiana State University*—Acquisition of grammatical structures appears to be more difficult for adults than children. The Less is More Hypothesis (Newport, 1990) holds that this results from developmental increases in domain-general processing capacity. Previous research on adults has

tested this hypothesis by imposing limits on input or capacity, with incremental presentation or concurrent auditory tasks respectively, facilitating acquisition. However, Cowan (2005) argued that these effects were due to external limits, whereas internal capacity limits would prove ineffective because of flexible strategy use. Preliminary data suggests that a concurrent visual task is in fact effective; however, the extent of the effect may depend on individual differences in working memory capacity. The aim of the current study is to manipulate availability of domain-general resources such as executive function and attention in order to compare the relative efficacy of manipulations while also appropriately matching load levels to individual capacity and to manipulate strategy use with learning instructions.
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(2116)

Simulating a Profile of Specific Language Impairment in Adults. CHRISTY M. SEIDEL and JANET L. MCDONALD, *Louisiana State University*—Children with Specific Language Impairment (SLI) have normal nonverbal intelligence but have difficulty mastering particular aspects of language, including certain grammatical morphology. Theories accounting for SLI include ones focused on grammar specific mechanisms, phonological processing deficits and domain general processing abilities. Hayiou-Thomas et al. (2004) provided evidence for the latter, showing that a simulation of SLI performance is possible in unimpaired children under conditions of speeded speech or lengthened sentences. The current study aims to extend the findings of Hayiou-Thomas et al. (2004) by attempting a simulation of SLI performance in typically developing adults. Participants perform a grammaticality judgment task on sentences of various lengths under an external working memory load. Structures tested include two that are difficult for impaired children (verbal –S, auxiliary BE) and two that are not (progressive –ING, plural –S). Results are discussed in light of individual differences in working memory and phonological short term memory.
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(2117)

Delta Plots Reveal the Role of Response Inhibition in Lying. EVELYNE DEBEY, *Ghent University,* BRUNO VERSCHUERE and K. RICHARD RIDDERINKHOF, *University of Amsterdam,* JAN DE HOUWER, *Ghent University*—Previous research has shown that lying takes more time than truth telling. Because lying involves withholding the truth, this 'lie effect' (lie – truth) may be due to the time-consuming process of response inhibition. We investigated the response inhibition hypothesis on lying using the delta-plot method, in which differences between conditions are mapped as a function of reaction time. Delta plots prototypically have a positive slope (i.e., larger effects with increasing reaction time). However, if the conditions differ in the degree of inhibition that is applied, a gradually developing inhibition process reduces the effect size with slow responses, which counteracts the positive slope of the delta plot. This leveling-off is known to be more pronounced in people with better inhibitory control. We report two experiments in which participants performed a reaction time task that required them to alternate between lying and truth telling. We found that the delta plot of the lie effect leveled off for slow responses and that this leveling-off was more pronounced in participants with better inhibition skills (i.e., smaller lie effects). Our experiments support the hypothesis that response inhibition may be crucially involved in lying.
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(2118)

Developmental Differences in the Effect of Orthography on the Neural System for Phonological Processing of Spoken Words. AMY S. DESROCHES and DREW L. MELLER, *The University of Winnipeg,* JAMES R. BOOTH, *Northwestern University*—We used functional magnetic resonance imaging [fMRI] to evaluate the development of the processes involved in spoken word recognition. Brain activity was recorded from 19 adults and 25 typically developing children during auditory word and pseudoword rhyming. Consistent with our previous work, both groups showed activation across the language network during auditory rhyming, including in the fusiform gyrus (FG), an area typically associated with visual word processing. Greater activation was observed for adults versus children in the left IFG and STG for both words and pseudowords. Additionally, developmental differences in the FG and IPL (an area linked to orthographic-phonological conversion) were limited to words only, suggesting that lexicality modulates the influence of orthography during spoken word recognition. The results have implications for understanding the interactions between representational systems during language processing.
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(2119)

Age of Acquisition effects and Morphology: A Contribution of Gender? CRISTINA IZURA and SHAKIELA K. DAVIES, *Swansea University* (Sponsored by Irene Reppa)—All other things being equal, early learned words are processed faster than words acquired some time later. The arbitrary mapping hypothesis (Ellis & Lambon-Ralph, 2000) suggests that this age of acquisition (AoA) effect emerges whenever processing involves the use of arbitrary mappings, but not with predictable mappings (e.g., reading consistent words such as 'lake', or 'cake'). In this study the mapping hypothesis was tested in two experiments using morphologically transparent (e.g. happy & happiness) and morphologically opaque words (e.g. sign & signal). AoA effects were predicted only for morphologically opaque words. Results from Experiment 1 showed significant main effects of AoA and morphological transparency but no interaction. In Experiment 2 using a larger sample of words and controlling for gender, a significant interaction between AoA, morphological transparency and gender emerged. The results suggest that reading words aloud is modulated by AoA, morphology and gender.
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(2120)

Contextual Constraint of Phonological Representations During Reading. PATRICK PLUMMER and KEITH RAYNER, *University of California, San Diego* (Sponsored by Barbara Juhasz)—Target words were presented in highly predictable or neutral contexts. The invisible boundary paradigm (Rayner, 1975) was used to manipulate the available information for target words during parafoveal preview. The preview was either identical to the target word, a homophone of the target, or a control word which was orthographically similar yet phonologically distinct from the target word. Reading times across measures showed significant effects of target word predictability. The preview manipulation also yielded significant effects on all first-pass measures. Planned comparisons showed that first-pass reading times were significantly faster in full preview conditions when compared to orthographic control conditions but not when compared to homophone preview conditions. Interestingly, the effect size of the preview manipulation was quite small in neutral contexts. These data suggest that readers utilize phonological information during parafoveal processing and that contextual constraint facilitates the processing of phonological codes and semantic representations for predictable words.
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(2121)

Processing of English Compounds is Sensitive to the Constituents' Semantic Transparency. CHRISTINA L. GAGNE, THOMAS L. SPALDING and ROWAN EL-BIALY, *University of Alberta*—Compounds vary in terms of the extent to which the meaning of the constituents contributes to the meaning of the compound. Some compounds (e.g., eyewash) are fully transparent, others are fully opaque (e.g., hogwash), and still others are partially opaque (e.g., sugarcane and ladybug). Previous research has not provided consistent results concerning the availability of the semantic representations of the constituents of opaque compounds. We present three lexical decision experiments that investigate whether some of the discrepancy in the literature might be due to opacity effects on semantic composition (i.e., the active construction of a meaning based on the constituents), rather than due to differences in activation of semantic representations of the constituents. Our results indicate that semantic priming of the first constituent occurs for fully transparent and fully opaque compounds, but not for partially opaque compounds.
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(2122)

The Final Word: Statistical Regularities Governing the Word Ending a Sentence. LANCE W. HAHN, *Western Kentucky University*—In some languages, such as German, grammatical rules can require a word to end the sentence. English rules are less specific regarding the ending but do exclude words, such as prepositions, from occurring at the end. Nevertheless, statistical regularities inherent in typical language usage at the end of a sentence may lead to an expectation for specific words or word classes. This work elucidates the existing regularities and tests several specific hypotheses: 1) content words are more likely than function words to end a sentence, 2) nouns are likely to end a sentence and 3) the final word provides some expectation that the sentence is ending. A text corpus analysis suggests content words are more likely than function words to end a sentence. Observed statistical regularities are consistent with adverbs, nouns and pronouns occurring commonly at the end of a sentence and predicting the sentence's end.
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(2123)

Language Development in ASD: Longitudinal Growth Curves Support Subgroups of ASD. EMMA C. KELTY, DEBORAH FEIN and LETITIA R. NAIGLES, *University of Connecticut*—Development in children with autism spectrum disorders (ASD) is heterogeneous, and it is unclear how typical language development in particular is across groups. Longitudinal studies can illuminate the processes of language development, and the current study uses growth curve analyses to investigate production and comprehension in preschoolers with ASD and typically developing (TD) children at six visits over two years. Lexical and grammatical development was measured via type-token ratio (TTR) and mean length of utterance (MLU). TTR shows different effects for nouns versus verbs: noun TTR increases over time for TD children and those with high-functioning autism, and decreases for verbs; low-functioning children show increases in TTR for both, suggesting that classes of words develop differently across groups. MLU growth is relatively unimpaired for the high-functioning group, but severely impaired for the lower-functioning group. TTR and MLU findings reveal differences across lexical and grammatical measures over time, supporting subgroups of ASD.
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(2124)

Incremental Planning of Complex Noun Phrases in Sentence Production. MAUREEN GILLESPIE, *University of Illinois at Urbana-Champaign,* T. FLORIAN JAEGER, *University of Rochester,* VICTOR S. FERREIRA, *University of California, San Diego*—The degree of incrementality while planning noun phrases (NPs) within sentences was examined using a video description task. Sentences took the form "Bob moved the (big) kangaroo (in the square) above the bicycle." The critical NP (kangaroo) could require prenominal or postnominal modification due to a co-present contrast object. The duration of the name was longer for prenominally modified NPs compared to unmodified NPs, with no effect of postnominally modified NPs. The durations of the verb and the determiner preceding the NP were longer for postnominally modified NPs compared to unmodified NPs, with no effect of prenominally modified NPs. These results support an incremental language production system, with elements planned in the order of production (Griffin, 2001). Additionally, these results suggest that speakers can modulate articulation duration to accommodate planning demands (Fox Tree & Clark, 1997; Griffin, 2003). Implications for accounts of planning scope in language production will be discussed.
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(2125)

Learning Victor's Name and Nickname. JORDAN C. DAVISON and ZENZI M. GRIFFIN, *University of Texas at Austin*—Personal names have high social importance, but they are harder to learn than other types of nouns and personal information. Moreover, a person may be called different names depending on the talker, the audience, and the situation. Two experiments examined how the relationship between the first name and nickname for a single person affected the rate of learning to produce the names when cued with a photographed face. Participants took the most training to successfully label a novel face as "Victor" when "Victor" was trained along with an unrelated nickname like "Marty." "Victor" needed less training with a phonologically related nickname, "Vince," and least with a conventional, derivationally related nickname, "Vic." Learning rate for occupations was unaffected by name-nickname relationship. The results have implications for understanding nickname choices. Parallels with other types of vocabulary learning and tip-of-the-tongue states for personal names will be discussed.
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• BILINGUALISM I •

(2126)

Inhibition During Linguistic and Non-linguistic Contexts in Bilinguals of Varying Second Language Proficiency. CAITLIN Y. TING and JANET G. VAN HELL, *The Pennsylvania State University*—One key finding in bilingual language processing research is that both languages are active in a bilingual's mind. The ability to focus on one language only, despite the parallel activation of both, has been explained in the Inhibitory Control Model (Green, 1998). This study examined whether this inhibitory mechanism is also used in non-linguistic tasks. Also examined is if this inhibitory process varies with increased second language proficiency. English-Spanish bilinguals with high and low proficiency in their second language, Spanish, performed behavioral non-linguistic and linguistic versions of the Go/No-Go Task featuring single items (e.g., an isolated word or shape). Implications of the results with respect to inhibition from general cognition being employed to resolve linguistic conflict, as well as theories on the effect of one's second language proficiency on domain general inhibition will be discussed.
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(2127)

Evidence for Cross-Language Orthographic Neighborhood Effects in Balanced Bilinguals. HE PU, KATHERINE J. MIDGLEY and PHILLIP J. HOLCOMB, *Tufts University,* JONATHAN GRAINGER, *Laboratoire de Psychologie Cognitive, Marseille*—Words and pseudowords with many orthographic neighbors have been shown to elicit larger N400s compared to stimuli with few neighbors. Here we examined the effects of orthographic neighborhood both within and across languages in balanced bilinguals in a lexical decision task with ERP recordings. We manipulated the number of orthographic neighbors in English and French of pseudoword stimuli presented in blocked lists of English or French words. According to models of bilingual word recognition that allow non-selective access (BIA-model), effects of cross-language neighborhood should be particularly strong in pseudoword stimuli, where the stimulus itself provides no direct language information. In line with this prediction we found larger N400 amplitudes to pseudowords with many cross-language neighbors (e.g., French neighbors for pseudowords in an English block of trials) compared with pseudowords with few cross-language neighbors, and these effects were similar in size and spatial distribution to the effects of within-language neighborhood.
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(2128)

Bilingual Lexical Access: Interlingual Homographs and the Cross-Modal Lexical Paradigm. OMAR GARCÍA, ROBERTO R. HEREDIA and ANNA B. CIESLICKA, *Texas A&M International University*—Is bilingual lexical activation selective or non-selective? To address this question, interlingual homographs (i.e., words with competing semantic and overlapping orthographic representations across languages such as CASES = COURT in English and MARRIAGE in Spanish) are further examined by using a cross-modal lexical decision priming paradigm. Spanish-English and English-Spanish bilinguals listened to sentences in which the preceding context was neutral or biased towards the meaning of the English homograph. Participants made lexical decisions to visually presented homographic targets. For Experiment 1, the target (e.g., CASES) was associated to the critical English prime (e.g., LAWYER), or a translation of the Spanish meaning of the homograph (e.g., MARRIAGE) in Experiment 2. Experiment 3 expanded Experiment 2 by introducing a language mode variable at the beginning of the experiment. Our results are mixed suggesting evidence for both selectivity and non-selectivity. Results are discussed in terms of bilingual activation models of language processing.
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(2129)

Bilingual Interlingual Homograph Processing: The Relative Influences of Semantic And Language Contexts. MALLORIE LEINENGER and NATHALIE N. BÉLANGER, *University of California, San Diego,* TIMOTHY J. SLATTERY, *University of South Alabama,* KEITH RAYNER, *University of California, San Diego*—While previous studies have examined the individual influences of semantic and language contexts on bilingual interlingual homograph (ILH) processing (e.g., Dikstra & van Hell, 2003), the manner in which they interact and the relative influences of the different contextual sources remains unclear. The present study used eyetracking to measure the reading times on English sentences containing Spanish/English ILHs. We held language context constant and manipulated whether the pre-ILH semantic context biased the Spanish interpretation of the ILH or was neutral. When the pre-ILH semantic context was neutral, we observed increased reading times on the ILH for Spanish/English bilinguals. However, when the pre-ILH semantic context biased the

L1 interpretation of the ILH, reading times for the ILH decreased; followed by longer reading times in the post-ILH region when the semantic context ultimately supported the L2 interpretation. These results are consistent with a greater influence of semantic context relative to language context.
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(2130)

Bilingual Lexical Access: Interlingual Homographs and the Grammaticality Maze Task. ROBERTO R. HEREDIA, WUALÚ A. ALTAMIRA, ANNA B. CIESLICKA and OMAR GARCÍA, *Texas A&M International University*—This experiment explores how bilingual speakers comprehend interlingual homographs (i.e., words across languages with competing semantic and overlapping orthographic representations such as CASES which is related to LAW in English and MARRIAGE in Spanish), and whether they are activated selectively (i.e., only one meaning is activated) or non-selectively (i.e., both meanings are activated simultaneously). Using the Grammaticality Maze Task, bilinguals read contextually unbiased Spanish monolingual sentences (e.g., "Asegúrate siempre que se encuentren bien preparados, SINO, no CASES/LLORES a nadie": "Assure that they are well prepared, OTHERWISE, no CASES/CRIES anyone") or mixed language sentences (e.g., "Asegúrate siempre que se encuentren bien preparados, OTHERWISE, no CASES/LLORES..."). The critical target (homograph/control) followed a conjunctional/adverbial modifier, in Spanish/English, joining two sentences. Overall, the results were suggestive of non-selectivity, in which control targets were actually faster than the critical homographs (i.e., lexical competition). The results are interpreted in terms of bilingual lexical access models.
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(2131)

Investigating the Bilingual Advantage in a Verbal Conflict Task. DEANNA C. FRIESEN, KORNELIA HAWRYLEWICZ and ELLEN BIALYSTOK, *York University*—The literature reports a bilingual executive control (EC) advantage on non-verbal conflict tasks and a disadvantage on language processing measures relative to monolinguals. We examined whether bilinguals demonstrate this EC advantage in a language task if it includes conflict by using a Simon task paradigm. Participants classified pictures according to a semantic (natural or manufactured?) or lexical (object's name begin with vowel or consonant?) criterion. In the simple blocks, pictures were presented in the center of the computer screen. In the Simon block, pictures were presented on either the same or opposite side of the screen as the correct response key. Bilingual and monolingual performance did not differ on the simple classification tasks. However, bilinguals responded more quickly than monolinguals when they were required to ignore the picture's location. These results indicate that the bilingual processing advantage is found when increased EC is required during language processing.
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(2132)

Homographs Processing in Sentence Context: Inhibitory Processes and Time Course. MARÍA CRUZ MARTÍN, PEDRO MACIZO and MARIA TERESA BAJO, *University of Granada*—This study investigated inhibitory mechanisms on language selection in Spanish-English bilinguals during the processing of interlexical homographs in a sentence context. Furthermore, we explored if the inhibitory mechanism extends in time. Recent studies on out-of-context homographs processing already showed cross-language activation, and that inhibitory processes are triggered to select the target meaning (Macizo, Bajo, & Martín, 2010). Moreover, Martín et al. (2010) showed that this inhibitory effect had a transient effect lasting around five-hundred milliseconds. In this study, participants read sentences in English, including homographs as critical stimuli. After each sentence, they were presented a test word and decided weather it was related with the sentence meaning previously read. Test words included the English translation of the Spanish homograph meaning, and they were presented 100 ms immediately after the sentence or after 500 ms. The results showed that participants slowed their responses to the test words preceded by sentences including homographs as compared to control sentences. Furthermore, only the interference effect due to cross-language activation was observed at the immediate interval. A control experiment w
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(2133)

Language Dominance Modulates Cross-language Lexical Interaction. BARBARA MALT, *Lehigh University,* PING LI, *The Pennsylvania State University,* EEF AMEEL, *University of Leuven,* HUICHUN ZHU, *Lehigh University*—First-language (L1) patterns of word use influence second-language (L2) word usage, but over time L2 usage can influence L1 patterns as well. What language experience causes the L2 to evolve away from the L1 starting point, and the L1 to show signs of L2 influence, and what experience does not do so? We studied cross-language lexical interaction for Chinese-English bilinguals whose L1 was mature at the time of immersion in L2, having arrived in the U.S. at age 14 or later. Participants had varying degrees of L2 dominance and proficiency. They named large picture sets of household containers and dishwares in L1 and L2 in separate sessions. The match of their naming patterns to monolingual patterns of each language was assessed as a function of self-reported and objective measures of language dominance and proficiency. Results have implications for whether L1 changes as a function of L2 immersion are inevitable due to interconnections in the lexical network or vary depending on language dominance and proficiency, and whether L2 can be shaped to be native-like despite late immersion.
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(2134)

Switching the Language of Sentence Context Produces No Apparent Costs to Lexical Access. JASON W. GULLIFER, PAOLA E. DUSSIAS and JUDITH F. KROLL, *The Pennsylvania*

State University—Bilinguals activate words in both languages despite the intention to use one language alone. At the same time, there are costs associated with language switching that implicate the role of inhibitory control in language selection. The evidence for switch costs comes from tasks in which words are presented in isolation. Here we ask whether switch costs persist when words are produced in sentence contexts. Proficient Spanish-English bilinguals read and named cognate and control words in English or Spanish sentences. Sentences were blocked by language or mixed in an alternating runs sequence. There were no costs following a language switch and the magnitude of cognate facilitation was the same regardless of task context. The counterintuitive absence of switch costs can be understood within models of bilingual word recognition that assume language nonselectivity at the lexical level and models of code switching at the sentential level that assume cost free cross-language exchange.
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(2135)

Hemispheric Differences in Bilingual Activation of Homonym Meanings. YU-CHENG LIN and ANA I. SCHWARTZ, *University of Texas at El Paso*—Do bilinguals show hemispheric differences in processing cross-language cognates and false friends? How early and late bilinguals process different types of semantic relationships across languages? We investigated the hemispheric semantic processing of early Spanish-English bilinguals and late bilinguals with a lateralized lexical decision task. Mean RTs to targets showed a strong, inhibitory effect from the left hemisphere in recognizing false friends for all bilinguals, demonstrating that bilinguals non-selectively accessed meanings from both lexicons. For early bilinguals, within-language semantic priming was observed in both hemispheric processing conditions but for the late bilinguals semantic priming was observed in the left hemisphere processing condition only. These results suggest that for early bilinguals, both hemispheres contribute to semantic lexical processing, whereas for late bilinguals processing is primarily from the left hemisphere.
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(2136)

Statistical Learning of Implicit Regularity Correlates With Acquisition of Chinese Literacy as a Second Language. DENISE H. WU and ESTHER H.-Y. SHIH, *National Central University,* RAM FROST, *Hebrew University of Jerusalem,* JUN REN LEE, *National Taiwan Normal University,* CHIA-YING LEE, *Academia Sinica,* JI-LIE TSAI, *National Chengchi University,* DAISY L. HUNG, *National Central University* OVID J.-L. TZENG *National Chengchi University*—Recent findings have indicated that statistical learning abilities correlate with literacy acquisition of alphabetic languages as a second language. In the present study, we examined whether the same abilities of detecting statistical regularities embedded in sequential stimuli, as well as the abilities of auditory perception and phonological processing, predict the literacy level in young adults who learn Chinese as a second language. Cross-sectional results from native speakers of alphabetic languages showed that their Chinese literacy was significantly correlated with the time they spent on learning Chinese, and their performance on rapid automatized naming and on statistical learning of visual stimuli (VSL). The regression analysis further revealed that VSL accounted for unique variance of Chinese literacy even when the contribution from other variables, intelligence, and working memory was considered. These results suggest that the abilities of statistical learning are critical to support literacy acquisition of both alphabetic and logographic languages.
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• REASONING AND PROBLEM SOLVING I •

(2137)

Interference Resolution Within Analogical Reasoning Modifies Mental Representations. MICHAEL S. VENDETTI, BARBARA J. KNOWLTON and KEITH J. HOLYOAK, *University of California, Los Angeles*—Analogical reasoning is used for making comparisons between two domains that share an underlying relational structure. The current study shows how inhibition moderates mental representations within analogies. 52 University of California, Los Angeles Psychology undergraduates (10 males, avg. age: 20 yrs) solved trials consisting of a four-term (A:B::C:D) analogy problem containing four characters and four dimensions related to the visual properties of these characters (i.e., color, height, gender, and width), a brief distractor task, and a recognition memory task. Participants were instructed to solve the analogy on the highlighted dimension. For the other three dimensions, two were congruent relative to their decision for solving the analogy, and one was incongruent. After the distractor task, participants were shown a pair of characters and were asked if these were identical to the A:B pair on the previous analogy trial. These memory probes were either identical, or were changed based on the relevant, congruent dimension, or incongruent dimensions. Memory was worse for the incongruent dimension as indicated by proportion correct and d' analyses. Interference resolution led to inhibition of irrelevant relational information.
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(2138)

Predicting Analogical Transfer Based on Source Representation and Individual Differences in Attention. PATRICK J. CUSHEN, *University of Maryland,* JENNIFER WILEY, *University of Illinois at Chicago*—What factors might allow for the seemingly rare occurrence of spontaneous transfer between distant (superficially dissimilar) sources and targets during problem solving? While previous research has emphasized the role of controlled attention in analogical mapping, the current research explores the relationship between measures of controlled and diffuse attention on initial source representation and on spontaneous transfer from that source. Following the traditional paradigm, participants attempted to solve Duncker's radiation problem after having been exposed to a relevant, but superficially dissimilar source. In addition to measures of controlled attention (antisaccade

and WMC) and diffuse attention (Remote Associates Task), participants' source summaries were coded and used to predict transfer. Results suggest that each of these elements contribute uniquely to the likelihood of spontaneous analogical transfer from a dissimilar source.
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(2139)

Analogical Reasoning: How Constrained is it Really? LINSEY SMITH and DEDRE GENTNER, *Northwestern. University*—While there is prior evidence for structural constraints on analogical reasoning (e.g., Clement & Gentner, 1991), these studies have not explored the robustness of these constraints under various conditions. We use the belief bias method from deductive reasoning research to assess analogical constraints. Belief bias is the tendency to judge the logical validity of an argument by evaluating the believability of its conclusion (Evans, 1983). People typically show belief bias, departing from deductive rigor when the logically correct conclusion conflicts with prior beliefs. Here we ask the parallel question for analogy: When given analogies whose inferences conflict with background knowledge, do people adhere to structural constraints, or do they instead draw believable (but structurally inconsistent) inferences? Because analogy (unlike deductive logic) is not formally taught, we might expect a higher degree of belief bias. However, although some belief bias effects occurred, people showed a high degree of structural consistency.
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(2140)

Do Domain-General Skills Apply to Chemistry Reasoning? CONNOR QUINN and MICHELLE R. ELLEFSON, *University of Cambridge,* ANNE SCHLOTTMANN, *University College London,* KEITH S. TABER, *University of Cambridge*—Although domain-general reasoning skills have been investigated in a number of different domains, very little is known about their use when reasoning about chemistry. Twenty participants saw various mixtures presented using a standard property induction paradigm. The categorical and physical features of everyday materials were varied to assess the extent that participants use these features to inform their judgements about what happens when these materials are mixed with water. In general, the results followed the domain-general patterns seen when this paradigm has been applied to other domains, with both categorical and physical features informing inductive generalisation. However, categorical/physical features did not influence the accuracy of partcipants' judgements, i.e., the features were not causally relevant. Overall, the results highlight that reasoning about mixtures depends on domain-general features despite experience that these are not predictive – an important matter for reasoning about chemistry because causal relations are often opaque at a perceptual level.
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(2141)

Creative Ideation Under Pressure. SERGEY V. BLOK, KRISTIN E. GRUNEWALD, SUZANNE FREYNIK, JARED M. NOVICK and HENK J. HAARMANN, *University of Maryland*—Previous studies suggest that gain-oriented promotion focus facilitates divergent thinking over a loss-oriented prevention focus (Forster & Friedman, 2001). These studies typically employ an open-ended procedure in which participants are asked to write down novel uses for an object under a self-paced and relatively low-pressure regime. We used a one-shot alternative uses task performed under a deadline. Participants spoke responses into a microphone which they knew was monitored by the experimenter. Under these relatively high-pressure conditions, manipulated prevention focus facilitated higher novelty and lower plausibility of alternative uses over a promotion focus. These differences were not observed in common use control condition. Furthermore, participants with higher chronic prevention focus were more likely to meet the response deadline. Results are consistent with work highlighting importance of fit between global regulatory state (in this case, prevention focus) and task parameters (in this case, pressure) in facilitating flexible thinking (Worthy et al., 2009).
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(2142)

Paying Attention to Insight and Creativity: Contributions of Working-Memory Capacity and Mind-Wandering. BRIDGET A. SMEEKENS, MATTHEW E. MEIER and MICHAEL J. KANE, *University of North Carolina at Greensboro*—Should working memory capacity (WMC) and mind-wandering help or hinder insight problem solving and creative, divergent thinking? On one hand, insight and creativity might benefit from the effectively controlled attention that high WMC enables (and reduced mind-wandering reflects), particularly in selectively searching memory and inhibiting uncreative yet accessible ideas. On the other hand, unfocused or diffuse attention might promote insight and creativity; particularly during incubation periods, mind-wandering might allow access to more loosely relevant concepts that are remotely linked to commonplace ideas. We tested these ideas from an individual-differences perspective, asking whether people's WMC, and their propensity to mind-wander during an incubation period, predicts their insight problem solving or creative (divergent) thinking. Our findings suggest that, whereas higher WMC is beneficial for certain insight problems, it is unrelated to creativity. Furthermore, people who mind-wander more during incubation are not more insightful or creative than those who mind-wander less.
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(2143)

(Visually) Eliminating the Competition. ANDREW F. JAROSZ and JENNIFER WILEY, *University of Illinois at Chicago*—Why do tests of working memory capacity predict performance on the RAPM? Because complex span tasks tap the ability to control one's attention, the relationship may be due to the need to deal with interference during test taking. Previous research has shown that WMC is a better predictor of RAPM performance on problems in which salient distracters are present in the response bank. Following this theme, the present study attempted to manipulate the amount of competition experienced during test taking, by having

participants remove incorrect responses from the screen (and thus from view) to solve a problem, rather than selecting the correct response. This solution-by-elimination condition significantly decreased the RAPM-WMC relationship as compared to the typical select-the-correct-answer condition. Results will be discussed in terms of both individual differences in attentional control, as well as in relation to the strategies that individuals may use on the RAPM.
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(2144)

Eliminating Violation of Causal Markov Condition in Common Cause Network via Hypothetical Intervention. JUNGHO J. HAN and BOB REHDER, *New York University*—We asked whether adult reasoners' tendency to violate the Causal Markov Condition when reasoning about scenarios involving a common cause network (E1<-C->E2) was affected by whether they intervened on one of the effects (E1<-C->do(E2)). Participants estimated the probability of E1 conditioned on the absence or presence of C and E2. We hypothesized that intervening on one of the effects (do(E2)) would not only cut the causal relationship with the common cause – graph surgery (Pearl, 2000) - but also any unobservable causal links that might transmit information between the two effects (Rehder & Burnett, 2005). Consistent with past research, subjects exhibited robust violations of the Causal Markov Condition. Moreover, their tendency to do so was unaffected by whether they intervened on variables. That is, the state of E2 continued to affect people's probability estimates of E1 even when the state of C was known, regardless of whether they themselves set the state of E2.
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• JUDGMENT AND DECISION MAKING I •

(2145)

Risk Perception in Aviation Students. DARCI VANDYKE, RIC FERRARO, KRYSTA ANDERSON and BETHANY GADDIS, *University of North Dakota*—Forty-nine aviation students and 71 non-aviation students completed a series of experiments concerning aviation experience, risk perception and decision making. The Risk Perception Scale (Hunter, 2002) contained 1-sentence scenariois related to four risk perceptions (non-aviation composite risk, aviation composite risk, aviation baseline risk, weather risk). Subjects rated each of 26 1-sentence risk scenarios on a 1 (low) to 100 (high) risk perception if performed tomorrow. Non-aviation students rated all risk scenarios as having higher perceived risk than aviation students except for the weather risk scenarios. For the weather risk scenarios, aviation students perceived them as more risky. These results have implications for how future pilots not only perceive risk but how they act on that risk perception. In other words, (future) pilots who do not perceive risks associated with adverse weather may in fact be more likely to engage in higher risk activities when actually dealing with adverse weather conditions and situations.
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(2146)

Risky Preferences: Content and Context Dependent Utility. SHERIDAN TAYLOR, *Kingston University London,* PETKO KUSEV, *Kingston University London; City University London*—People's behavior in the face of risk implies that they judge and weight the probability of risky events in ways that deviate from Expected Utility Theory (EUT; von Neumann & Morgenstern, 1947). EUT, Prospect Theory (Kahneman & Tversky, 1992) and experience-based decision research (Hertwig et al., 2004) have a common assumption: that there are generic behavioral patterns for risk; consistency of people's utilitarian performance (and risk preferences) is independent of the decision making content, experience, and psychological reasoning (Kusev et al., 2009, 2011). Accordingly, in two gambling experiments, we studied the consistency of human preferences by manipulating probability disclosures, decision-making domain (loss and gain), and reasoning (choice and reject). The results of both experiments are not anticipated by EUT, PT and experience-based decision research. We found evidence that consistency in decision making changes with probability disclosure and invited reasoning in gambling scenarios and that consistency is consequently compromised.
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(2147)

Influences of Valence and Arousal States on Risky Choice. DOUGLAS H. WEDELL and JONGWAN KIM, *University of South Carolina*—On each trial participants viewed affectively normed (IAPS) pictures from one of five arousal-valence combinations: low arousal with negative, neutral or positive valence; or high arousal with negative or positive valence. After determining if a test picture was from the presented set in a recognition task, they made a choice between two gambles or a gamble and a sure thing. From the pattern of choices we calculated an index of loss aversion and indices of risk aversion in the domains of losses and gains. Results indicated that loss aversion was greater for negative affective states than for positive states and uninfluenced by arousal level. In the domain of gains, risk aversion was not influenced by affective state. In the domain of losses, higher arousal led to greater risk aversion than lower arousal regardless of valence. Results implicate the need to consider influences of both arousal and valence in risky choice.
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(2148)

Decision-Making Under Uncertainty in the Cash Cab. ROBERT J. LEMKE and MATTHEW R. KELLEY, *Lake Forest College*—Television game shows have long been used as natural experiments to analyze risk-taking. We use episodes of Cash Cab to investigate how a contestant's ability to answer trivia questions earlier in the game affects her decision to accept or reject a gamble offered to her at the end of the game. We view the data as informing us as to the contestant's mechanism by which she updates her subjective probability of winning the gamble. Our results support the general notion that contestants objectively update their subjective probabilities by considering their previous ability to answer questions. We also find that streaks of answering questions correctly are not

important when updating but streaks of being confident (and correct) in one's answers are important. Our results generally are supportive of the ideas inherent in prospect theory.
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(2149)

The Effects of Communication Format on Decision Making in Different Weather Situations. SUSAN L. JOSLYN, MARGARET A. GROUNDS and JARED E. LECLERC, *University of Washington*—Public response to threatening weather may be related to the way in which the forecast is communicated, to the complexity of the decision, as well as to decision-makers' recent experience. In a study to explore these issues, participants made decisions about whether to spend limited resources to salt roads to prevent icy conditions. Decision complexity (one kind of salt versus two) did not matter but recent experience did. Participants performed better in a condition in which freezing was less frequent than in a condition in which freezing was more frequent. The optimal communication format included a probabilistic forecast paired with a decision recommendation. That was because the probabilistic forecast encouraged precautionary action in the condition in which freezing was less frequent. However explicit advice encouraged precautionary action at low probabilities in the condition in which freezing was more frequent. The implications of these results will be discussed.
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(2150)

Uncertainty Estimates and the Interpretation of Climate Change Forecasts. JARED E. LECLERC and SUSAN JOSLYN, *University of Washington*—Due to lingering skepticism in the general public about climate change, experts are reluctant to incorporate uncertainty estimates in climate forecasts. This study suggests that such concerns are unfounded. College students read a series of climate forecasts for various parameters at future time points and gave their own predictions and ratings of concern. There was no negative impact of including uncertainty estimates in climate change forecasts: participants were equally concerned whether or not a predictive interval was included. Nonetheless, they were influenced by predictive intervals. Their own ranges of expectations were significantly closer to predictive interval ranges when predictive intervals were included in the forecasts. The study also addressed the relationship between time discounting and change in forecast severity over time. Results carry implications about the perception of climate change forecasts and how best to communicate climate change risk.
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(2151)

Re-Designing Discount Rate Measurement in Intertemporal Choice. HAEWON YOON and GRETCHEN B. CHAPMAN, *Rutgers University*—In intertemporal choice research, discount rates measured from participants are not always correlated with real behavior. One possible explanation for the lack of correlation could be use of poor discount rate measurements. We used a simulation with an ideal decision maker to examine the properties of three popular discount rate measurement procedures. The simulation results revealed a narrow measurable range and a crude resolution for all three measurements. As an alternative, we propose a new discount rate procedure using a three-alternative-forced-choice (3AFC) design with a heuristic algorithm. A simulation showed the new procedure can measure a wide range of discount rates (approx. 0.035% APR to 350,000% APR) with high accuracy under 10 questions. An experiment with human participants confirmed the reliability and validity of the measurement, and showed that less than a minute was needed for a completion of the task. The new method can provide fast and accurate discount rate estimation over a wide range.
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(2152)

Cognitive Constraints on Cooperation in an Iterated Prisoner's Dilemma. PEI-PEI LIU and CHRISTIAN C. LUHMANN, *Stony Brook University*—Prisoner's Dilemma (PD) is widely used as a behavioral measure of altruism; willingness to behave on behalf of others at personal cost. Thus, failures to cooperate in PD are typically assumed to reflect self-interest. Here we instead investigate cognitive constraints on cooperation. Study 1 had subjects play iterated PD. The inter-trial interval (ITI) was 6s in one condition and .5s in the other. Results indicated that long ITIs produced less cooperation than short ITIs. One potential explanation is that long ITIs impaired memory for previous rounds which prevented subjects from reciprocating opponents' past behavior. Alternatively, longer ITIs may have discouraged cooperation because subjects were too impatient to wait for opponents' future reciprocation. Study 2 had subjects play iterated PD with variable ITIs. Before each round subjects were presented with a cue predicting the ITI following that round (short vs. long). Long-ITI cues elicited less cooperation, but only when subjects were instructed about how ITI might influence their opponent's willingness to reciprocate. Together the results suggest that both memory and patience may represent constraints on cooperation, though patience may require strong explicit awareness.
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(2153)

Sample Size Bias in Estimation of Average Area and Saturation. NICOLE M. KIMURA and PAUL C. PRICE, *California State University, Fresno*—When people judge averages they exhibit a sample size bias; their judgments increase as a function of the number of units in the sample. We have previously shown this with judgments of the risk of the average person in a group (Price, Smith, & Lench, 2006) and more recently with judgments of the average of sets of numbers (Smith & Price, 2010). In the present study, we wanted to see if people exhibit the sample size bias in judgments of the averages of perceptual dimensions. In three studies, participants judged the average size of sets of 3, 6, 9, and 12 squares. In Experiment 1, all the squares in each set were presented simultaneously. In Experiment 2, all the individual squares in each set were presented sequentially. In Experiment 3, we added a condition in which participants

judged the average saturation ("greenness") of sets of squares. In every case, there was a clear sample size bias; participants' judgments of size and saturation increased as function of the set size. These results might be explained by the automatic integration of mental representations of sample size and the average stimulus, possibly occurring in the horizontal segment of the intraparietal sulcus.
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(2154)

Inferring Conjunctive Probabilities From Experienced Noisy Samples: Evidence for the Configural Weighted Average Model. MIRJAM A. JENNY and JÖRG RIESKAMP, *University of Basel,* HÅKAN NILSSON, *Uppsala University* (Sponsored by Eric-Jan Wagenmakers)—Judging whether different events will co-occur is important in everyday decision making. However, the underlying probabilities of occurrence are usually unknown and have to be inferred from experience. We investigated how people judge such conjunctive probabilities by introducing the rigorous, quantitative modeling approach of hierarchical Bayesian parameter estimation to this research area. In two experiments, participants were provided with a monetary incentive to accurately choose the larger of two conjunctive probabilities, which they could assess on the basis of small samples. Participants did not have to to state probabilities, but could make simple decisions instead. Compared to the other models, the configural weighted average model—which assumes that constituent probabilities are ranked by importance, weighted accordingly, and added up—performed best overall. This model also described the largest group of participants best when people were individually categorized according to the different models. While not all participants were best described by the configural weighted average model, these findings are in line with a large body of previous research showing that weighted averaging models predict people's judgments well.
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(2155-2156)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION III

Friday Evening,
Minneapolis Convention Center, Ballroom A
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION II •

(3001)

The Attentional Blink and Repetition Blindness as a Consequence of Rational Inference. CORY A. RIETH and EDWARD VUL, *University of California, San Diego*—The attentional blink (AB) and repetition blindness (RB) are detriments in accuracy during rapid serial visual presentation following a task-relevant stimulus. In AB paradigms, identification of a second target appearing from two to five items after a first is impaired. RB refers to a tendency to miss repetitions of stimuli when the repetition occurs shortly after the initial stimulus in an RSVP stream. We seek to understand AB and RB at a computational level through rational inference. We propose that RB and AB are consequences of priors about the temporal distribution of event transitions, and the probability of task-relevant events. We show that rational inference using these priors reproduces the basic effects and time courses of both RB and AB, and the patterns of specific intrusion errors during AB. This framework also explains related effects such as order confusions, the influence of pre-cueing, and spreading the sparing.
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(3002)

Location Looks Like Any Other Feature During Encoding Into Visual Working Memory. MUSTAFA T. BILGE and GEOFFREY F. WOODMAN, *Vanderbilt University*—It has been proposed that spatial location is a feature that defines objecthood in visual working memory. Previous work (e.g., Logie, Brockmole, & Jaswal, 2011) examined whether location is maintained better than other features, but the nature of encoding locations into visual working memory is not well understood. Here we used masks to disrupt the encoding of critical features in a change-detection task. We compared the encoding of location, color, orientation, and their conjunctions. We found that location had the slowest encoding rate, contrary to the claims attributing it a unique status (Experiment 1). We could make location the fastest to encode feature when we reduced the number of possible locations used (Experiment 2), however this same effect is seen with other features, because color showed a similar benefit from such reduction (Experiment 3). Our results indicate that location behaves like other features during encoding into visual working memory.
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(3003)

Global but Not Local Properties of Stimuli Prime Saccadic Eye Movements. JOHN CHRISTIE and MATTHEW HILCHEY, *Dalhousie University,* NIHARIKA SINGH and MISHRA RAMESH, *University of Allahabad,* RAYMOND M. KLEIN, *Dalhousie University* (Sponsored by Shannon Johnson)—Presenting all stimuli on a circle around fixation we use multiple cues prior to a single target that requires an eye movement. We then use the distance from the nearest individual (local) cue, and from the (global) centre of gravity of the array of cues, to assess the degree to which each of these properties of the cue array influences the the reaction time (RT) to make an eye movement to the target. At 50ms after onset of the cue array two effects were strongly present: a delay in processing when the target was presented at a location that had previously contained a cue element (an effect with no gradient that might be due to sensory adaptation or local masking) and a strong facilitatory gradient generated at the centre of gravity of the cue array. This global effect is little diminished at 150ms while the effects of individual stimuli have almost vanished. By 400ms after onset of the cues, eye movements to targets are no longer primed by the prior cue array.
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(3004)

Pupil Diameter Changes Non-Monotonically With Perceptual Learning. TAYLOR R. HAYES and ALEXANDER A. PETROV, *The Ohio State University*—Pupillometry has been almost completely neglected in perceptual learning research despite the well documented correlations between pupil size and cognitive variables such as cognitive load. To examine how pupil size changes with learning, twenty observers performed a motion direction discrimination task using filtered-noise textures that differed by either 8 or 4 degrees and were presented to either the Left or Right of fixation (eccentricity 7 deg.). Each participant trained on a particular combination of difficulty and position on days 2 through 5, and was tested on all 4 combinations on days 1 and 6. Observers in each group showed monotonic improvements in accuracy (increase of d'=1) and reaction time (decrease of RT=200ms) during training. However, pupil diameter changed in a non-monotonic inverted-V pattern across sessions (Takeuchi et al., 2011) with its peak modulated as a function of discrimination difficulty. The qualitative difference between the monotonic learning and non-monotonic changes in pupil diameter suggests that pupillometry captures a unique aspect of learning. We interpret these results in light of recent evidence (Jepma et al., 2011) suggesting pupil size may reflect exploration-exploitation tradeoffs.
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(3005)

A Dual Process Model of Perceptual Learning. ALEXANDER A. PETROV, *The Ohio State University*—Most current perceptual learning (PL) theories assume rather simplistic mechanisms for categorization. The perceptual categorization (PC) literature has identified mechanisms

that are in better agreement human performance. Bridging the two fields, we propose a Dual Process Model of PL (Dimple) that integrates the influential selective reweighting model of PL (Petrov, Dosher, & Lu, 2005, Psychological Review) with the influential COVIS theory of PC (Ashby et al, 1998, Psychological Review). The selective reweighting model maps naturally onto the implicit system in COVIS. The innovation in Dimple lies in the explicit system, which operates on intermediate-level representations that give separate, controlled access to individual stimulus attributes such as orientation and spatial frequency. Dimple also has a working memory layer that maintains and adjusts the current decision boundary. The implicit system determines the fine-tuned performance after prolonged training in a given environment, whereas the explicit system supports much of the generalization to novel stimuli and tasks.
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(3006)

Can a Stroop Procedure Induce the Mehta and Zhu (2009) Color Effect? KENNETH M. STEELE, MELISSA BAKER, NATSUMI KIMURA, JENNIFER GRAY, ELIZABETH STRICKLAND and PLAYER BARRETT, *Appalachian State University*—Mehta and Zhu (2009) reported that the colors, red and blue, induced different motivational states that affected performance across a series of cognitive tasks. Red was hypothesized to induce an avoidance motivational state and blue an approach state. Mehta and Zhu presented participants with anagrams and reported that solution times were faster when the motivational meaning of the anagram matched the state induced by the color. Steele et al. (2010, 2011) were unable to replicate the Mehta and Zhu results. Prior studies presented black letters on a color background. The purpose of this study was to use a Stroop-type procedure. Avoidance, Neutral, and Approach anagrams were presented in either red, gray, or blue letters. Solution times, accuracy, and speed-accuracy strategy were recorded. The predicted color by word-type interaction did not occur. Additionally, a word valence effect was observed. Approach words were solved more quickly than neutral and avoidance words.
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(3007)

How Well Do We Know Average Liking of Others? RYOSUKE NIIMI and KATSUMI WATANABE, *The University of Tokyo*—This study examined people's ability to predict how much others would like a particular object. Twenty participants viewed a common object (e.g., a car) and rated its visual likability from their own point of view. They were also asked to predict the average likability ratings of others. Prediction validity was evaluated as a correlation between the predicted and the average of actual likability ratings of others. Each participant's prediction remained modest (r = .32 on average). Further, this correlation was not higher than that between each participant's own likability rating and the average likability rating, suggesting that the participants' effort to predict the average liking did not add predictive validity. An analysis revealed that each prediction correlated more with one's own liking than with the actual average liking. These results suggest that the ability to predict the average liking of others tends to be biased toward one's own liking.
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(3008)

The Spectrum of Grapheme-Color Synesthesia. KAZUHIKO YOKOSAWA, *The University of Tokyo,* MICHIKO ASANO, *Keio University*—Yokosawa, Nagai, & Asano (2011) reported that, among non-synesthetes, there were both people who showed high consistency in grapheme-color association over time and people who did not. This suggests that synesthetes and non-synesthetes may lie on a continuum, and we might be all synesthetes to some extent. To test this hypothesis, we explored factors influencing grapheme-color association in a group of participants with varying degrees of temporal consistency in grapheme-color association, i.e, confirmed synesthetes and non-synesthetes, both with high and low temporal consistency. All participants selected a color, from a palette of 138 colors, that "goes with" each of 232 characters comprising Japanese characters, English alphabets, and numerals (Asano & Yokosawa, 2011, 2012). This process was repeated twice. Results revealed that the degree of temporal consistency positively correlated with the degree of impact of phonology and meaning on grapheme-color association. This suggests that grapheme-color synesthesia is a spectrum phenomenon.
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• ACTION AND PERCEPTION II •

(3009)

Children Benefit More Than Adults From Variability of Practice When Learning to Intercept Moving Gaps. BENJAMIN J. CHIHAK, JODIE M. PLUMERT, TIMOFEY Y. GRECHKIN, JAMES F. CREMER and JOSEPH K. KEARNEY, *University of Iowa*—Understanding how children become more skilled at performing complex perception-action tasks during late childhood and early adolescence is an important research objective. Here we explored how interceptive actions become more finely tuned with experience by comparing how child and adult cyclists learned to perform a gap-interception task during a single experimental session. Participants rode an actual bicycle along a virtual roadway with several intersections. At each intersection, participants attempted to pass through a gap between two moving blocks without stopping. Participants either experienced consistent timing conditions, in which they were required to speed up or slow down to successfully intercept the gap on all trials, or a variable timing condition, where either acceleration or deceleration could be required on a given trial. Experiencing variable timings led to enhanced perception-action tuning for children but not adults. The roles of previous experience and online perceptual information in guiding interceptive actions are discussed.
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(3010)

Auditory and Motor Imagery Abilities Influence Music Learning. RACHEL M. BROWN, ANDRAS TIKASZ and CAROLINE PALMER, *McGill University*—Speakers and musicians often can imagine the auditory or motor components of their productions in the absence of sound or physical movement. We examine how individual differences in auditory and motor imagery abilities influence how performers learn. Pianists learned novel melodies by listening without performing (auditory learning) or by performing without sound (motor learning); during learning, participants additionally performed auditory, motor or no interference tasks. Following learning, pianists performed melodies from memory with auditory feedback (recall). Independent tests measured auditory and motor imagery skills. Pianists with high motor imagery skills recalled melodies better than pianists with low motor imagery skills. Higher auditory imagery skills predicted better recall following motor learning with no interference and auditory learning with interference. Thus, motor imagery abilities may enhance motor performance at retrieval, whereas auditory imagery abilities may compensate for missing auditory feedback at learning and safeguard learned auditory information from interference.
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(3011)

Quantifying Intentionality. EVE A. ISHAM, *University of California, Davis*—The intent to act represents a fundamental component of consciousness. Intention itself is assumed to be the basis for one's sense of agency, ownership, and free will. One approach to studying intentionality is via introspection – asking an individual to report the moment when she experiences the intention to act. A related approach indexes the sense of agency by illustrating that an intended action is perceived to occur closer in time to an intended effect (i.e., Intentional Binding). These approaches assume that intentionality is directly experienced and can be accurately measured. We examined alternative factors that might contribute to the generation of intention-related temporal reports and observed that these reports are contaminated by multiple events and information surrounding the action. Our findings thus suggest that the moment of intentionality is an impression inferred from local information and is not accurately assessed by approaches proposed in earlier studies.
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(3012)

An Investigation of Automatic Affect-Response Bindings. JOSHUA SHAW and JASON P. LEBOE-MCGOWAN, *University of Manitoba*—The authors investigated costs and benefits on response time (RT) to a probe task, asserting that an affective prime stimulus will either encourage or discourage response repetition to a subsequent unrelated task. On each trial, participants made a valence evaluation to an affectively charged prime word and then make a localization judgment to an affectively neutral probe stimulus. Both evaluations used the same two-alternative, forced-choice button-press responses. The authors found response repetition costs on probe RTs following a response to a negatively valenced prime word. This cost was significantly reduced on trials for which the probe task followed a positively valenced prime word. In another experiment, the authors demonstrate strong response repetition benefits when the the affective-valence of the prime word was congruent with a subsequent size-change discrimination judgment. For example, response repetition was much faster when a positively valenced word preceded presentation of an increasing visual object, designed to mimic the object as getting closer. We interpret these results within an approach-avoidence framework that relies on contact with episodic representations that contain affect-response bindings.
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(3013)

An Electrophysiological Study of Object-Based Correspondence Effects: Is Visual Processing Modulated by the Intended Action? ELLIOTT JARDIN and MEI-CHING LIEN, *Oregon State University,* ROBERT W. PROCTOR, *Purdue University* (Sponsored by Philip A. Allen)—Some studies have found that responses are faster when the orientation of an object's graspable part corresponds with the response location than when it does not (i.e., the object-based correspondence effect). We examined Goslin et al.'s (2012) claim that the effect is the result of object-based attention (visual-action binding). As in their study, participants determined the category of the centrally located object (kitchen utensil vs. tool). The handle orientation (left vs. right) did or did not correspond with the response location (left vs. right). We found no correspondence effect on response time for either category. Consistent with the behavioral data, there was no correspondence effect in lateralized readiness potentials. The effect was also not evident in P1 and N2, thought to reflect the direction of visual/spatial attention. These findings are contradictory to those of Goslin et al. and provide no evidence that an intended grasping action modulates visual/spatial attention.
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(3014)

What Makes an Event File: Temporal integration of Visual Features or Action Features? JONATHAN GALLIMORE and LISA R. FOURNIER, *Washington State University*—We examined whether feature binding required to form a single "event file" is dependent on the temporal integration of visual features and/or action features relevant to an event. Participants planned and maintained a joystick movement (e.g., move left and then down) in working memory to a visual event (A), and then executed a speeded, left or right joystick movement to a second visual event (B). Temporal separation/integration of two relevant visual features and two response movements corresponding to (A) were manipulated. If features for (A) represent a single event file, then responses to (B) should be delayed when the action features between (B) and (A) partly overlap vs. do not overlap (partial repetition cost; Stoet & Hommel, 1999). Results showed a partial repetition cost, but

only when response movements to (A) were integrated, not separated. Thus, action integration is more important than feature integration in defining an event file.
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(3015)

Are Object Affordances Visuo-Spatial, Semantic, or Something Else? A Factor Analysis of Correspondence Effects. JAMES D. MILES, *California State University, Long Beach*—Responses are faster and more accurate when they correspond with target features compared to when they do not. Correspondence effects for locations and spatial words have been attributed to separate sets of mental processes – visuo-spatial and semantic-spatial, respectively. Recently, similar correspondence effects have been found for object affordances. For example, responses are faster when on the same side as a to-be-grabbed handle versus the opposing side. There is an ongoing debate as to whether object affordance effects are visual-spatial or semantic-spatial, or if they represent a unique class of correspondence effects. In the current study, participants performed correspondence tasks involving locations (visuo-spatial), spatial words (semantic-spatial), and object affordances. A factor analysis of results provided additional evidence that location and spatial word correspondence effects are unrelated to one another. Additionally, object affordance effects were unrelated to either words or locations. We suggest that object affordance effects involve a combination of several mental processes. More generally, the results provide additional evidence that the correspondence effect is not a homogenous phenomenon.
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(3016)

The Cross-Modal Simon Effect. THOMAS DOLK, *Max Planck Institute for Human Cognitive and Brain Sciences,* ROMAN LIEPELT, *Westfaelische Wilhelms-University Muenster,* BERNHARD HOMMEL, *Leiden University,* WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Sharing a go-nogo Simon task with another person typically elicits a Stimulus-Response-Compatibility Effect across both participants (joint cSE). In contrast to the social co-representation account, recent findings suggest that the joint cSE may result from any salient event that provides a reference for spatially coding one's own action. Even though bottom-up and top-down manipulations of the joint cSE provide striking evidence for a crucial role of the response-dimension, surprisingly little is known about the influence of the stimulus-dimension. To address this issue, participants performed an auditory-visual-go-nogo Simon task by exclusively responding to their assigned modality (either auditory or visual) in the presence (joint condition) or the absence of a co-actor (single condition), respectively. Results showed reliable cSEs in both conditions, suggesting that the cSE occurs whenever agents code their own action as left/right in reference to another sufficiently salient (social or non-social) event in the stimulus and/or response dimension.
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(3017)

Object Manipulation in Infants and Children. KATE M. CHAPMAN and DANIEL J. WEISS, *The Pennsylvania State University*—Converging evidence from tool-use, problem-solving, and action-planning research suggests that anticipatory abilities in object manipulation emerge early in infancy and advance on a rapid trajectory between birth and two years of age. Young children are capable of planning their actions based on (a) objects' affordances, (b) the childrens' own intentions, and (c) when another individual is present, the expected intention of the recipient. Despite this early emergence of sophisticated planning abilities, robust sensitivity to future states does not approximate adult-like levels until quite late in development -- around 10-years of age. We discuss research concerning the ontogeny of motor planning and propose alternative hypotheses to explain the delayed sensitivity to future states in children's object manipulation.
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(3018)

Intentional Processes in Tool Use are Similar for Simulated and Executed Actions. CARL GABBARD, *Texas A&M University,* PRISCILA CAÇOLA, *University of Texas at Arlington* (Sponsored by Jyotsna Vaid)—There are indications from research that tool use influences intention and action planning. Here, we instructed young adults to estimate distance reachability with hand (arm extended) and a tool (20 cm rod) using motor imagery only (IO) and imagery followed with actual execution (IE). Two expectations were likely: participants would perform better in the IE task due to heightened intentional state, or there would be no difference based on the equivalence hypothesis associated with simulated and executed actions. Each participant's scaled maximum reach with hand and tool was used as target distance presentation and baseline for accuracy estimates. With each HAND and TOOL condition, participants performed two trials at seven randomly presented targets in peripersonal and extrapersonal space - half of the trials IO (red target) and half IE (green target); HAND and TOOL and intention conditions (IO / IE) were presented in counterbalanced order. ANOVA results indicated no differences in accuracy within or between conditions. These findings support an increasing body of evidence suggesting that the neurocognitive processes (in this case, intention) driving motor imagery and executed actions are similar.
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• SPATIAL COGNITION III •

(3019)

Sensing the Slopes: Sensory Modality Effects in Using Slope. STEVEN M. WEISBERG, *Temple University,* DANIELE NARDI, *Sapienza University of Rome,* NORA S. NEWCOMBE and THOMAS F. SHIPLEY, *Temple University*—Terrain slope can be used by humans and other animals in navigation and reorientation tasks. However, little is known about the relative

contributions of different sensory modalities, and the type of representation formed in using this spatial cue. In this study, participants completed a goal location task in an enclosed, square, sloped environment. Results suggest slope could be effectively encoded in conditions offering visual cues alone, kinesthetic cues alone, as well as both cues together, but using kinesthetic cues alone took longer. We also found evidence for an egocentric representation of the goal. Concordant trials (e.g., facing uphill when the goal was hidden uphill) were completed more quickly and more accurately than discordant trials (e.g., facing downhill when the goal was hidden uphill) and there were no differences between facing-uphill and facing-downhill trials. Building on previous work (Nardi, Newcombe, & Shipley, 2011), these data suggest that sex differences in the use of slope as a spatial cue may be linked to the modality of encoding, because females showed difficulty in using kinesthetic cues compared to males.
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(3020)

Minimal Effects of Memory Load on the Updating of Multiple Target Arrays. CHRISTOPHER R. BENNETT, *The University of Maine,* JACK M. LOOMIS, *University of California, Santa Barbara,* ROBERTA L. KLATZKY, *Carnegie Mellon University,* NICHOLAS A. GIUDICE, *The University of Maine*—People can update their self-position relative to a location when walking without vision, but can they simultaneously update multiple locations? We offer evidence that they can. Participants viewed 1, 3, or 6 targets (colored lights) on the floor of a dimly lit room. Then without vision, either immediately after viewing (direct) or after a period of forward walking (indirect), they walked to a target designated by its color. Neither the accuracy nor the precision (dispersion) of walked distance relative to the target location (physical location or group centroid) showed a significant effect of indirect vs. direct walking or number of targets. This indicates people updated their position relative to six targets as effectively as one. Only decision time (i.e., time between hearing the target color name and physically orienting toward its location) showed a reliable advantage for one over six targets, constituting a typical effect of choices on reaction time.
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(3021)

Expertise Effects in Defining Spatial Categories. MARK P. HOLDEN, *University of Western Ontario,* NORA S. NEWCOMBE and THOMAS F. SHIPLEY, *Temple University*—According to the Category Adjustment Model (Huttenlocher, Hedges & Duncan, 1991), Bayesian combination of categorical and metric information offers an optimal strategy for location memory under uncertainty. Prior research supports this hypothesis within simple shapes and complex photographs, and shows that both low-level visual cues and conceptual information may be used to define spatial categories (Holden, Curby, Newcombe, & Shipley, 2010). What happens when these cues define different categories? It would be optimal to use the smaller category to constrain location estimates, to minimize overall error. Here, we explore this prediction using novice and expert geologists, and photographs of geological interest. The size of the conceptually defined (geological) categories varied relative to visually defined categories. Results demonstrate that geology experts used geological categories to constrain location estimates, but only for cases where the geologically defined categories were smaller. This suggests that conceptual and visual information are both used flexibly to define spatial categories.
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(3023)

A Question of Intention in Hand and Tool use via Reach Estimation: Children vs Adults. PRISCILA CAÇOLA, *University of Texas at Arlington,* CARL GABBARD, *Texas A&M University*—This study examined whether intention for processing imagined and executed actions influences accuracy in children's and adults' hand and tool use. Participants used motor imagery to estimate reach using a GO / NOGO paradigm in peripersonal and extrapersonal space, with their hand and while holding a tool of 20 cm. Results indicated no observable intentional effect in hand or tool accuracy for both age groups. However, a significant Age x Space interaction revealed that children were less accurate than adults in extrapersonal space, exhibiting greater overestimation. Based on the similarity of results for hand and tool use in both children and adults, we conclude that intentional processes driving motor imagery and the planning and execution of a movement are at least similar, remaining comparable when space is represented with a tool. Furthermore, intention does not seem to follow a gradual developmental trend, being an intrinsic factor in movement planning and execution from an early age.
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(3024)

Haptic Spatial Updating Across the Lifespan. NICHOLAS A. GIUDICE and CHRISTOPHER R. BENNETT, *The University of Maine,* ROBERTA L. KLATZKY, *Carnegie Mellon University,* JACK M. LOOMIS, *University of California, Santa Barbara*—This research investigated updating accuracy of spatial images (3D working memory representations of space) developed from haptic learning of table-top object arrays by three age-delineated participant groups ranging from twenty to eighty years. After learning, participants performed pointing judgments between target pairs and a reproduction task from a new perspective after physical or mental rotation. Pointing results revealed significant differences between age groups, with the highest accuracy observed with the youngest group and lowest accuracy with the oldest group. Reproduction accuracy followed a similar pattern, with the youngest participants yielding the least errors and the oldest group the most errors. Although these results point to a degradation of performance with age, the oldest group showed reasonable overall accuracy across tasks and did not reliably differ from either of the younger groups on physical versus mental updating performance. These findings suggest similar development and updating of spatial images over the lifespan.
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(3025)

Combining Language and Space: Word Bisection in Unilateral Spatial Neglect. LAURA VERONELLI, *University of Milano-Bicocca; Casa Di Cura Privata del Policlinico, Milan,* GIUSEPPE VALLAR, *University of Milano-Bicocca; IRCCS Italian Institute for Auxology, Milan,* CHIARA V. MARINELLI and SILVIA PRIMATIVO, *University of Rome La Sapienza, Rome; IRCCS Foundation Hospital Santa Lucia, Rome,* LISA S. ARDUINO, *Lumsa University; ISTC-CNR, Italy* (Sponsored by Lucia Colombo)—Right brain-damaged patients with unilateral spatial neglect (USN) bisect lines to the right of the midpoint, while healthy participants show a minor reversed bias ('pseudoneglect'). Both linguistic and perceptual mechanisms may be involved in word and line bisection. The present study investigated these stimulus-dependent effects. In Experiment #1 11 USN patients, 11 right brain-damaged patients without USN, and 11 controls were asked to bisect 5-10-13-letter words, and lines of comparable length. Experiment #2 required the bisection of words stressed on the penultimate or antepenultimate syllable. Results show that, despite an overall rightward bias modulated by stimulus length, in a few patients USN affects the bisection of words and lines in a different fashion (Exp. #1). Results from Exp. #2 indicate that the word final sequence modulates the allocation of attention in both patients and controls. Visuo-spatial and lexical mechanisms influence word bisection in USN patients.
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(3026)

Examining the Relation Between Math Anxiety and Spatial Processing. ERIN A. MALONEY, *The University of Chicago,* EVAN F. RISKO, *Arizona State University,* STEPHANIE WAECHTER, *University of Waterloo,* MAREIKE WIETH, *Albion College,* *SIAN L. BEILOCK, *The University of Chicago,* JONATHAN A. FUGELSANG, *University of Waterloo*—Math anxious individuals experience negative affect when performing tasks involving number, resulting in verbal ruminations that disrupt the working memory capacity necessary for the task at hand. Little is known, however, about how math anxiety relates to other processes important for math (e.g., spatial processing). We demonstrate a negative relation between math anxiety and spatial processing ability (Experiment 1). We also show that math anxiety is associated with poor performance on a trait measure of spatial, but not verbal, WM capacity (Experiment 2). In Experiment 3, we demonstrate that an intervention known to reduce the link between math anxiety and poor math performance (expressive writing) is more effective for verbally demanding than spatially demanding math questions. This last experiment suggests that deficits on spatially demanding math questions are not caused by online verbal ruminations. Together, these results suggest that math anxiety co-occurs with spatial processing deficits.
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(3027)

Stereotype Threat and Gender Differences in Math and Spatial Performance: A Meta-Analysis. RANDI A. DOYLE and DANIEL VOYER, *University of New Brunswick*—The present study aimed to quantify the magnitude of gender differences in math and spatial performance under stereotype threat conditions. A total of 81 effect sizes (d) were entered in a meta-analysis using a hierarchical approach. The effect sizes were calculated in such a way that a positive value reflected a male advantage. An overall significant effect was found (d. = 0.41). However, effect sizes had to be partitioned to achieve homogeneous clusters. Initial partitioning showed significantly larger gender differences in experimental groups (d. = 0.60) than in control groups (d. = 0.20). Further partitioning for experimental groups revealed a non-significant effect among children aged 13 and younger (d. = 0.23) whereas it was significant in adolescents aged 14 to 18 (d. = 0.45), and in adults 19 and over (d. = 0.87). Finally, the partitioning required for adult experimental groups showed very large gender differences for individual testing (d. = 2.06), medium effects for groups testing (d. = 0.52), and intermediate effects for unreported testing conditions (d. = 1.06). Implications of these results for future work and for theoretical interpretations of gender differences in math and spatial performance are discussed.
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(3028)

The Effect of Flight Training on Spatial Cognition Outside the Cockpit. JENNIFER E. SUTTON, *Brescia University College at the University of Western Ontario*—Early in training, pilots learn to engage in dynamic, large-scale spatial updating using multiple landmarks and beacons, but little is known about how this experience affects non-flight spatial information processing. The current study investigated whether flight experience (i.e., hours) in early training is related to cognitive mapping ability. Pilot trainees in a university-based aviation program learned the layout of a novel virtual town and subsequently completed a judgment of relative direction (JRD) task. They also completed the Object Perspective Test (OPT; Hegarty & Waller, 2004), a task related to the JRD but with no memory component. Multiple regression revealed that flight hours, but not other variables such as age, year in school, completion of aviation-specific university courses, or video-game experience predicted performance on the OPT. Further, performance on the OPT predicted accuracy on the virtual town JRD task. Therefore, increased flight experience seems to be associated with better perspective-taking ability.
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(3029)

Grid Cells and Human Path Integration. XIAOLI CHEN and TIMOTHY P. MCNAMARA, *Vanderbilt University,* JONATHAN W. KELLY, *Iowa State University*—Effective wayfinding depends on the ability to maintain spatial orientation during locomotion. Humans and other animals maintain spatial orientation, in part, via path integration, which operates by integrating self-motion cues over time, providing relative information about displacement. The neural substrate of path integration may exist in grid cells, which are found in the dorsomedial entorhinal cortex and pre- and parasubiculum in rat. Signatures of grid-cell activity have been identified in humans. This project used immersive virtual reality to test grid-cell based models of path integration

by taking advantage of their sensitivity to environmental geometry. Participants walked an outbound path and then attempted to walk straight back to the starting location without vision. Stretching a rectilinear environment along one axis led participants to underestimate the distance "home" whereas compressing an environment led participants to overestimate the distance "home." These effects were predicted by a neurally based model of the role of grid cells in path integration.
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(3030)

Evidence for a Stimulus Size-Response Position Correspondence Effect. BARBARA TRECCANI, ROBERTA SELLARO, REMO JOB and ROBERTO CUBELLI, *University of Trento*—This study aimed at assessing whether the typical size of objects is represented, and whether this representation is spatial in nature, as has been found to occur for number magnitudes (the SNARC-effect). Target stimuli were centrally presented pictures or words referring to typically large or small animals or inanimate objects. Participants were required to press a left- or right-side key either to judge whether the target was smaller or larger than a reference stimulus or to classify it as belonging to the category of living or non-living entities. Results showed that left responses were faster when the target represented small sized entities, whereas right responses were faster in the case of typically large entities. These results suggest that the typical size of objects is represented and that it is coded spatially, small objects being represented on the left and large objects on the right.
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• COLLABORATION AND MEMORY •

(3031)

Collaborative Inhibition in Spatial Memory Retrieval. MATTHEW ERDMAN, LORI A. SJOLUND and JONATHAN W. KELLY, *Iowa State University*—Previous research has shown that collaborative pairs recall more previously studied information than individuals but less than nominal pairs (i.e., the pooled performance of non-interacting individuals), a finding termed collaborative inhibition. This project examined the generality of collaborative inhibition by testing whether collaborative inhibition extends to recall of spatial locations. Participants studied a layout of objects and later reconstructed the layout from memory. Learning and retrieval occurred individually or in collaborative pairs. Collaborative reconstruction produced more accurate layouts than individual reconstruction. However, nominal pairs produced more accurate layouts than collaborative pairs, indicating collaborative inhibition in spatial memory retrieval.
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(3032)

The Influence of Partner Accuracy on Socially Introduced False Memory. KATYA T. NUMBERS, JAIMIE C. MCNABB and MICHELLE L. MEADE, *Montana State University*—This study examined whether increasing the proportion of false information suggested by a confederate would influence the magnitude of socially introduced false memories in the social contagion paradigm (Roediger, Meade & Bergman, 2001). One participant and one confederate collaboratively recalled items from previously studied household scenes. During collaboration, the confederate interjected 0%, 33%, 66% or 100% false items. On subsequent individual recall tests across three experiments, participants were just as likely to incorporate misleading suggestions from a partner who was mostly accurate (33% incorrect) as they were from a partner who was not at all accurate (100% incorrect). Even when participants witnessed firsthand that their partner had a very poor memory, and every item suggested by the confederate was false, they were still likely to incorporate the confederate's misleading suggestions on subsequent recall and recognition tests. Participants misremember erroneous suggestions from both highly accurate and highly inaccurate partners.
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(3033)

The Role of Group Configuration in the Diffusion of Memory. HAE-YOON CHOI, *Stony Brook University,* HELENA BLUMEN, *Albert Einstein College of Medicine,* ADAM CONGLETON, *Macquarie University,* SUPARNA RAJARAM, *Stony Brook University*—Individuals recall less information when recalling in groups than when recalling alone, a phenomenon called collaborative inhibition. But collaboration improves post-collaborative individual performance, a phenomenon called re-exposure benefits. We examined the effects of group configuration (identical or reconfigured) on collaborative inhibition and post-collaborative memory, to assess non-overlapping as well as collective (or shared) memories. Participants studied a list of words and completed three recall sessions in one of three conditions: Individual-Individual-Individual, Collaborative-Collaborative (Identical group)-Individual, and Collaborative-Collaborative (Reconfigured group)-Individual. During first recall, the typical collaborative inhibition effect occurred in both group conditions. During second recall, collaborative inhibition persisted in identical groups, but completely disappeared in reconfigured groups. During third recall, re-exposure benefits were greater following reconfigured group collaboration than identical group collaboration. The effects of group configuration on collective memories were the opposite: repeated collaboration increased overlap in memory for group members in the identical group compared to the reconfigured groups.
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(3034)

The Influence of Knowledge Overlap on Learning From Collaborative Discussions. JESSICA J. ANDREWS and WILLIAM S. HORTON, *Northwestern University*—Group discussions often focus on shared information rather than the unique knowledge people individually possess, thus failing to benefit from individual expertise. We investigated how the distribution of information—and whether individuals are aware of this distribution—would influence processes

of conversational grounding during group discussions. Participants independently studied information about the circulatory system before engaging in a collaborative discussion as pairs. Individuals in some pairs studied mostly similar information (high overlap) while individuals in other pairs studied mostly unique information (low overlap). Half of the pairs were also informed about the partially overlapping nature of their study materials. On a posttest, individuals from low overlap pairs performed better than individuals from high overlap pairs, but only when they were aware of the distributed nature of studied information. Content coding of the discussions will explore how knowledge overlap leads to characteristic patterns of collaborative grounding of task-relevant information.
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(3035)

Individual and Collaborative Retrieval Practice Effects on Long-Term Learning. JANELL R. BLUNT, *Purdue University,* AFRIDA RAHMAN, *Indiana University*, JEFFREY D. KARPICKE, *Purdue University*—When two individuals recall alone, their combined recall is greater than when the pair recalls together, a counterintuitive finding known as collaborative inhibition. Most previous research has examined collaborative inhibition using word lists or short delays. We examined the effects of collaborative and individual retrieval practice of educationally relevant materials on long-term conceptual understanding. Students read science texts and either recalled collaboratively with another subject, recalled individually, or engaged in no additional activity in a control condition. Initially, the collaborative groups recalled less than the combined scores of the individuals, the collaborative inhibition effect. One week later, students took a final test that assessed comprehension and inferencing. Both retrieval practice methods – collaborative and individual – produced better performance than the control condition. However, there was no difference between retrieval conditions. Collaborative inhibition occurs with educational materials, but may disappear after a week delay.
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(3036)

Collaboration Changes What We Remember and How We Organize it. ADAM CONGLETON, *Macquarie University,* SUPARNA RAJARAM, *Stony Brook University*—Cognitive research on human memory has primarily focused on how individuals form and maintain memories across time. However, less is known about how groups of people working together can create and maintain shared, or "collective," memories of the past. Empirical research has been focused on understanding the processes behind the formation of such collective memories, but virtually none has investigated the structure of collective memory. We examined the extent to which the strength of individual and shared memory structure relates to the formation of collective memory and its persistence over time. Results indicate that collaborating with others to recall the past increases people's access to a commonly available way of structuring their memories, while decreasing access to their own idiosyncratic method. This leads to greater overlap in both the content and structure of their later individual memories as a result of collaboration.
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(3037)

Does Collaborative Practice Improve Statistical Problem Solving? SARAH POCIASK and SUPARNA RAJARAM, *Stony Brook University*—Applied educational research often highlights the positive social and academic outcomes of collaboration, while collaborative memory research from the laboratory shows a more mixed picture where working with others to remember can actually hurt individual memory performance. This study sought to bridge the cognitive research on collaborative memory with the education research involving classroom subject content to address the question of how collaborative practice affects statistical problem solving. After viewing a lecture about statistics, participants completed two successive tests that contained nonoverlapping problems. These problems were designed to assess computational as well as conceptual understanding of the material, and were balanced for content across tests. On the first test, participants worked collaboratively or individually, and on the second test, all participants worked individually. The observed bounds of collaboration benefits will be discussed as a function of gender and type of test problem (i.e. computational or conceptual).
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(3038)

Older Adults Recall More Episodic Details When They Remember Together. AMANDA J. BARNIER and ALICE C. PRIDDIS, *Macquarie University,* DONNA R. ADDIS, *The University of Auckland*—Recent research has shown that older adults recalling alone have difficulty retrieving episodic, but not semantic, details of past events, especially compared to young adults. We created a social version of Addis, Musicaro, Pan, and Schacter's (2010) episodic memory paradigm to investigate if remembering with a long-term spouse overturns this age-related memory deficit in older adults. In Session 1, participants individually generated ten memories of specific events they experienced with their spouse during the past five years. In Session 2, they recalled some of these events in detail either alone (Individual Control condition) or together with their spouse (Collaborative condition). Careful coding of the resulting individual and collaborative memories revealed that long married, older adult couples who remembered together generated more "internal" – on topic, episodic – details than couples who remembered alone, but the same amount of "external" – off-topic, semantic – details. Our findings suggest that although individual memory may decline over time, collaborative remembering with a long-term partner may "scaffold" successful memory as we age and even compensate for age-related memory deficits.
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(3039)

Is Cooperative Memory Special? The Role of Costly Errors and Context When Remembering the Past. JEFFREY R. STEVENS, *University of Nebraska, Lincoln,* TIM WINKE, *University of Bayreuth*—Theoretical studies of cooperative

behavior have focused on decision strategies that depend on remembering a partner's last choices, such as tit-for-tat. A previous empirical study, however, demonstrated that human memory may not meet the requirements needed to use these strategies (Stevens et al. 2011). When asked to recall the previous behavior of simulated partners in a cooperative memory task, participants performed poorly, making errors in 10–24% of the trials. The current study investigates the flexibility of memory in cooperative contexts by 1) varying the costs of different types of errors and 2) measuring recall accuracy in cooperative and non-cooperative situations. We found that neither including differential costs for misremembering defection nor removing the cooperative context influenced memory accuracy for cooperation. Combined, these results suggest that memory accuracy is robust to differences in the cooperative context. Thus, by including unrealistic assumptions about cognition, theoretical models overestimate the robustness of the existing cooperative strategies based on tracking a partner's most recent choices.
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• RECOGNITION MEMORY II •

(3040)

Memory Updating: A Test of the Selective Rehearsal Account. WILLIAM B. LANDON and DANIEL R. KIMBALL, *The University of Oklahoma,* MARTHA MANN, *University of Texas at Arlington*—Updating memory often requires remembering correct information and forgetting incorrect information. Selective rehearsal of to-be-remembered information at encoding provides one explanation for this process. The present study explored the generality of this explanation, using lists of semantically associated word pairs. Each cue word was paired with either one or two target words. After each target's presentation, it was labeled as correct (to-be-remembered) or incorrect (to-be-forgotten); the last-presented target for each cue was always labeled as correct. In Experiment 1, a cued recall test on all pairs—regardless of label—yielded improved memory for correct targets following errors relative to the second of two correct targets, with impaired memory for errors relative to the first of two correct targets. However, in Experiment 2, a recognition test revealed no such differences. This difference in patterns as a function of test type argues against an encoding explanation of memory updating for word pairs based on selective rehearsal.
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(3041)

An Investigation into the Nature of Partial Recollection. ANTHONY J. RYALS, ANNE M. CLEARY and CAROL A. SEGER, *Colorado State University*—According to dual-process theories, recollection involves bringing to mind a specific occurrence, a target item, or details surrounding a past experience. Many dual-process methods index recollection in a binary fashion, thus treating it as an all-or-none occurrence. However, some research suggests that recollection may actually vary along a continuum (i.e., it may be a "some-or-none process" rather than all-or-none). We examined the nature of partial recollection using a variation of the general-knowledge recognition-without-identification procedure (Cleary, 2006). Across experiments, participants attempted to answer general-knowledge questions and were prompted to retrieve various types of partial information when target retrieval failed. Two notable findings occurred across experiments: 1) partial recollection of all types was extremely rare compared to either full target recollection or complete recollection failure, and 2) partial recollection behaved differently in response to our manipulations than either full recollection or recognition occurring in the absence of any recollection.
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(3042)

The Consolidation of Recognition Memory Over Time: An ERP Investigation Into Vocabulary Learning. SHEKEILA PALMER, *University of York,* JELENA HAVELKA, *University of Leeds,* JOHANNA VAN HOOFF, *VU University Amsterdam*—Event-related potentials were used to examine the effect of consolidation on the recognition of familiar and novel words. Native English speakers were taught novel words associated with English translations, before performing a Recognition Memory task in which they made old/new decisions in response to both words and novel words. The memory task was performed 45 minutes after training (Day 1) and then repeated the following day (Day 2) without any additional training. For familiar words, the late parietal old/new effect distinguished old from new items on both Days, butthe response to trained items was significantly weaker on Day 2. For novel words, the LPC again distinguished old from new items on both days, but the effect became significantly larger on Day 2. The data suggests that while recognition memory for familiar items may fade over time, recognition of novel items seems to benefit from a period of consolidation.
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(3043)

Exploring the Representations Underlying Recollection and Familiarity-Based Recognition. STEPHEN DOPKINS, HYOUN PYOUN and KATY VARNER, *The George Washington University*—The representation underlying recollection is said to be more capable of refined discrimination than is the representation underlying familiarity-based recognition. The representation underlying familiarity-based recognition is said to be more capable of recording inter-item relationships than is the representation underlying recollection. We obtained support for both of these claims using a priming manipulation. We interpret the effects of prime-test overlap at long and short response intervals as reflecting recollection and familiarity-based recognition, respectively. We provide converging evidence in support of this interpretation.
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(3044)

How the Measurement of Memory Processes Can Affect Memory Performance: The Case of Remember/Know Judgments. MOSHE NAVEH-BENJAMIN, MATT BRUBAKER and HOPE FINE, *University of Missouri*—

Relatively little attention has been paid thus far in memory research to the effects of measurement instruments intended to assess memory processes on the constructs being measured. Recently, Naveh-Benjamin and Kilb (2012) have shown that using the remember/know (R/K) procedure can affect memory performance in older adults. In the current report, we have extended this research to younger adults. Participants studied unrelated word pairs and then provided R/K judgments on the single words (item test) and the word pairs (associative test). Results indicated that performance in this group was better on both tests than that of a group who did not perform the R/K judgments. A follow-up study indicated that a potential mechanism mediating the effects of R/K judgments on memory performance is the opportunity for deep-level processing.
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(3045)

Does Judgment of Featural or Holistic Face Information Cause Verbal Overshadowing? AYA HATANO, SHINJI KITAGAMI and JUN KAWAGUCHI, *Nagoya University* (Sponsored by Atsunobu Suzuki)—Previous studies have suggested that describing facial memory impairs face recognition (the verbal overshadowing effect). We can use different methods of verbalization, such as judging features, conveying impressions, or simple description. However, whether judgment of a target causes verbal overshadowing has not been sufficiently clarified. Does judgment of a target without describing it cause memory impairment? This study examined whether face recognition was impaired by judging holistic information or featural information. Participants were assigned to two verbalization conditions: featural verbalization or holistic verbalization. In the featural verbalization condition, participants were asked to judge 20 descriptions that referred to featural information. Participants in the holistic verbalization condition were asked to judge 20 descriptions that referred to the target's second-order relations. The results indicated that judging featural information impaired recognition, while judging holistic information did not. We discussed how different kinds of verbalized information influence face recognition.
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(3046)

Familiarity Supports "Associative Recognition" of Faces, Even Inverted Faces. MITCHELL A. MELTZER, JAMES C. BARTLETT and JOSHUA A. ARDUENGO, *University of Texas at Dallas*—In associative recognition tests, participants distinguish pairs of stimuli that were studied together from pairs of stimuli that were studied apart (in different pairs). Findings suggest that while associative recognition often depends on recollection, with unitized stimuli such as upright faces, associative recognition of their constituent parts is based on familiarity. On the assumption that inversion disrupts the unitized encoding of faces, this view predicts that while associative recognition of facial parts can be based on familiarity, when the faces are inverted it depends on recollection. We tested this prediction by adapting the process dissociation procedure to associative recognition with upright and inverted faces, adjusting study presentation frequency to equate performance levels. Contrary to predictions, the findings indicated that associative recognition was based largely on familiarity, regardless of upright versus inverted orientation. These findings suggest that unitized encoding of inverted faces can be achieved through repetition, and raise important questions about unitization, familiarity, and the inversion effect in face recognition.
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(3047)

The Effects of Arousal and Prioritized Processing on Emotional Memory. EZGI ARIKAN, *Hacettepe University,* AYCAN KAPUCU, *Yasar University* (Sponsored by Hasan Gurkan Tekman)—Memory enhancement for emotionally arousing stimuli compared to non-arousing neutral stimuli has been posited to vary with respect to contextual factors. Hadley and MacKay's(2006) priority-binding hypothesis predicts emotional memory enhancement when presentation rate is rapid enough to prioritize emotional material bound to its context. By contrasting the arousal level versus the prioritized processing mechanisms, we investigated whether recognition advantage of emotional stimuli differed based on presentation rate and list type. Participants studied negatively arousing and non-arousing neutral pictures at short (250ms) and long (2000ms) presentation rates, either in pure lists, composed of items from a single emotion category, or in mixed lists. Signal detection analyses showed that negative pictures were recognized better than neutral pictures only when studied in mixed lists and when the presentation rate was long.
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• HUMAN LEARNING AND INSTRUCTION II •

(3048)

GoCognitive – Online Teaching Resources for Cognitive Neuroscience. STEFFEN WERNER, *University of Idaho*—GoCognitive is an online resource that provides flash-based demonstrations and video interviews on topics related to cognitive neuroscience. This free repository of teaching materials currently includes interviews with almost two dozen leading researchers in cognitive science and neuroscience, broken up into more than 120 separate video segments with a total running time of 16 hours, as well as a dozen simple demonstration programs. Topics include perception, attention, short- and long-term memory, motor behavior, language, decision making, and the neural basis of cognition. The materials can be easily searched and filtered by associated tags, and related videos are grouped into chapters. We are currently working on including a quiz component to allow students to test their knowledge of cognitive neuroscience and a guide to related graduate programs. This poster gives an overview of existing materials and student and instructor grants available through the project.
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(3049)

Predictors and Correlates of Undergraduate STEM Enrollment. KATHLEEN M. GALOTTI, *Carleton College*—First-year undergraduates (n = 148) participated in a short-term longitudinal study of decision-making, goal-setting and stylistic change over their first 14 months of college. One aspect of this project focuses on the decision to enroll in STEM courses or declare STEM majors. Students have been surveyed about choosing courses for an upcoming term (for three different terms), choosing a major (twice), and course enrollment data over the first two years is available, along with several individual differences measures of decision-making, cognitive, and epistemological styles. The presentation will focus on the patterns of correlates and predictors of taking STEM courses or declaring a STEM major.
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(3050)

What Level of Redundancy Facilitates Learning From Multimedia Lessons? CAOLE L. YUE, ELIZABETH LIGON BJORK and ROBERT A. BJORK, *University of California, Los Angeles*—As technology-assisted multimedia materials become more prevalent in classrooms and self-directed study, knowing how to structure such materials to enhance learning is increasingly important. We examined the influence of verbal redundancy in auditory and visual modalities on students' ability to recall and transfer knowledge from a multimedia science lesson. Different participants in Experiment 1 listened to a narration explaining the life cycle of a star accompanied by an on-screen animation, the animation plus on-screen captions identical to the narration, the animation plus captions summarizing the narration, or a black screen (simulating a lecture podcast). Participants learned best when the narration was accompanied by the animation and summary captions, but those same participants judged that full captions would have been optimal for learning. In Experiment 2, we found that full-length captions worded differently than the narration were better for learning than identical captions, suggesting that a slight mismatch between narration and printed text may function as a desirable difficulty (Bjork, 1994), perhaps by inducing deeper processing of the to-be-learned content.
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(3051)

Meta-3R: Unique Contributions of Recitation and Metacomprehension Judgments. KHUYEN NGUYEN and MARK A. MCDANIEL, *Washington University in St. Louis*—Much research has shown retrieval practice to be beneficial for long-term retention. More specifically, McDaniel et al. (2009) found that reading, reciting, and reviewing (3R) improved performance on a delayed test relative to just reading and reviewing. They also found, however, that in the 3R condition, reviewing did not foster much learning of the information that was not recalled in the initial recitation. In the present experiment, we were interested in whether having participants make metacomprehension judgments prior to review would help them allocate study time more effectively and efficiently. Participants were randomly assigned to one of three conditions: 1) standard 3R, 2) meta-note-taking, and 3) meta-3R. Results revealed unique contributions of recitation and metacomprehension judgments, with optimal performance being observed under conditions in which both strategies were utilized (meta-3R).
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(3052)

Learning General and More Specific Relations From Practice Solving Arithmetic Problems. REBECCA A. BONCODDO, JORDAN THEVENOW-HARRISON, TIMOTHY T. ROGERS, MARTHA W. ALIBALI and CHARLES W. KALISH, *University of Wisconsin* (Sponsored by Colleen Moore)—Several studies have found that practice with mathematical problems does not transfer to novel problems. We suggest that highlighting the quantitative relations among and within problems may lead to better transfer. Twenty-one adults practiced predicting the distance a rocket would travel given information about its engines. The relation among quantities was Engine1 + Engine2 = Distance. All quantities were presented using "alphabetic" numerals (e.g., "B+B=?") in base 8. Participants then solved a variety of analogous transfer problems. There was significant improvement on both practice problems and on transfer problems that had identical structure to the practice problems (e.g., novel B+B = ?"). However, there was no improvement on problems with an alternate structure (e.g., "B+?=C"). Results suggest that participants learned a discriminative function. Future studies will explore the conditions under which participants do and do not learn such functions, as well as conditions supporting fully generative models of functional relations.
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(3053)

Learning by Teaching: How Does it Work? LOGAN FIORELLA and RICHARD E. MAYER, *University of California, Santa Barbara*—In learning by teaching, students teach their peers the content of a lesson and as a consequence their own understanding of the material improves. The mechanism underlying this effect may be caused by the learner's cognitive processing during teaching (selecting relevant information, mentally organizing it, and integrating it with prior knowledge) or by the learner's processing in preparing to teach. The current study aimed to disentangle these two explanations. Some participants studied a lesson on the Doppler Effect without the expectation of later teaching the material and took a test on the material (control). Other students studied the same lesson with instructions that they would later teach the material; of those expecting to teach, some participants actually taught the material before being tested (teaching), whereas others only prepared to teach (preparation). On a subsequent test, the teaching group significantly outperformed the control group (d = .60), and there was a significant linear trend in which the teaching group outperformed the preparation group, which outperformed the control group. Overall, this study provides support for the idea that actually teaching enhances learning beyond only preparing to teach.
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(3054)

Linguistic Competency and Social Emotional Development in the VL2-EELS Longitudinal Study. THOMAS E. ALLEN, M. DIANE CLARK and DONNA MORERE, *Gallaudet University*—The Science of Learning Center on Visual Language and Visual Learning (VL2)'s Early Educational Longitudinal Study (EELS) evaluates the linguistic readiness and social emotional development of 3-, 4-, and 5-year old deaf children across the US, using both direct and indirect assessments. This presentation examines the interrelationships among language and social variables and will test the hypothesis that deaf children with more effective language skills (either ASL or English) demonstrate higher levels of social adjustment. Linguistic competency is determined from measures of letter knowledge, vocabulary, receptive language skill and fingerspelling/related skills. Social emotional development is based on portions of the Adaptive Behavior Assessment Scale, which were adapted for use with this special population. We will also evaluate the effects of moderating variables such as home language (English or American Sign Language) and parental income.
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(3055)

Escaping the Dangers of Errorful Learning. FARIA SANA, CHRISTOPHER TEETER and JOSEPH A. KIM, *McMaster University* (Sponsored by Geoff Norman)—Making errors during initial information acquisition can affect subsequent performance. However, the extent to which these errors affect learning remains unclear. During initial acquisition, having learners provide self-explanations or receive instructional explanations can enhance information retrieval later on. Self-explanations encourage learners to infer information omitted from text and revise their conceptual understanding. Instructional explanations present correct and complete information in a coherent way, which is helpful for learners who do not generate such explanations on their own. We examined how these two learning conditions influence recognition performance of learners who have errorless (deep) or errorful (shallow) conceptual understandings of statistical tests. Results suggest that performance depended on the quality of self-explanations: good explanations improved performance whereas poor explanations decreased performance. Moreover, instructional explanations given in isolation or given as feedback on self-explanations increased performance for errorful learners but not for errorless learners. These findings highlight the critical need to correct errors generated during learning.
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(3056)

Effects of Typography and Image Informativeness on Memory for New Words. CASSIE PALMER-LANDRY and KIEL CHRISTIANSON, *University of Illinois at Urbana-Champaign*—To follow-up recent findings that bolding aids memory in multimedia and that highly informative areas in imagery draw attention, eye-tracking was used to investigate effects of typography and pictorial information availability on memory for novel words. Participants read two short sentences containing a nonword and a nonce image; they were later asked to recall in an offline image-nonword association task. Analyses revealed that accuracy was predicted by longer total dwell time on the image, quicker reaction time to the post-test, and their interaction. Results from a second post-test re-administered after a 15-minute delay showed a marginal interaction of typography and information availability: repeating the nonword on the image when the type was bold helped boost memory accuracy, thereby demonstrating persistent effects on memory. Participants with lower WM capacity were more affected by bolding. Readers thus form stable, perseverant mental representations of word meanings by using both image and sentential informativeness.
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• PROSPECTIVE MEMORY •

(3057)

Prospective Memory: Aging and Spontaneous Retrieval. GILLES O. EINSTEIN and THEODORE J. HESS, *Furman University,* HILLARY G. MULLET, *Duke University*—Research has shown that prospective memory retrieval can be accomplished through relatively automatic spontaneous retrieval processes in which cues associated with an intended action can trigger retrieval of the intention in the absence of monitoring. The present experiment used a suspended-intention paradigm to test whether spontaneous retrieval is preserved with aging. Specifically, young and older participants encoded a prospective memory task (e.g., press a designated key when you see the words money or teeth) within the context of a particular ongoing task and then were told to suspend their intention while performing an intervening lexical decision task. Importantly, critical words (prospective memory target words or semantically related words) were presented during the lexical decision phase. We inferred spontaneous retrieval from slowed lexical decision response times to these critical words. The results revealed conditions under which spontaneous retrieval is and is not spared.
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(3058)

Cognitive and Neural Plasticity in Older Adults' Prospective Memory Following Training on the Virtual Week Computer Game. NATHAN S. ROSE and FERGUS I.M. CRAIK, *University of Toronto,* MATTHIAS KLIEGEL and ALEXANDRA HERING, *Universite de Geneve,* PETER G. RENDELL, *Australian Catholic University*—Prospective memory (PM) declines with age and is important for functional independence, yet few studies have attempted to train these abilities in older adults. We developed a PM training program using the Virtual Week computerized board game. Training participants played the game in twelve, 1-hour sessions over one month. Measures of neuropsychological functions, lab-based PM, event-related potentials (ERPs) during performance on a lab-based PM task, activities of daily living, and real-world PM were assessed before and after training. Performance was compared to both no-contact and active control groups. PM on the Virtual Week game

dramatically improved following training relative to controls, suggesting PM plasticity is preserved in older adults. Relative to control participants, training did not produce reliable transfer to other laboratory tasks, but was associated with a reduction of ERP components (N300 over occipital cortex and sustained positivity over frontal cortex) associated with processing PM cues, indicative of more automatic PM retrieval. Additionally, training produced far transfer to real-world outcomes including performance on activities of daily living and real-world PM.
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(3059)

Facilitative Effects of Disrupted Sequence Learning on Prospective Memory Retrieval: Support for the Discrepancy Hypothesis. JI HAE LEE, JULIE BUGG and MARK A. MCDANIEL, *Washington University in St. Louis*—The multiprocess theory (McDaniel & Einstein, 2000; 2007) suggests that various mechanisms support prospective memory (PM), including discrepancy-plus-search processes (McDaniel et al., 2004). In the present experiment, we tested the hypothesis that discrepancy, which is elicited when actual processing quality mismatches expected processing quality (Whittlesea & Williams, 1998; 2001), facilitates retrieval in PM. Borrowing from the implicit learning literature, we manipulated discrepancy using a motor sequence-learning paradigm (Richard, Clegg, & Seger, 2009). In the discrepant condition, PM targets were presented when a well-learned sequence was disrupted, thereby eliciting discrepancy. In the non-discrepant condition, PM targets were presented during the same block as the discrepant condition, but there was no sequence to be learned (or disrupted). The results indicate a facilitating effect of discrepancy on PM performance in this novel paradigm. We discuss the implications of these data, as well as RT costs, for the multiprocess theory.
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(3060)

Self-Controlled Encoding Processes Benefit Future Intention Fulfillment. BRETT H. BALL, KIMBERLY WINGERT, SELDA EREN and GENE A. BREWER, *Arizona State University*—Considerable research investigating event-based prospective memory has examined the attentional and control processes that support cue detection and intention retrieval. However, the extant literature examining control processes that underlie intention formation is relatively minimal. In the current study, participants were allowed to self-select the cues in which they were to later make a special response to and we compared prospective memory performance to yoked controls that studied the exact same cues for the same duration but were instructed that the computer would randomly determine the encoding conditions for them. Prospective memory was better when encoding was self-controlled than when encoding was controlled by the experimenter and this occurred with no additional cost to ongoing task performance. These findings highlight the importance of examining encoding and planning of prospective memories and suggest that in everyday settings individuals may select appropriate encoding strategies to optimize intention fulfillment and minimize cost to ongoing activities.
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(3061)

Effects of Categorical Priming on Prospective Memory Accuracy. BRANDON J. THOMAS and DAWN M. MCBRIDE, *Illinois State University*—The current study provides evidence of spontaneous retrieval in prospective memory (PM) retrieval. Discrepancy-plus-search is a spontaneous retrieval mechanism involving differential exposure to ongoing task items and PM cues. This context has yielded increases in the proportion of responses to PM cues that are discrepantly processed as predicted by a Multi-process account of PM retrieval (Breneiser & McDaniel, 2006). The current study tested whether this mechanism can be initiated in a category priming context by creating a dominant category within an ongoing processing task. The PM cues were either members of the dominant category or members of a discrepant category within an unrelated pleasantness-rating task (i.e., the ongoing task). Participants responded to more PM cues when there was a discrepancy between the PM cues and ongoing task items. Moreover, participants' identification of PM cues was not accompanied by an increase in reaction times. These results support discrepancy-plus-search as a possible mechanism of PM retrieval in certain contexts.
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(3062)

Unspecific Intentions Require Specific Attention: Target-Action Mapping Affects Interference From Prospective Memories. JAN RUMMEL, *University of Mannheim*—Event-based prospective memory (PM) requires performing an intended action in response to a target event. Previous research has shown that target specificity influences performance in a PM task as well as its attentional requirements reflected by the interference with an ongoing task. Not only PM targets themselves, however, but also their mapping to a PM response can vary in specificity. To investigate the role of the specificity of target-action mapping, participants had to respond to four targets by either pressing (1) one specific key, (2) a different key specified for each target, or (3) one out of four different keys in a specified order but not mapped to a specific target. PM performance was comparable between the three conditions. PM-induced interference did not vary with the number of actions but was higher when there was no specific target-action mapping (3rd condition), suggesting increased attentional demands of such unspecific intentions.
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(3063)

Paying What You Expect: Performance Expectations Influence Initial Ongoing-task Costs in Event-based Prospective Memory. BEATRICE G. KUHLMANN, *University of North Carolina at Greensboro,* JAN RUMMEL, *University of Mannheim,* DAYNA R. TOURON, *University of North Carolina at Greensboro*—Event-based prospective

memory (PM) is performing an intended response following a target cue. Allocation of attentional resources to intention fulfillment slows ongoing activities, referred to as costs. Intention characteristics influence cost magnitude but little is known about individual differences in costs on the same PM task. We examined whether metacognitive expectations about PM performance influence costs in a focal PM task where intention fulfillment requires little attention. Participants performed an ongoing lexical-decision task alone and with a focal PM intention (pressing a special key for a specific word), allowing individual cost assessment. Participants' predictions were generally underconfident, with lower predictions related to higher initial costs. These costs were not functional as they did not result in higher PM-cue detection. With task experience, costs were no longer related to initial performance predictions. Thus, high costs in focal PM tasks may in part reflect participants' low performance expectations before task experience.
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(3064)

Too Easy? The Influence of Implicit Demands on Prospective Memory. JOANA S. LOURENCO, JOHNATHAN HILL and ELIZABETH A. MAYLOR, *University of Warwick*—Prospective memory (PM) research exploring metacognitive factors is limited. We examined whether implicit PM demands can influence judgments about the cognitive effort required for success. Participants performed a lexical decision task in which a PM task of responding to animal words was embedded. PM demands were varied implicitly by presenting participants with either typical or atypical animal exemplars at both instructions and practice (low and high demands, respectively). PM targets were always atypical animals. Results revealed an effect of implicit demands on task interference such that cost was greater for the high- than low-demands condition. Moreover, task interference increased following the first target detection for participants in the low-demands condition suggesting adaptation to the higher-than-expected demands. PM performance was lower in the low- than high-demands condition. Thus, participants' beliefs about a PM task from previous experience can affect ongoing-task processing, and mismatch between implicit and actual demands can impair performance.
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(3065)

Why are You Late? The Role of Time Management in Time-Based Prospective Memory. EMILY R. WALDUM and MARK A. MCDANIEL, *Washington University in St. Louis*—Time-based prospective memory tasks (TBPM) are those that are to be performed at a specific future time. Contrary to typical laboratory TBPM tasks (e.g., "hit the "f" key after you have been performing the lexical decision task for 5 minutes."), many real-world TBPM tasks require more complex time-management processes. For instance to attend an appointment on time, one must estimate the duration of the drive to the appointment and then utilize this estimate to create and execute a secondary TBPM intention (e.g., "I need to start driving by 3:45 to make my 4:00 appointment on time"). In a novel paradigm, older and younger adults were told that they would need to first work on a jigsaw puzzle and then repeat a trivia task that they had previously performed before they could make a TBPM response. Because the TBPM response was to be made as close to 20:00 as possible, participants needed to utilize a time estimate of the trivia task to determine how long they could initially work on the puzzle and still have enough time to complete the trivia task by 20:00. Results indicate that time estimation biases and plan fidelity influence performance accuracy in complex TBPM tasks.
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• METAMEMORY/METACOGNITION II •

(3066)

Cashing Out: Macaques' and Humans' Decisional Flexibility of Uncertainty Responding. ALEXANDRIA C. ZAKRZEWSKI, *University at Buffalo, SUNY,* BONNIE M. PERDUE and MICHAEL J. BERAN, *Georgia State University,* BARBARA A. CHURCH and J. DAVID SMITH, *Univiersity of Buffalo, SUNY*—Recent research has explored the important question of whether human and non-human animals share a metacognitive capacity or the ability to monitor mental states and control cognitive processes (Kornell, 2009; Smith, 2009; Smith et al., 2012). Although results support an interpretation of animal metacognition, competing low-level, associative interpretations persist. One problem is that tasks use fixed difficulty, risk, and reward, never examining dynamic changes in the animal's risk assessment. A changing risk environment might reveal metacognition more clearly. The present study tested macaques and humans for the first time in an uncertainty-monitoring paradigm within which risk changes dynamically. A modified uncertainty response allowed humans and monkeys to manage risk by choosing when to harvest rewards. Participants selectively "cashed out" accumulated rewards to protect against costly discrimination errors during difficult trials, demonstrating calibration of risk to trial difficulty, a finding consistent with a higher-level understanding of macaques' uncertainty system.
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(3067)

The Effects of Perceptual Fluency on Metamemory Judgments: Relative or Absolute? JONATHAN A. SUSSER and NEIL W. MULLIGAN, *University of North Carolina at Chapel Hill* (Sponsored by Kelly Giovanello)—Perceptual fluency has recently been examined as a cue for metamemory judgments, such that memory predictions may be based on salient perceptual information that seems fluent at encoding (e.g., Rhodes & Castel, 2008). Using an auditory generation manipulation, the current study investigated whether the effects of perceptual fluency on metamemory judgments are relative or absolute. A mixed-list design produced a crossed-double dissociation with greater judgments given for words heard in intact form compared to ones heard in fragmented form despite recall being enhanced for the latter items. Differences in both memory predictions and recall were eliminated in pure-list design. These results suggest that the

use of perceptual fluency as a metamemorial cue is relative in nature, with both fluent and disfluent items needing to be experienced in order for perceptual information to differentially influence memory predictions.
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(3068)

The Recalibration Hypothesis: Retrieval Evidence and the Underconfidence-with-Practice Effect. KATARZYNA ZAWADZKA and PHILIP A. HIGHAM, *University of Southampton*—The underconfidence-with-practice (UWP) effect is a common finding in paired-associate learning studies that incorporate more than one study-recall cycle. In these studies, participants use a percentage scale during study to judge the likelihood they will recall the target in each pair at test (judgement of learning, JOL). The general finding is that mean JOLs match recall percentage on cycle 1, but underestimate it on subsequent cycles – the UWP effect. Our research examined a possible explanation of the UWP effect: that people use JOLs to distinguish between items that have different evidence of being studied and they reserve their highest JOLs for items for which the quality of such evidence is especially high. This strategy contributes to the UWP pattern because many items without such evidence are assigned low JOLs but are still recalled successfully. To examine this possibility, we incorporated a remember/know task into our procedure to discriminate between qualitatively different types of successful retrieval. Our results suggest that participants use JOLs to distinguish between items judged as "remembered" and those judged as merely "known", and this holds true even when the analyses are restricted only to correct answers.
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(3069)

Perceptual Information Influences Judgments of Learning and Study Time Control. MARIANA V. COUTINHO, BARBARA A. CHURCH and J. DAVID SMITH, *University at Buffalo, SUNY*—Participants monitor and control their learning of semantic-verbal information (e.g. Koriat, Ma'ayan, & Nussinson, 2006). They make lower judgments of learning (JOLs) and allocate more study time to difficult items. However, it is still not clear whether participants can accurately monitor and control their learning for nonsemantic-perceptual information. Perceptual information is hypothesized to be encoded differently than conceptual (Blaxton, 1989), and it is not clear whether these differences impact JOLs and study time control. We investigated whether participants could accurately predict their learning when information is perceptual and whether they allocate their time differentially based on difficulty. We gave participants a perceptual paired associate task including similar and dissimilar pairs of dot-distortion shapes and asked them to make JOLs. The results demonstrated that participants can make accurate predictions about their performance and they allocate more study time to items they judge as difficult even when the information is primarily perceptual.
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(3070)

The Roles of Frequency Estimation and Strategy Efficacy in Knowledge Updating. JARED M. HOLDER and CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Research examining knowledge updating of strategy effectiveness, after giving individuals study-test experience on a memory task using two differentially effective strategies, has shown that individuals tend to greatly underestimate their performance with the superior strategy (Dunlosky & Hertzog, 2000). We hypothesized that this could be due to poor online frequency estimation of success with each strategy at test and/or to subjective experience at the item level causing shifts in local estimates of strategy efficacy. In the current study, we asked one group of individuals to keep a running tally of successfully recalled test items studied with each strategy, and another group to give item level strategy efficacy ratings for each strategy. Our data showed that performance underestimation for the superior strategy was eliminated in participants that kept a running tally, but not in a control condition or in participants that gave strategy effectiveness ratings. Strategy efficacy ratings are further examined with regression techniques to assess how item level experience influences performance estimation and declarative strategy knowledge.
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(3071)

Can we Override Foresight Bias by Manipulating Encoding Fluency? DEBBIE A. MAGREEHAN and NEIL H. SCHWARTZ, *California State University at Chico,* SUSANNE NARCISS and CLAUDIA KRILLE, *Technishe Universitaet Dresden, Germany* (Sponsored by Roman Taraban)—Foresight bias occurs when information seems easy to recall during encoding but is difficult to recall when tested. We attempted to override this illusion by focusing participants instead on the perceptual encoding fluency of items, which was not predictive of recall. Participants studied 60 paired-associates, made immediate judgments of learning (JOLs) for each, and then completed a cued-recall test. To produce foresight bias, some pairs were presented in a strong, "forward" direction and some were presented in a weak, "backward" direction. To manipulate encoding fluency, some pairs were presented in a large, black (fluent) font and some were presented in a small, italicized light-gray (disfluent) font. Although the word-direction manipulation produced differences in recall and the font-size manipulation did not, participants' JOLs reflected differences based on font fluency but not word-direction, supporting theoretical evidence that encoding fluency can alter JOL's; but also creating a further metacognitive illusion based on fluency.
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(3072)

Metamemory: The Monitoring and Control Processes for Schizophrenia. MARIE IZAUTE, *Université Blaise Pascal,* ELISABETH BACON, *INSERM*—Schizophrenia is a common disorder with a lifetime risk of about 1 %. It has been closely linked to a wide range of cognitive deficits. The study of metamemory permits an experimental approach to

the disorders of consciousness related to memory processes. Three studies were reported. The first study is on FOK, a metamemory judgment that is expressed at the time of retrieval. The second study examines JOL, which is expressed at the time of learning, and evaluates the control before monitoring relation. The third study by studying the strategic regulation of learning in schizophrenia patients, it will explore the relationship between monitoring and control. The findings of the three reported studies showed preservation of the accuracy of prospective metamemory judgments in schizophrenia patients. Evidence from the second study indicates that the accuracy of judgments elicited at the time of encoding, namely JOLs, is also relatively preserved but the strategic (control) regulation is impaired in schizophrenia.
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(3073)

Metacognitive Control of Encoding Same- and Other-Race Faces. JONATHAN G. TULLIS and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—People often recognize same-race faces better than other-race faces. This cross-race effect (CRE) has been proposed to arise in part because learners devote fewer cognitive resources to encode faces of social out-groups. In two experiments, we evaluated whether learners' "cognitive disregard" during study is under metacognitive control. Learners either studied each face for as long as they wanted (the self-paced condition) or for the average time taken by a self-paced learner (the fixed-rate condition). Learners allocated equal amounts of study time to same-race and other-race faces, and control over study time did not change the size of the CRE. In the second experiment, both self-paced and fixed-rate learners were given instructions to "individuate" other-race faces (Hugenberg et al., 2007). Replicating previous results, individuating instructions reduced the size of the CRE for the control (fixed-rate) group. Individuating instructions caused self-paced learners to allocate more study time to other-race faces, but this allocation did not reduce the size of the CRE. We propose that the differential processing subjects apply to faces of different races is not fully under the strategic control of learners.
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(3074)

Prior Knowledge, Not Confidence, Facilitates Error Correction Following Feedback. DANIELLE M. SITZMAN and MATTHEW G. RHODES, *Colorado State University,* SARAH K. TAUBER, *Kent State University*—Previous research has demonstrated that, when given feedback, participants are more likely to correct confidently held errors compared with errors held with lower levels of confidence, a finding termed the hypercorrection effect. Accounts of hypercorrection suggest that confidence modifies attention to feedback; alternatively, hypercorrection may reflect prior domain knowledge with confidence ratings simply correlated with this prior knowledge. In the current experiments, we attempted to adjudicate among these explanations of the hypercorrection effect. Experiment 1 showed that hypercorrection remained unchanged even when prior confidence was made less accessible following feedback. Experiment 2 directly compared estimates of domain knowledge with confidence ratings and showed that prior knowledge was related to error correction whereas confidence played a negligible role. Overall, our results suggest that prior knowledge plays a strong role in error correction, while confidence may merely serve as a proxy for prior domain knowledge.
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(3075)

Using Subjective Confidence to Improve Metacognitive Monitoring Accuracy and Control. TYLER M. MILLER, *South Dakota State University,* LISA GERACI, *Texas A&M University*—People often predict that they will perform better than they do on an upcoming memory test, yet research shows that they may not be confident in these predictions. The purpose of the present experiments was to examine whether confidence in one's predictions could be used as a guide to improve prediction accuracy (lower predictions) and lead participants to increase study times to improve performance. Participants predicted how they would perform on an upcoming memory test and reported their confidence that their predictions were accurate. Then participants were given the opportunity to adjust their predictions following confidence judgments. Results showed that making confidence judgments lead to more accurate memory predictions and that this improvement in accuracy continued after three adjustments. We also examined the effect of making confidence judgments on study time as well as study strategy use and awareness.
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(3077)

The Role of Agenda-Based and Habitual Processes in Self-Regulated Learning. BARBARA J. WRIGHT, KRISTA BOND, BRENDA TAYLOR-MOODY, JONATHAN J. BERRY, FATIMA IQBAL, RACHEL JOSEPH, KELSEY MCELROY and JODI PRICE—The agenda-based regulation model (Ariel, Dunlosky & Bailey, 2009) suggests that allotted study time, reward structure, and task difficulty influence participants' learning agendas and item selection behaviors. However, Dunlosky's lab has demonstrated that participants may rely on habitual processes, selecting items in a left-to-right reading order, rather than choosing the highest valued English-Spanish vocabulary pairs. We examined if their results would hold if Spanish words were used as cues rather than English, given that Spanish cues reveal more information about each pair's difficulty level. We assigned point values to 48 moderately difficult Spanish-English pairs presented in 1x3 grids in either a 1-3-5, 5-3-1, or random order and participants had either 5 s or unlimited study time. Of interest was which items younger adults (N = 130) would select first. We found points affected selections most when study time was unlimited. Habitual processes were prevalent when study time was constrained.
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(3078)

Metacognition of Emotion Recognition: Beyond Static Images. KAREN J. KELLY and JANET METCALFE, *Columbia University* (Sponsored by Lisa Son)—Research on metacognition of emotion recognition has demonstrated that individuals are adept at making accurate metacognitive judgments about their ability to recognize posed facial expressions. This research seeks to expand this finding using more dynamic stimuli. In experiment 1, participants were asked to view videos of point light displays depicting individuals walking in a manner consistent with specific emotions. In experiment 2, participants were asked to listen to spoken sentences with neutral content but varied emotional prosody. In both tasks, participants made prospective trial-by-trial judgments of their perceived ability to correctly identify the expressed emotions in both the videos and sentences. They were later asked to select the expressed emotion and make an immediate retrospective confidence judgment. Participants demonstrated both prospective and retrospective resolution accuracy on both tasks. Further, participants demonstrated prospective metacognitive consistency across tasks such that good prospective resolution was correlated across tasks.
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(3079)

Memory and Metamemory of Emotional Words Depend of Encoding? FLAVIEN THUAIRE and MARIE IZAUTE, *LAPSCO UMR-CNRS 6024; Blaise Pascal University,* ELISABETH BACON, *INSERM Unité 666; Strasbourg University*—Despite the emergence of new theories of embodied cognition, few researches has been conducted on metamemory for emotional materials. In this article, two experiments investigated metamemory monitoring (JOLs) and cued recall about words decribing emotions with manipulating either depth of encoding (EXP 1) or emotional congruence encoding (EXP 2). Results indicate that words describing positive emotional states are rated with higher JOLs and better recalled even after low encoding. Moreover, the inhibition of muscles associated with smiling canceled the benefit of emotionality at recall which resulted in lower accuracy of JOLs for positive words. These results are discussed in terms of the possible implication of embodiment processes in the use of cues for JOLs and in the relation between monitoring and control.
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• COGNITIVE AGING •

(3080)

A Low-Burden Tool for Measuring Memory Declines in Healthy Aging and Neurocognitive Impairment. CARLOS F. A. GOMES, C. J. BRAINERD and V. F. REYNA, *Cornell University*—We report preliminary results from a longitudinal study in which a simple modeling tool was used to measure individual differences in recollective and nonrecollective retrieval, with recall data. Ninety-two older adults first received a battery of neuropsychological tests and performed low-burden recall tasks (to measure recollective and nonrecollective retrieval). The model fit the recall data of individual subjects well, and its parameter estimates were reliable within individuals. Declining scores on the Mini-Mental State Exam, a classic marker of neurocognitive impairment, were predicted by declines in nonrecollective retrieval but not recollective retrieval. In contrast, comparisons of older adults to young adults revealed that normal age declines in recall were due to declines in recollective retrieval rather than nonrecollective retrieval. These results replicated findings from an independent sample and, importantly, they demonstrated that the modeling tool can be applied in clinical settings to predict later emergence of neurocognitive impairment in at-risk individuals.
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(3081)

Neural Patterns During Successful Memory Formation Across the Lifespan Using Multivariate Pattern Analysis. IAN M. MCDONOUGH, KRISTEN M. KENNEDY, KAREN M. RODRIGUE, ANDREW C. HEBRANK and DENISE C. PARK, *Center for Vital Longevity*—The present study characterized how the patterns of neural activity differed during memory formation across the adult lifespan. Multivariate pattern analysis was used to model the pattern of neural activity in young adults (aged 20-29). This young pattern was compared to activations associated with subsequent decades (30-70). Participants in the Dallas Lifespan Brain Study (N = 192) were scanned using fMRI while viewing scenes and later received a recognition test. Patterns of brain activity in the 20's sample were classified using subsequently remembered and forgotten trials via linear support vector machine. Results revealed decreases in classification accuracy with age, largely after age 60. Across all ages, better matches to the young pattern were associated with better memory discrimination. The data suggest that subtle differences in neural activity begin in middle age and that using a lifespan design increases our understanding of when and how cognitive aging progresses.
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(3082)

A Diffusion Model Account of Age Differences in Post–Error Slowing. GILLES DUTILH and BIRTE U. FORSTMANN, *University of Amsterdam,* JOACHIM VANDEKERCKHOVE, *Leuven University,* ERIC-JAN WAGENMAKERS, *University of Amsterdam* (Sponsored by Mark Steyvers)—People generally slow down after they make an error, a phenomenon that is more pronounced for elderly than for young participants. We examined the origin of this age–related difference in post–error slowing (PES) by applying the diffusion model to data from young and elderly participants performing a perceptual task (random dot motion) and a lexical decision task. Results show that PES effects on response time and accuracy were qualitatively different for young and elderly participants. Diffusion model analyses revealed that following an error, elderly participants became more cautious, processed information less effectively, and spent more time on irrelevant processes. This pattern was evident in both the perceptual task and the lexical decision task. For young participants, the origin of the PES effect depended on the task: in the perceptual task, the PES effect was due to time spent on irrelevant processes; in the lexical decision task, the PES effect was due to increased caution and decreased effectiveness in information processing. These findings indicate that PES originates from the interplay of different psychological processes whose contribution depends on both task settings and individual differences.
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(3083)

Proper Name Retrieval Across the Lifespan: The Impact of Semantic and Phonology Availability. MEREDITH A. SHAFTO, BILLI RANDALL and LORRAINE K. TYLER, *University of Cambridge*—Older adults often experience difficulty remembering names for familiar people, as revealed by increasing numbers of tip-of-the-tongue states (TOTs) for proper names. Although current models suggest that normal aging affects phonological and not semantic access, studies on proper name TOTs rarely directly relate TOTs to the fundamental phonological and semantic processes that underpin normal word production. In the current study, adults aged 18-80 performed a TOT-inducing task where they named pictures of famous people or indicated they were having a TOT. Results replicated previous findings of an age-related increase in TOTs. Participants also performed a picture-picture priming task in which we manipulated the phonological and semantic overlap between prime and target pictures. Individual differences in sensitivity to semantic and phonological priming were then tested as potential modulators of the relationship between age and TOTs. Results indicated a differential effect of phonological compared to semantic priming in modulating the relationship between age and TOTs. These findings are discussed in terms of competing models of TOTs and models of how normal ageing affects fundamental access to word form and meaning.
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(3084)

Feedback's Impact on Younger and Older Adults' Number Estimation Performance. BARBARA J. WRIGHT, LINDSEY CLEMENT, DANIELLE ATKINS, MIA PARK, KRISTA BOND, JODI PRICE and JEFFREY NEUSCHATZ, *University of Alabama in Huntsville*—Number estimation involves rapidly estimating the number of dots in a visual scene. Research suggests individuals overestimate as the number of random dots increases, but that clustering dots yields underestimation. We examined how frequency of feedback (on 0, 50, or 100% of acquisition trials) interacted with dot presentation format (random, clustered, or stacked) to influence the accuracy of younger and older adults' estimates and their confidence in their estimates across four acquisition and two retention blocks, each containing 48 trials. We expected frequent feedback and more structured presentations to enhance participants' accuracy and confidence. We tested 100 younger (age 18-25) and 97 older (age 60-85) adults and found that feedback enhanced accuracy for both age groups, but that younger adults were most accurate estimating stacked presentations and older adults random presentations, collapsing across blocks. Although feedback increased confidence for both age groups, younger adults were more confident than older adults.
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(3085)

How Retellings Shape Memory in Younger and Older Adults. SARAH J. BARBER and MARA MATHER, *University of Southern California*—The way a story is retold influences the way it is later remembered; after retelling an event in a biased manner people subsequently remember the event in line with their biased retelling. In the current research we examined whether this is especially true for older adults given that they tend to be more susceptible to memory interference effects. To test this, older and younger adults retold a story to be entertaining, to be accurate, or did not complete an initial retelling. Twenty minutes later, all participants recalled the story as accurately as possible. On this final recall test younger adults were unaffected by how they had previously retold the story. In contrast, older adults had higher final recall if they had previously retold the story to be accurate. Retellings thus exert a greater effect on quantitative memory performance in older, compared to younger, adults.
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(3086)

The Role of Agency and Emotion on Memory Retrieval: An Aging Perspective. LAUREN NUTILE, SHAINA GARRISON, ANNA B. DRUMMEY and IRENE P. KAN, *Villanova University*—Aging research suggests that as we get older, we tend to endorse emotionally positive memories, both when they are true and when they are erroneous (a pattern known as "positivity bias"). It has been argued that as we get older, we become motivated to maintain positive emotions, and this change in emotion regulation impacts other cognitive processes. Here, we investigated the role of agency and age in the positivity bias. If the positivity effect reflects motivation, then this effect should be most pronounced when

information is self-referential, where the incentive to enhance positive emotions is the highest. Subjects (ages 18-83) read short vignettes and performed a recognition test on story content. Each story contained positive, negative, and neutral events, and each passage was either self-referential or other-referential. Contrary to the motivational account, a negative bias for self-referential materials was observed across all ages. On the other hand, only the youngest group (ages 18-22) maintained this negative bias for other-referential materials. All other groups displayed a positive bias for other-referential information.
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(3087)

An Exploration of the Self-Reference Effect for Words and Narratives in Normal Aging. NICOLE CARSON, *York University,* KELLY J. MURPHY, *Baycrest Hospital,* MORRIS MOSCOVITCH, *University of Toronto,* R. SHAYNA ROSENBAUM, *York University*—The self-reference effect, enhanced memory for information encoded through self-related processing, has been established in healthy younger and older adults in studies examining memory for single word trait adjectives. Here we examined whether the self-reference effect generalizes to memory for narratives. Memory for stimuli encoded through deep processing (self-referential or semantic) or shallow processing (structural) was examined using a typical trait adjective paradigm and a novel narrative paradigm. Consistent with previous research younger adults performed better than older adults. Both groups showed a self-reference effect in the trait adjective paradigm ($p<.001$), with self-reference > semantic > structural encoding promoting recognition accuracy. Narrative information was also found to benefit from deep vs. shallow processing, though there was no difference between the self-referential and semantic conditions ($p<.001$). Results indicate that while memory for trait adjectives benefits from self-referential encoding, memory for narratives appears to more generally benefit from deep encoding strategies.
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(3088)

The Ability to Automatize Task Performance Is Lost in Old Age. FRANÇOIS MAQUESTIAUX, *Université Paris-Sud,* ANDRÉ DIDIERJEAN, *Université de Franche-Comté,* ERIC RUTHRUFF, *University of New Mexico,* GUILLAUME CHAVEL, *Université Paris-Sud,* ALAN HARTLEY, *Scripps College*—Can elderly adults automatize a new task? Ten older adults performed 10,080 training trials, spread over 12 sessions, on an easy but novel task. The psychological refractory period (PRP) procedure was then used to evaluate whether this highly practiced task, when presented as Task 2 along with an unpracticed Task 1, could proceed automatically. If automatic, Task-2 processing should bypass the bottleneck and produce little dual-task task interference. This is exactly what Maquestiaux et al. (2008) observed in a sample of younger adults using this paradigm but with half the amount of practice. Even though training reduced older adults' mean reaction times from 482 ms to 308 ms, this highly practiced task was nevertheless slowed by 485 ms when transferred as Task 2 in the PRP procedure. This large interference despite extensive practice on an easy task in elderly but not young adults indicates that task automatization is lost in old age.
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(3089)

The Subjective Value of Cognitive Effort: A Behavioral Economics Approach. JOHN A. WESTBROOK and TODD S. BRAVER, *Washington University in Saint Louis*—Behavioral economic paradigms have been developed to enable quantification of value discounting – the extent to which choice features, like delay, risk, and physical effort, make options subjectively less valuable than their objective worth. In this work, we exploit the discounting framework to provide a first-ever quantitative measure of the cost of cognitive effort. We show that effort costs increase with objective task demands (here, n-back n), declining performance, and self-reported difficulty. Moreover, we show significant individual variation in the cost of cognitive effort that correlates with well-established and related self-report measures (e.g., Need for Cognition). Additionally, older adults show steeper discounting of cognitive effort than younger adults, controlling for performance. Cognitive effort discounting provides a novel and quantitative measure of the subjective experience of cognitive effort, distinct from objective indicators (i.e., task demand, performance), thus serving as a potentially new tool for investigating the relationship between motivation and cognitive performance.
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(3090)

Aging and the Positivity Effect: What We Say vs. How We Say It. LISA A. VANWORMER and JONATHAN D. SOBER, *University of West Florida*—Although there are general cognitive declines as one ages, the ability to regulate emotion improves and emotional content becomes more salient (Carstensen & Charles, 1998).The positivity effect is a developmental shift seen in older adults toward more positive information and away from negative information in attention and memory. In this study, 18 younger and 18 older adults were presented auditorily with a factorial combination of semantically valenced (i.e., negative or positive) and prosodically valenced (i.e., high or low intonation) words. Recall performance showed a semantic positivity effect for older adults, and a prosody positivity effect for younger adults. Additionally, older adults showed a significant decrease in recall for semantically negative words said in an incongruent, prosodically positive tone. This suggests that both older and younger adults show a positivity effect, however older adults focus on what is being said and younger adults focus on how it is being said.
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(3091)

Aging and the Segmentation of Narrative Film. CHRISTOPHER A. KURBY, *Grand Valley State University,* LILLIAN K.E. ASIALA, *Northern Illinois University,* STEVEN R. MILLS, *Grand Valley State University*—The perception of event structure in continuous activity is important for

understanding and remembering experience. Although the segmentation of experience into events is a normal concomitant of perceptual processing, there are individual differences in how well this segmentation is accomplished. Previous research shows that younger adults tend to segment continuous naturalistic everyday activity, such as someone washing a car, better than older adults. This suggests an age-related impairment in the perception of event structure. However, past research has also shown that older adults have a preserved ability to comprehend events in narrative text, which suggests that narrative may improve the event processing of older adults. This study tested whether there are age-differences in event segmentation at the intersection of continuous activity and narrative: narrative film. In support of the possibility that narrative structure supports event understanding for older adults, we found minimal age-differences in segmentation performance.
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(3092)

Impact of a 12-Week Fitness Training Program on Associative Memory and Attentional Control Processes in Older Adults. ASHLEY S. BANGERT, SANDOR DORGO, REBECCA REED-JONES, NAZANIN HEYDARIAN, RACHEL MONTES and CHANDRA S. BULUSU, *University of Texas at El Paso*—Aging leads to declines in associative memory (Naveh-Benjamin, 2000) and increases in intra-individual variability (Hultsch, MacDonald & Dixon, 2002); the latter may index integrity of attentional control systems (Duchek et al., 2009). Increased fitness appears to benefit some cognitive functions in older adults (Colcombe & Kramer, 2003). Therefore, the current study explores the impact of fitness training on associative memory and attentional control in community-dwelling older adults. Participants (aged 60+) completed a 12-week fitness training intervention involving cardiovascular, strength, and flexibility exercises. Pre- and post- test fitness and cognitive assessments were administered. Significant fitness improvements were found. Participants also showed reduced intra-individual variability on attentional control tasks as well as improved accuracy in task conditions requiring suppression of irrelevant information. Improvements in associative memory accuracy and reaction time were found when participants had to verify intact associations. These results support the view that even a short-term fitness intervention leads to improvements in older adults' physical health and higher level cognitive functions.
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• SELECTIVE ATTENTION III •

(3093)

Attentional Capture With Emotional Images in a Matching Task. BRYAN DASILVA and PAUL HAERICH, *Loma Linda University*—We investigated the process of attentional capture by emotional (IAPS) images examining how capture impacts ongoing task processing. Subjects performed the letter matching task indicating when two letters matched based on physical (A, A), name, (A, a) or rule (A, e – both vowels) identity. On each trial the letters appeared on either side of an IAPS image which varied in valence and arousal. As expected, response times slowed across tasks from the physical to the categorical rule ($p < .001$, $\eta 2 = .79$). Arousing images interfered more with tasks than neutral images ($p = .001$, $\eta 2 = .46$) slowing responding similarly in each task. The results suggest that both pleasant and unpleasant images produced a consistent and additive interference in the matching task. The results are consistent with an interpretation that although affective identification may follow semantic identification, affective information is available prior to and may delay response selection.
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(3094)

Individual Differences in Attentional Capture: Is Attention Capture an Individual Trait? KIRK A. STOKES and KAREN M. ARNELL, *Brock University*—Do individuals differ reliably in how readily their attention is captured by an irrelevant item? To answer this question we employed an individual differences approach to examine the reliability and generalizability of attentional control processes in a variety of attention capture tasks performed in two experimental sessions separated by one to two weeks. The control of attention and ability to resist shifting attention towards an irrelevant stimulus is believed to be associated with working memory capacity and moderated by attentional settings for target-specific features. We observed that some measures of attentional capture remained stable over time whereas other measures did not. The relationships between these measures and their relationships with working memory capacity also varied. Results provide a cross section of the reliability and generalizability of recognized attention capture measures and are discussed in terms of the validity of treating attention capture as a trait-like individual differences variable.
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(3095)

Sex Differences in Attentional Capture. TOMOE INUKAI, *Kobe Shinwa Women's University,* JUN-ICHIRO KAWAHARA, *Chukyo University*—Target identification is impaired when temporal or spatial diversion of attentional focus occurs by a task-irrelevant item (attentional capture). The present study examined whether there are sex differences in the magnitude of attentional capture. Participants identified a target embedded among nontargets temporally ($N = 189$) or spatially ($N = 229$) while ignoring a singleton distractor. Robust attentional capture was obtained in temporal and spatial search tasks. Importantly, the magnitude of attentional capture deteriorated more for females than for men in the temporal task, suggesting that females are more sensitive to bottom-up signals than men. However, no such differences were obtained in the spatial task. The finding that the sex differences in attentional capture are limited to the temporal search task supports a notion that temporal and spatial attentional capture underlie different mechanisms (Kawahara & Kihara, 2010).
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(3096)

Attentional Biases for Smoking Cues in Smokers: Role of Gender and Individual Traits. CHIARA DELLA LIBERA, ANDREA PERLATO, ELISA SANTANDREA and LEONARDO CHELAZZI, *University of Verona*—Attentional deployment is often affected in addiction, so that drug-related stimuli attract attention automatically and gain control over behavior. For instance, chronic smokers show attentional biases for smoke-related cues, but the mechanisms underlying these effects and the nature of their link to addiction are still a matter of debate. We tested the temporal dynamics of attentional deployment in a group of young chronic smokers and replicated previous reports of altered patterns of deployment in relation to smoke-related items. Crucially, we also found a striking gender difference in performance at the group level: Only males exhibited a robust attentional bias for smoke-related items, while no such effect was found for females. Additionally, we found that different personality traits and smoking habits predicted the direction and strength of the measured bias. Overall, these results demonstrate a crucial influence of several factors on the biases of attention towards smoke-related items in smokers.
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(3097)

Attentional Control and Biomarkers for Alzheimer Disease in Non-Demented Older Adults: Sensitivity of a Stroop Switching Test. JONATHAN D. JACKSON, DAVID A. BALOTA, JANET M. DUCHEK, ANNE M. FAGAN and DAVID M. HOLTZMAN, *Washington University*—The Color-Word Interference Test (CWIT) is a recent variant of the classic Stroop task that introduces a switching component. Given the sensitivity of Stroop and Stroop-like paradigms to non-demented individuals at risk for developing Alzheimer disease (AD), the current study explored whether CWIT performance was associated with biomarkers (cerebrospinal fluid beta-amyloid 42, CSF Ab42, and CSF Tau) and genetic factors (Apolipoprotein e4, APOE4) that are implicated in AD. Non-demented older adults (n = 142) completed pure blocks of color-naming, word-reading, and word-color switch trials in an AABB switching format. APOE4 carriers committed more intrusions than non-e4 individuals. Lower accuracy on pure blocks and longer response latencies on switch blocks were associated with low CSF Ab42 levels. Intrusion rate was also significant over and above standard psychometric tests in distinguishing e4 from non-e4 subjects. The results demonstrate that the CWIT is sensitive to AD risk factors in non-demented older adults.
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(3098)

Assessing Interference Effects Across Modalities: Print-Based Versus Auditory Stroop Conflicts. EMILY M. ELLIOTT, *Louisiana State University,* CANDICE C. MOREY and RICHARD D. MOREY, *University of Groningen,* SHARON D. EAVES, *Shawnee State University,* JILL T. SHELTON, *Lee University,* DANIELLE A. LUTFI-PROCTOR, *Louisiana State University*—Selective attention processes underlying Stroop interference effects were assessed using four versions of the color-naming task. Stimuli in the auditory and visual modalities were contrasted to determine the mechanisms driving the interference effects. Behavioral analyses of reaction times (RT) were conducted, along with distributional RT analyses. The results suggested that auditory stimuli receive obligatory processing; however, this processing does not incur as great a cost as the color-naming of incongruent printed stimuli. In fact, the presence of auditory stimuli reduced the level of interference observed in the print-based Stroop effect, compared to the same effect with no auditory stimuli present. These findings supported similar underlying mechanisms, distractor interference (i.e., response competition) and goal neglect (i.e., error rates in the incongruent condition), in all four Stroop tasks, but the degree of goal neglect was minimized when printed words were not the sole source of the conflict.
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(3099)

The Effect of Attention Shifts: Should We Be Talking About 'Transient Vs. Sustained' Rather Than 'Involuntary Vs. Voluntary'? ROCCO CHIOU and ANINA N. RICH, *Macquarie University* (Sponsored by Matthew Finkbeiner)—In a series of recent studies, Prinzmetal et al. suggest that voluntary attention refines perceptual representation whereas involuntary attention enhances post-perceptual processes. Here we utilise a pitch-induced attention cuing effect to test the hypothesis of Prinzmetal et al. Previously we have demonstrated transient attention shifts caused by non-predictive pitch cues that nonetheless reflect voluntary attention as they can be overridden top-down control. We used the Posner cuing paradigm and manipulated the level of perceptual difficulty and predictability of auditory pitch cues. Our results show, despite the fact that both predictive and non-predictive pitch cuing reflect voluntary attention, they are modulated by perceptual difficulty in opposite directions: Predictive pitch (sustained attention) improves perception and has stronger impact when perceptual difficulty is high, whereas non-predictive pitch (transient attention) has no effect on perception and is more pronounced when perceptual difficulty is low (akin to involuntary attention). These results suggest that it is actually the distinction of 'transient vs. sustained', rather than 'involuntary vs. voluntary', that causes different attentional effect on performance.
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(3100)

Priming of Popout in a Go/No-Go Task. BRYAN R. BURNHAM and SUSANNAH P. BRUNO, *University of Scranton*—Intertrial facilitation effects are found throughout the literature. In particular, priming of popout is the finding that visual search is faster when the features of a singleton target and nontargets repeat across trials than switch across trials. Theoretical accounts suggest that intertrial repetition influences only perceptual and attentional selection processes, only episodic (response) retrieval processes, or both. This study combined a popout search task with a go/no-go task,

where the nontarget distractors carried the go/no-go feature. Results showed that the go/no-go task moderated the intertrial repetition effects. Specifically, interference from the preceding distractors was larger when the preceding trial was a no-go trial, suggesting the target color elicited retrieval of the preceding distractor color and no-go response. Also, go trials resulted in stronger target activation and bias to attend to same-colored distractors on the following trial. The results suggest that intertrial repetition influences both perceptual selection and response retrieval processes.
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(3101)

Exploring an Attentional Contribution to the Numerical Size Congruity Effect. EVAN F. RISKO, *Arizona State University,* ERIN MALONEY, *The University of Chicago,* JONATHAN FUGELSANG, *University of Waterloo*—Understanding the mechanisms supporting our comprehension of magnitude information represents an important goal in numerical cognition. One of the most commonly studied phenomena in the effort to understand how the brain processes magnitude information is the size congruity effect, namely, the observation that comparing the relative numerical size of two numbers is influenced by their relative physical size. The standard account of this size congruity effect attributes the effect to the automatic influence of the irrelevant physical magnitudes on numerical judgments. In the present investigation, we develop and test an alternative account of this effect based on the operation of attention in the typical size congruity display. We provide evidence that supports this alternative account. Implications for our understanding of magnitude are discussed.
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(3102)

Subitizing Requires Top-Down But Not Bottom-Up Control of Attention. TOMONARI SHIMOMURA, *Chukyo University,* TAKATSUNE KUMADA, *RIKEN Brain Science Institute*—We examined whether demand on spatial attention affects on subitizing, using a modified version of a multiple cueing task (Franconeri, Alvarez, and Enns, 2007). In the present study, cues indicated where the targets were never presented. In the target display, 500 ms after the cues disappeared, multiple objects were presented on cued and uncued locations. Participants' task was to enumerate objects presented only on uncued locations. The numbers of cued locations and to-be-enumerated objects (i.e., targets) were orthogonally varied across trials. In this task, participants were required to enumerate for targets at uncued locations while maintaining their spatial attention to cued locations. The result showed that subitizing for targets was disrupted when the number of cued locations was more than four. However, in the subsequent experiment, when the interval between cues and targets was removed so that the targets were presented over the cued objects, then subitizing remained intact irrespective of the number of cued locations. These results indicate that top-down, but not bottom-up control of attention, is involved in subitizing.
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(3103)

Is Endogenously Generated Inhibition Improbable? JASON G.S. IVANOFF and ASHLEY JOLLIE, *Saint Mary's University*—Nonpredictive peripheral cues attract exogenous attention and benefit target detection at short stimulus onset asynchronies (SOAs). At long SOAs, these cues elicit performance costs (i.e., inhibition of return; IOR). Predictive central cues, on the other hand, are not known to elicit IOR. Here we explore whether regions of space can be actively inhibited by a non-spatial, predictive, central cue. We used a predictive cueing paradigm wherein a central informative digit (from 1-12) indicated a location in space. When the central digit indicated where the target would most likely appear, responding to targets at those locations was faster than responding to targets at any of the other locations. In contrast, when the central digit indicated the location where the target would unlikely be presented, responses to targets at this "improbable" location were slower than responses to targets presented at any of the other locations. We discuss these results in the context of current taxonomies of attention.
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• DISCOURSE PROCESSES •

(3104)

Integrating Body and Speech in Conversational Contexts. ALEXANDRA E. PAXTON and RICK DALE, *University of California, Merced*—Research into the area of interpersonal alignment seeks to characterize how interacting individuals grow to have similar behavior and cognition over time. Numerous modes of communication have been studied in this context, from gesture to affect to speech patterns. However, this research is generally unimodal – studying how two individuals align over a single mode. We believe that the next step in interpersonal alignment research must seek to connect these individual data streams to create a picture of multimodal alignment. Using a simple but robust method of tracking body movement and speech during naturalistic conversation, we collected conversation data from dyads involved in affiliative and argumentative interactions. In this project, we analyze the links between body movement alignment and turn-taking dynamics in different conversation types. In this poster, we showcase the intimate temporal coordination between these channels as different conversational contexts unfold. We conclude that the timing patterns across channels will be an important element to future explorations of interpersonal interaction.
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(3105)

Mental Representations of Characters in Narratives: Managing Information From Text and Images. KRIS GUNAWAN, ADAM B. OSMAN, DAVID E. COPELAND and KATHLEEN G. LARSON, *University of Nevada, Las Vegas*—People construct and retain mental representations (e.g., situation models, Zwaan & Radvansky, 1998) of characters or protagonists from stories. However, people may often receive information about the characters from two different sources.

For example, it is possible to read descriptions of characters as well as see images of them. In the current study, participants read a series of narratives that included illustrations and they completed recognition tests to assess their memory of characters. We examined physical character traits (e.g., hair, physique, clothing) by manipulating text descriptions and pictorial depictions of characters, the consistency of text and pictures, and the order of presentation (i.e., primacy / recency). While the results supported a picture superiority effect (Shepard, 1967), there was evidence that people also relied on text descriptions. These findings suggest that people's situation models can consist of multiple, conflicting representations that can be used to reconstruct degraded information from a source.
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(3106)

Knowledge Revision: Teasing Apart the Refutation Text Effect. PANAYIOTA KENDEOU, *Neapolis University Pafos,* ERINN WALSH, EMILY SMITH and EDWARD J. O'BRIEN, *University of New Hampshire*—In three experiments we investigated the textual factors that support individual belief revision in the context of refutation texts. Refutation texts are designed to persuade students to change their commonsense beliefs through direct contradiction of that belief and a presentation of the scientifically correct belief. In Experiment 1, we demonstrated that providing a refutation that explicitly negated a commonsense belief was sufficient to significantly reduce disruption when reading a correct outcome sentence. In Experiment 2, the addition of an explanation attenuated the impact of the refutation and disruption was reduced even further. Finally, in Experiment 3 the explanation alone was as effective as the refutation with the explanation in supporting belief revision. These findings highlight the essential textual 'ingredients' for the initial stages of belief revision and have direct implications for theories of reading comprehension and conceptual change learning.
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(3107)

Coherence Maintenance With Readers of Differing Proficiency Levels. VIRGINIA E. CLINTON, *University of Wisconsin, Madison,* BEN SEIPEL, *California State University, Chico*—Successful reading comprehension requires the maintenance of coherence at local and global levels. In a reading time experiment and ERP experiment, undergraduate students read texts with and without inconsistencies at local and global levels. Reading-time data indicated that proficient and less-proficient readers had similar patterns of slow-downs when reading locally and globally inconsistent texts. In contrast, ERP data indicated that less-proficient readers (N = 25) had increased negativity in the N100 and the P600 with locally consistent texts compared to locally inconsistent texts ($p = .02$; $p = .02$, respectively). For proficient readers (N = 25), there were no differences in ERPs between consistent and inconsistent texts, either global or local. Therefore, there may be subtle differences in text comprehension processing between readers of different proficiency levels that can be illuminated with ERP analysis, but are not apparent in reading-time data.
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(3108)

Understanding the Relationship Between Comprehension Processes and Task-Oriented Reading. KARYN HIGGS and JOSEPH P. MAGLIANO, *Northern Illinois University,* EDUARDO VIDAL-ABARCA, *University of Valencia,* DANIELLE MCNAMARA, *Arizona State University*—Reading in academic context almost always is grounded in some task Presumably, this task affects how readers approach reading, but certainly how readers approach the task may be related to how successfully readers are able to comprehend what they read. How succefully readers are at task-oriented reading likely involves an interaction betweeen aspects of the reader and the task (i.e., aspects that make it more or less difficult. The goal of this study was to explore the relationship between comprehension processes, how reader search and use a text, and features of task difficulty on performance. Read&Answer provided assessments of how students initially read and then search a text in order to answer questions. The task involved answering short asnwer questions on under conditions in which the text was available during questions or when the text was not available. Task difficulty was measured by determining the number of parts of the text required ot answer the questions and the distance between those part. Using hierarchical linear modeling, this study showed that dimensions of the reader and task difficulty both affect peformance, and interact in the context of task-oriented reading.
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(3109)

Sense-Making Can Impede Recall. CHARLOTTE A. ZEAMER and JEAN E. FOX TREE, *University of California, Santa Cruz*—Despite claims that humor and positive affect improve creative thinking and learning, there has been little empirical exploration of the role of laughter on attention and memory. In support of claims that positive affect improves learning, we found that in the laughter conditions, the greater the appeal of the lecturer to a listener, the more the listener recalled. However, we also found that incongruous laughter interfered with recall of lecture content. A short spoken lecture was played to participants. In three experiments, the effects of auditory distractors, both naturally occurring and overlaid sounds, were tested. Participants were tested on recall of the details of the lecture itself (verbatim phrases and gist) and were asked about their opinion of the lecturer. Added noise incongruous to a lecture setting resulted in impaired recall, as did added laughter perceived to be excessive and unnatural. Naturally occurring laughter and non-human or meaningless sounds did not produce this negative effect. Our findings suggest that social noise or other auditory input difficult to understand in context draws attentional and cognitive resources away from a target speech stream during a listening task, impairing recall.
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(3110)

Individual Differences in Validation Processing During Reading. MURRAY SINGER and JEFFREY C. DOERING, *University of Manitoba*—Upon encountering a text sequence such as "Ken gobbled some apples on the way to practice. . The coach determined that it was oranges that Ken ate," full understanding requires noticing the apples-oranges discrepancy. Evidence that reading time of the "coach" sentence is regulated by its congruence and polarity (affirmative-negative) indicates that readers continually validate text ideas (Singer, 2006, JML). This study assessed the contribution to validation processing of people's reading span and their predisposition to access relevant antecedent text ideas and general knowledge. On the assumption that relating the two crucial sentences is supported by passive retrieval processes, it was predicted that Access but not Reading Span would interact with congruence and polarity. The data supported this prediction, suggesting that high-access readers exhibit greater sensitivity to subtle pragmatic characteristics of text than low-access readers.
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(3111)

Memory for Cognitive and Emotional Content From Subtitled Films. RICHARD J. HARRIS, RACHEL N. PEOPLES, KATHERINE PHELAN and NATHALIA COELLO, *Kansas State University*—To examine how emotion and information are conveyed by sound, subtitles, and pictorial content in film, participants watched a film clip from either 1) the emotionally reserved Jane Austen costume drama Sense and Sensibility or 2) the wacky farcical comedy Overboard, under one of six conditions systematically varying the language of the soundtrack (English, Portuguese, or none) and subtitles (English or none). On a subsequent memory task rating the truth of the information and the emotional states of the characters in the clip, native-English-speaking participants better remembered both information and emotion when the soundtrack or subtitles were in English, and especially so if both were. Some interesting differences between the emotion and information content were observed, as well as differences in the movies. There were no effects of prior participant mood (as measured by PANAS) on the emotion memory.
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• LANGUAGE PRODUCTION/WRITING •

(3112)

Ingesting Caffeine Does Not Impact Phonological Priming Effects on Word Retrieval. LORI E. JAMES, LILLIAN SPRAGUE, AUSTIN BOWMAN and ELIZABETH CRANDALL and SHALYN OBERLE, *University of Colorado at Colorado Springs*—Lesk and Womble (2004) reported that participants given caffeine had increased correct responses and decreased tip-of-the-tongue states (TOTs) following phonological priming on a word retrieval task, but that participants who were given a placebo had no change in correct responses and an increase in TOTs following priming. We attempted to replicate their findings by randomly assigning participants to a caffeine condition (water containing 200 mg of caffeine) or a no caffeine condition (regular bottled water). They had 20 minutes to consume the water, and then were asked 66 questions with low-frequency target answers. Each question was preceded by 10 words: 5 of the 10 words were phonologically related to the target for the primed trials, and all 10 words were phonologically unrelated to the targetfor the unprimed trials. Participants responded to each question with "TOT," "Don't Know," or the answer to the question, and we measured the number of correct responses and number of TOTs. There were no main effects of caffeine condition on either measure, and no interactions of caffeine with priming condition. Further research is needed to clarify the reasons for differences between the current findings and those of Lesk and Womble.
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(3113)

Semantic and Phonological Distractors Influence Production of Proper Names. DANIELLE K. DAVIS and LISE ABRAMS, *University of Florida*—Research on object names using the picture-word interference paradigm has illustrated that pairing a distractor word with a to-be-named target picture influences production. Semantically related distractors typically slow production of the target, while phonologically related distractors facilitate production. We utilized a picture-word interference task to investigate production of proper names. Target pictures of celebrities (e.g., Joe Biden) were presented simultaneously with a semantic distractor (Ron Paul), a phonological distractor (Joe Paterno), a semantic and phonological distractor (Joe Lieberman), or an unrelated distractor (Dan Aykroyd). Semantic distractors shared at least the same profession (both Biden and Paul are politicians), whereas phonological distractors shared at least the first syllable of either first or last name. Participants' target naming times and accuracy were recorded. Results showed that producing famous names was influenced by distractor type. These findings will be discussed in terms of stages of speech production at which distractors exert their influence on proper name retrieval.
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(3114)

The Production of "Hotdog" is not the Production of "Hot" and then "Dog". CASSANDRA L. JACOBS and GARY S. DELL, *University of Illinois at Urbana-Champaign*—Do we say "dog" when we say "hotdog"? Certain research suggests the production of "hotdog" entails the production of "dog" because the frequency of "dog" matters, in addition to the frequency of the entire compound. In four experiments using the implicit priming paradigm, we assessed whether nominal compounds composed of two free morphemes like "tablecloth" or "fishbowl" are prepared for production at the segmental level in the same way that two-syllable monomorphemic words are (e.g. "napkin") or instead as sequences of separable words (e.g. "full bowl" or "soiled cloth". The results of these experiments support the idea that nominal compounds are planned in the same way as monomorphemic words, regardless of the number of component morphemes, and not like sequences

of multiple words, which may be planned separately. We conclude that there is a "dog" in "hotdog" at a morphemic level, but not when segments are sequenced for production.
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(3116)

Cumulative Semantic Interference Persists Even in Highly Constraining Sentences. DANIEL KLEINMAN, *University of California, San Diego,* ELIN RUNNQVIST, *Universitat de Barcelona,* VICTOR S. FERREIRA, *University of California, San Diego*—Speakers name pictures (e.g., cow) more slowly when they have previously named other (and more) members of the same semantic category (horse, pig). However, words in natural speech are typically produced in richer semantic contexts. Does this cumulative semantic interference effect (CSIE) persist even when pictures are presented in such contexts? In three experiments, subjects named pictures that were either presented in isolation or preceded by a high-cloze sentence with the final word omitted ("On the class field trip, the students got to milk a ___"). Although a sentence context sped naming latencies by 214 ms, naming cow slowed the subsequent naming of horse by the same amount regardless of whether cow or horse were named in isolation or after a sentence. These results bolster claims that the CSIE characterizes natural word production. Furthermore, they potentially shed light on the nature of cloze, suggesting that high-cloze sentences increase target activation while leaving competitor activation unchanged.
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(3117)

Does Variability in Production Disrupt Perceptual Learning? MELISSA M. BAESE-BERK, *Basque Center on Cognition, Brain and Language*—The relationship between speech perception and production is complex. For example, two recent studies (Leach & Samuel, 2007; Baese-Berk 2010) have demonstrated that when participants are trained in both perceptual and production, perceptual learning is disrupted. The current study examines the source of this disruption. Participants were trained on a novel phonological category in a paradigm that used both perceptual and production exposures, and tested on discrimination and repetition. Based on performance on the discrimination post-test, participants were categorized as either learners or non-learners. Preliminary evidence suggests that while overall production accuracy during training does not differ between learners and non-learners, the two groups do differ in terms of the variability of their productions during training. Specifically, participants are who are more variable in their productions during training do not learn to perceive the new contrast, regardless of their average production accuracy.
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(3118)

Persistent Semantic Interference in Picture Naming: Tests of an Incremental Learning Account. GARY M. OPPENHEIM, *University of California, San Diego* (Sponsored by Vic Ferreira)—Cumulative semantic interference (CSI) in speech production is thought to reflect incremental learning, but previous studies have largely concluded that its effects must dissipate in less time than it takes to boil an egg. The first experiment uses a continuous picture-naming paradigm to consider the persistence of CSI and its possible decay as a set of planned contrasts. Participants first named 24 pictures from 8 semantic categories, in six large cycles. An hour later they named 12 novel pictures from previously encountered categories, and 12 from novel categories; the pictures from novel categories were named faster, showing that interference persisted across the delay. Then they named 12 novel pictures from categories encountered an hour before, and 12 from categories encountered immediately before; results suggest that CSI is not affected by time-based decay. A second experiment considers further predictions of the incremental learning account for CSI in the blocked-cyclic naming paradigm.
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(3119)

Emotion Moderates Phonological Facilitation in Picture-Word Interference. KATHERINE K. WHITE, LAUREN R. LABAT and ANNE M. RHYNES, *Rhodes College,* LISE ABRAMS, *University of Florida*—This research investigated the role of emotional valence in speech production using a picture-word interference task. Participants named target pictures superimposed with distractor words whose valences were taboo, negative, positive, or neutral. Distractor words were either phonologically related or unrelated to the target picture. Neutral filler pictures were presented after every target to investigate potential carryover effects from emotional trials. Picture naming times were slowest when target pictures were accompanied by taboo words relative to all other distractors, and this slowdown in the presence of taboo words persisted when naming the subsequent filler picture. Distractor valence also interacted with phonological relatedness, where target pictures were named faster when accompanied by phonological compared to unrelated distractors, and phonological facilitation was largest when distractors were taboo words. These findings suggest that strong emotional words have immediate and persistent effects on speech production and that emotion can also specifically influence the phonological encoding stage.
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(3120)

Speeded Past Tense Verb Generation: An Ironic Effect of Consistency. EMILY R. COHEN-SHIKORA, *Washington University in St. Louis,* ELIZABETH R. SCHOTTER, *University of California, San Diego,* DAVID A. BALOTA, *Washington University in St. Louis,* MELVIN J. YAP, *National University of Singapore*—Although visual word recognition studies rely on response latency as the main dependent variable for understanding the quasi-regular domain of spelling-to-sound mapping, there has been relatively little work investigating the influence of variables on response latency in the quasi-regular domain of past tense verb generation in English. We present evidence from two experiments and a megastudy examining the influence of frequency, regularity, and consistency (among

other control variables) on the speeded production of the past tense from the present tense form of verbs. Results indicate that consistency effects are reliably smaller for verbs that follow the rule based form of the past tense (i.e., add "-ed") than verbs that do not follow the rule. Discussion focuses on the possible special status of past tense forms of verbs during early verb acquisition.
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(3121)

What Counts in Grammatical Number Agreement? LAUREL E. BREHM and KATHRYN BOCK, *University of Illinois at Urbana-Champaign*—Notional and grammatical number both affect agreement during language production. To explore this, we investigated how semantic integration, a type of conceptual relatedness, produces variations in agreement (Solomon & Pearlmutter, 2004). These variations are open to competing notional and lexical-grammatical number accounts. The notional hypothesis is that changes in number agreement reflect differences in referential coherence: More coherence yields more singularity. The lexical-grammatical hypothesis is that changes in agreement arise from competition between nouns differing in grammatical number: More competition yields more plurality. These hypotheses make opposing predictions about semantic integration. On the notional hypothesis, semantic integration promotes singular agreement. On the lexical-grammatical hypothesis, semantic integration promotes plural agreement. We tested these hypotheses with agreement elicitation tasks in two experiments. Both experiments supported the notional hypothesis, with semantic integration creating faster and more frequent singular agreement. This implies that referential coherence mediates the effect of semantic integration on number agreement.
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(3122)

The Role of Phonological Syllable and Orthographic Syllable (BOSS) in English Handwritten Word Production. JENN-YEU CHEN, *National Taiwan Normal University,* MARCUS TAFT, *University of New South Wales*—The architecture and mechanism of a processing system must be constrained by the kind of input and output it is designed to receive and to produce. In the domain of word processing, how the word recognition system processes a word is constrained by whether a spoken word or a visual word is to be recognized. Likewise, how the word production system processes a word is also constrained by whether a word is to be spoken or to be written. We tested the Output Constraint Hypothesis by examining the kind of syllable that might affect the preparation effect in a form preparation task. The phonological syllable (SYLL) and the orthographic syllable (BOSS) of a target word were manipulated factorially, and the task involved spoken and written word production. Results show that both SYLL and BOSS modulated the segment preparation effect during written word production and there was no interaction between them. The results confirm the validity of BOSS and support the Output Constraint Hypothesis.
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(3123)

Global and Local Probabilities in Cumulative Structural Priming. TIMOTHY J. KUTTA and MICHAEL P. KASCHAK, *Florida State University*—We examined cumulative structural priming effects. Experiment 1 presented participants with blocks of trials where they were induced to produce the double object (DO) or prepositional object (PO) construction, and blocks on which they could produce either construction. The cumulative odds of producing the DO construction was a significant predictor of the subsequent odds of producing a DO construction, but the current run of productions (i.e., whether the participant has just produced a DO series of DO or PO constructions) and the construction produced on the preceding trial were not. Experiment 2 examined similar effects in language users who have different long-run probabilities of producing DO and PO construction – American speakers from Experiment 1 have a bias toward the DO, but the British speakers in Experiment 2 are biased toward the PO. In spite of these differences in long-run probabilities, Experiment 2 produced results similar to what we observed from speakers of American English.
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• JUDGMENT AND DECISION MAKING II •

(3124)

Evidence for Parallel Coactivation With Double and Triple Redundant Targets. DENIS COUSINEAU and BRADLEY HARDING, *Université d'Ottawa,* SONJA ENGMANN, *Université de Montréal,* ZACKARIA MESTARI, *Université d'Ottawa*—Coactivation is a model invoked to explain the improvement in performance (faster response time with similar amount of errors) when targets defined by redundant attributes are presented to observers. This model posits the existence of detectors for the individual attributes but, contrary to the statistical facilitation model, further assumes that the detectors' activations are pooled so that perception of a target composed of redundant attributes is improved more in the latter model than in the former. Evidence for coactivation model is sadly always by default: when performances are too fast to be accounted for by the statistical facilitation model, it is considered evidence in favor of a coactivation model. Here, we will show that only a certain version of the coactivation model can account for the result, the parallel coactivation model. This model predicts flat coefficient of change in standard deviation and accounts for the whole response time distribution (its mean, standard deviation, and skew) found in the results of the experiment.
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(3125)

Examining the Effect of Payoffs on Detecting Multiple Targets. CHENG-TA YANG and YUAN HU, *National Cheng Kung University*—A redundant-target detection task has been widely used to study how the decision process is completed when detecting signals from spatially independent channels. However, it is still unclear whether the decision process is affected by the top-down factors, i.e., payoffs, which can affect the perceived relative salience between signals. In the present study, participants had to detect whether there was a signal on the right or left side (single-target condition) or on both sides of the screen (redundant-target condition). In addition, the payoff matrix was manipulated. Results showed that no matter when an unbiased or a biased payoff matrix was applied, parallel self-terminating processing with unlimited-capacity processing was adopted to detect redundant targets. The manipulation of payoffs only affected the allocation of attentional weight, which in turns affected the processing speed on different channels. Relative saliency does not affect the processing structure when signals are from spatially independent channels.
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(3126)

On the Difference Between Monkeys' and Humans' Response Times: Could It Be the Experimental Procedure? GUY E. HAWKINS, *The University of Newcastle,* BIRTE U. FORSTMANN and ERIC-JAN WAGENMAKERS, *University of Amsterdam,* *SCOTT D. BROWN, *The University of Newcastle*—In order to understand the neural processes underlying decision behaviour in humans, we study the neurophysiological correlates of decision processes in non-human primates. Like all animal models of human processes, this requires the assumption that monkeys are qualitatively similar to humans, for the processes under investigation. However, response time distributions from monkeys are less skewed than those from humans, a finding with strong implications for theoretical models of choice. We examined in humans two potential procedural explanations for this cross-species difference: delayed feedback and extensive task practice. Both procedures have been used in decision-making research with monkeys, but are almost never used in corresponding experiments with humans. In both cases, when we implemented the experimental procedures utilized in monkey research in humans, the human response time distributions changed in a manner consistent with response time distributions from monkeys. We conclude that differences in response time distributions between monkeys and humans may not be solely due to qualitative cross-species differences, but might be partially explained by differences in experimental procedure.
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(3127)

Examining Strategy Use and Differential Levels of Dual-Task Pressure. ROY E. ACUFF, ANA M. FRANCO-WATKINS and JOSEPH G. JOHNSON, *Auburn University*—Many everyday decisions involve competition for attentional resources, such as attempting to complete two tasks concurrently. We investigated the how differential levels of dual-task pressure affected simple (lexicographic) and complex (weighted additive) strategies during a probabilistic inference task. This task was completed concurrently with a random generation task where participants generated random numbers at different rates (i.e., 1.0, 1.5 and 2.0 seconds). Eye-tracking and response data provided converging evidence regarding complex versus simple strategy use during dual-task pressures. Participants in the increasing pressure condition were able to utilize more complex strategies whereas those in the decreasing pressure condition were more likely to rely on simple strategies during the inference task. These findings demonstrate the importance of the effects of differential dual-task pressure and strategy use.
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(3128)

How Dependencies Between the Consequences of Options Influence People's Preferences? SANDRA M. ANDRASZEWICZ, BENJAMIN SCHEIBEHENNE and JÖRG RIESKAMP, *University of Basel*—Standard economic theory of decision making assumes that people evaluate options independently of each other. However, more recent cognitive models, such as decision field theory (DFT, Busemeyer & Townsend, 1993), regret theory (Loomes & Sugden, 1982), or the similarity model (Leland 1994, 1998), suggest that people compare options' consequences with each other for making a decision. To investigate this assumption we conducted an experiment in which the option's consequences were dependent on the outcome of an external event and therefore covaried with each other. According to the DFT, larger covariance should lead to increased choice probabilities. We experimentally tested this prediction by letting people choose between binary gambles with fixed difference in expected values ($\Delta EV=15$) but with different covariance structures. As predicted, the observed choice probabilities were substantially influenced by the covariance structure as predicted by DFT. The results show that the interdependent evaluation of choice options represents a fundamental cognitive mechanisms underlying human decision making.
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(3129)

Executive Control, Reward Salience, and Impulsivity in Reward-Based Decision Making. ERIC G. FREEDMAN, JULIE BROADBENT, RANDY GENGLER and KAYLA LYLE, *University of Michigan, Flint* —The present study investigated the effects of decision time, explicit or implicit goals, and

impulsivity (based on the BIS-11) on Iowa Gambling Task (IGT) performance. The IGT required deciding between advantageous (low immediate gains/better long term gains) and disadvantageous (higher immediate gains/larger long-term losses) choices. Unlimited decision time (UDT) with explicit goals resulted in relatively longer decision times during the initial blocks. When participants received explicit goals with UDT, there was a relatively greater increase in the number of advantageous choices with succeeding blocks. This UDT and explicit goals combination produced comparatively greater improvement for low impulsives as well as when gains for disadvantageous choices were smaller. High impulsivity was associated with fewer advantageous choices. Consistent with our prior results, explicit goals and UDT enables deployment of the executive control processes during the initial trials needed to form associations between choices and outcomes essential for making future advantageous decisions.
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(3130)

The Five-Factor Model as Predictor of Decision Making. DARCI VANDYKE and THOMAS V. PETROS, *University of North Dakota*—Prior research on personality and decision-making has failed to use adequate measurement of both constructs. The current research extended the literature by incorporating multiple measures of decision-making as well as the NEO-PI-3, a psychometrically sound measure of the five-factor model of personality. Five measures of decision-making that addressed various aspects of adequate decision-making were used. The current research also included a measure of cognitive ability (WAIS-IV Vocabulary) as previous research had noted a strong correlation between cognitive ability and decision-making. Results indicated that cognitive ability significantly predicted performance on three decision-making tasks. In regard to personality, Agreeableness was the only personality trait found to be a significant predictor of any decision-making tasks.
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(3131)

When Rationality and Fairness Conflict: The Role of Cognitive-Control in the Ultimatum-Game. ELIRAN HALALI, YOELLA BEREBY-MEYER and NACHSHON MEIRAN, *Ben-Gurion University of the Negev*—In the ultimatum game the responder faces a conflict between accepting every offer, thereby maximizing self-interest, and rejecting low offers because of fairness and reciprocity concerns. We use two independent behavioral measures to decide whether the preference for reciprocity is a deliberative cognitive-controlled act or is an automatic act. In Experiment 1, participants with depleted cognitive-control resources rejected more unfair offers compared to control participants. This effect was absent for fair offers, indicating that resource-depletion makes people more sensitive to unfairness rather than making them prone to reject offers in general. In Experiment 2, we asses participant's Individual-Rejection-Threshold (IRT) and found that it took longer to accept than to reject unfair offers around the IRT. This effect remained significant while controlling for a distance effect around the IRT. These results suggest that fairness considerations operate automatically, and that rational considerations depend on the availability of cognitive-control resources.
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(3132)

Training Away Anchoring in a Weighted Centroid Judgment Task. SHAW L. KETELS, ALICE F. HEALY, CHRISTOPHER D. WICKENS, CAROLYN J. BUCK-GENGLER and LYLE E. BOURNE, JR., *University of Colorado at Boulder*—In information integration tasks, anchoring is a prominent heuristic, such that the first few arriving information sources (cues) tend to be given greater weight on the final integration product than those cues following. Such a bias may be particularly problematic when the situation is dynamic, such that earlier arriving cues are more likely to have changed, and hence are less reliable for the final integration judgment. Such is often the case in military intelligence, when enemy intentions are inferred from multiple sources. We describe results of a simulation of such intelligence gathering in which anchoring is prominently manifest, in the processing of seven sequentially delivered cues bearing on enemy threat. In Experiment 1 an anchoring bias was present. In Experiment 2 a simple "debiasing" wording, inserted in the instructions and emphasizing the age of intelligence information, induced more optimal weighting of the most recent cues, but did not eliminate anchoring.
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(3133)

The Matchmaker Task: Sensitively Measuring Confirmation Bias. ROBERT C. MATHEWS and PATRICK C. LEDET, *Louisiana State University*—Confirmation bias has been blamed for a variety of decision-making errors including the prosecution of innocent suspects and missed medical diagnoses. We developed the Matchmaker task to manipulate and sensitively evaluate this bias. The task involves learning the preferences of two different bachelors. On each trial, participants see features of a potential date, decide which bachelor would prefer this person, and receive feedback. One feature (hair color) probabilistically predicted the correct match for each bachelor and all other factors were irrelevant. Bias was introduced in one condition by showing examples of previous dates where an irrelevant feature was confounded with the critical feature. Compared to controls, the bias group continued to make decisions based on this irrelevant feature despite feedback. The task also allowed us to see individual differences in features used to make decisions. This sensitivity makes it ideal for studying the development and elimination of biases.
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(3134)

A Text Corpus Analysis Approach to the Conjunction Fallacy. KUNINORI NAKAMURA, *Seijo University,* YUICHIRO WAJIMA, *University of Tokyo,* ASUKA TERAI, KIMIHIKO YAMAGISHI and NASANORI NAKAGAWA, *Tokyo Institute of Technology*—This study aims to explain the conjunction fallacy (Tversky & Kahneman, 1983) in terms of degree of confirmation (Crupi, Tentori, & Gonzalez, 2007) by employing corpus data analysis. To accomplish this, we calculated indexes of the degrees of confirmation from the British National Corpus and fitted them to data of the previous study (Shafir et al., 1990). The results show that a major index of the degree of confirmation (Crupi et al., 2007) can significantly predict the conjunction fallacy, indicating a relationship between the conjunction fallacy and degree of confirmation as well as the importance of corpus data to explain biases in judgment.
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(3135)

Tendency to Make Absolute Inference From Numbers With Approximate Meanings. XINGYU PAN, PRITI SHAH and KEVIN MILLER, *University of Michigan*—In current study, we explored how people use numerical information in their decision making, more specifically, their tendency to make absolute inference from absolute numbers, be it an approximate reference point or a small difference between two measurements. One hundred and sixty participants were recruited through Amazon Mechanical Turk. They were firstly asked to judge the difference between two choices across educational achievements, health and fitness, arts, and athletic settings. Afterwards, they need to judge how much deviance from a reference point can be tolerated (e.g. time interval between taking two pills, cooking time in a recipe). In the end, participants need to allocate study time for GRE test among different subjects, as well as allocate investments towards different emergency room improvement plans. Results suggested variability of individuals' tendency to infer meaningful and substantial difference between two choices with slightly different numerical values. Moreover, individuals who perceived more difference between two choices are also stricter with the reference points, and are more likely to allocate much greater resources towards a choice with slightly higher numerical values.
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• TIMING AND SEQUENCING •

(3136)

Summary Statistics Computed Across Time are Restricted to a 600-msec Window. MOUNA ATTARHA, SHAUN P. VECERA and CATHLEEN M. MOORE, *University of Iowa*—The visual system can extract a representation of average size across items that change over time (Albrecht & Scholl, 2010). Unlike averaging processes that occur over space (e.g., Chong & Treisman, 2005), the range across which temporal averaging occurs may be restricted by memory limitations. Subjects saw a movie of a disk that changed size smoothly at different rates. Critically, the movie varied in length; a 1,200-msec movie was divided into six 200-msec segments, and trials differed with respect to the number of segments presented. Subjects reported the disk's average size after each trial. Replicating Albrecht and Scholl, the rate of change was integrated into reports of the continuous average. However, reports were unaffected by information that occurred more than 600 msec prior to report. This suggests that statistical regularities may be extracted across a temporally limited window.
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(3137)

Could Your Equipment Account For Your Experimental Effect? RICHARD R. PLANT, *The Black Box ToolKit Ltd, UK,* GARRY C. TURNER, *University of York*—Widespread use of modern technologies has left many assuming they no longer need be concerned with the intricacies of millisecond presentation, synchronisation and response timing. However, through empirical investigation, we have discovered numerous sources of timing error within live studies (e.g. Plant et al, 2009). Timing errors can have many causes and are not wholly predictable as to what may, or may not, affect timing within certain types of paradigm. To more practically aid the researcher, we have developed a method for benchmarking timing in the majority of paradigms whilst running in-situ and without modification on the researchers own hardware. In this paper we outline our methodology, stress the importance of such independent validation for Psychology as a whole, and highlight typical areas that can be subject to error. Case studies from the fields of vision, judgment and decision making and space research are presented.
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(3138)

A Choose-Short Effect in the Absence of Retrospective Coding in Pigeons. DOUGLAS S. GRANT, *University of Alberta*—Pigeons were trained on a matching-to-duration task involving a short (2.5 and 5 s) and long (5 and 10 s) set of durations. Pecking one spatial position was reinforced if the sample was the shorter in either set and pecking the alternate position was reinforced if the sample was the longer in either set. The color projected on the center key (red or green) during sample presentation and on the side keys during testing signaled whether the sample was from the short or long set. Retention testing revealed a robust choose-short effect with both sets of samples. In further testing, noninformative yellow was presented during either the sample or test phase. Accuracy on 5-s sample trials was reduced markedly when yellow was presented during the sample phase, but was little affected when yellow was presented during the test phase. This result suggests that the durations were not coded retrospectively.
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• COGNITION AND EMOTION •

(3139)

Musical and Nonmusical Sounds Evoke Different Patterns of Neural Activity: An fMRI Study. REBECCA J. LEPPING, *University of Kansas; University of Kansas Medical Center,* RUTH A. ATCHLEY, *University of Kansas,* LAURA E. MARTIN and WILLIAM M. BROOKS, *University of Kansas Medical Center,* ALICIA A. CLAIR and RICK E. INGRAM, *University of Kansas,* CARY R. SAVAGE, *University of Kansas Medical Center*—Emotional music and sounds have been shown to evoke different physiological responses, suggesting that processing music is different from processing everyday sounds. The current study used functional magnetic resonance imaging (fMRI) to investigate neural processing of musical and nonmusical sounds. Participants identified the emotional quality of the sounds during scanning. When compared, nonmusical sounds activated thalamus, dorsolateral prefrontal cortex, and primary auditory cortex – brain regions involved in problem solving and linguistic processing – to a greater extent than music. Conversely, music activated regions involved in emotional decision-making and conflict resolution, including cingulate, insula, motor cortex, and precuneus more than sounds. Current theories hypothesize that the emotional power of music lies in its ambiguity, allowing individuals to derive idiosyncratic meaning. Results suggest that decisions about emotionality in music may involve brain regions supporting processing of feeling, while similar decisions about sounds may rely more on regions involved in linguistic representation.
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(3140)

The Ability to Perceive Emotions in Infants' Vocalizations is Linked to the Ability to Perceive Timbres of Musical Instruments. CASADY D. BOWMAN and TAKASHI YAMAUCHI, *Texas A&M University*—Acoustic features of sound such as timbre are related to emotion in regard to sound. This study shows that people's ability to perceive emotions in infants' vocalizations is linked to the ability to perceive timbres of musical instruments. In two experiments, 360 "synthetic sounds" were created by rearranging spectral frequencies of cooing, babbling, crying, and laughing as well as those of 10 musical instruments: flute, clarinet, alto-saxophone, trumpet, French horn, tuba, guitar, piano, violin, and bell. Participants (N=521) listened to each sound and rated the emotional quality of the "synthetic sounds." Results suggest that five acoustic components of musical timbre (e.g., roll off, mel-frequency cepstral coefficient, attack time and attack slope) could account for nearly 50% of the variation of the emotion ratings made by students, suggesting that the same mental processes are probably applied for the perception of musical timbres and that of infants' prelinguistic vocalization.
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(3141)

Tracking the Neural Representation of Context and Emotion During Reminiscence of Real-World Experiences. TROY A. SMITH, WILLIAM A. CUNNINGHAM, SIMON DENNIS and PER B. SEDERBERG, *The Ohio State University*—To examine how context and emotion are represented in the brain, we used a novel experimental design combining experience sampling and fMRI. Participants wore an Android device that automatically captured images as they went about their everyday activities for at least 14 days. We then selected 120 images from each participant's experience that varied along objective contextual dimensions (time and location) and self-reported dimensions (e.g., activity, people, affective state). Participants viewed their images and mentally "replayed" the depicted events while in an fMRI scanner, then rated the emotionality of each event outside the scanner. We used representational similarity analysis to track neural activity that varied on different dimensions of context. Patterns of neural activity in left amygdala, lateral orbitofrontal cortex, medial and frontomedial prefrontal cortex, and superior temporal lobe correlated with pairwise differences in the emotionality ratings, as predicted by the iterative reprocessing model of emotion (Cunningham & Zelazo, 2009).
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(3142)

Keeping Goals in Mind: Changes in Emotion and Importance Over Time in Autobiographical Memory. MELISSA M. BURCH, *Hampshire College,* JENNIFER A. WENNER, *University of Minnesota,* MOLLY A. SCHLESINGER, *University of California, Riverside*—Memory for emotional past events helps shape our autobiography and informs our sense of self. One phenomenon relevant to emotional events is the fading affect bias: the emotional intensity of negative past events fades more quickly over time than the intensity associated with positive events. (e.g., Walker & Skowronski, 2009). The present work explores the possibility of a FAB in relation to goal events, which arguably have greater personal significance than everyday events. Sixty-seven participants reported on achieved and not-achieved goals that had occurred in the recent or distant past. Participants rated goal importance as well as emotional reaction to achieving or not achieving the goal. Results did not reveal a FAB. There was, however, a fading importance bias with a greater decrease over time in reported importance of not-achieved events as compared to achieved events. Discussion centers on the self-defining qualities of personal goals in autobiographical memory.
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(3143)

Memory for Emotional Behaviors: Do Discrete Emotional Categories Matter? JACOB NEGLEY, COLLEEN M. KELLEY and KYNDRA LEWIS, *Florida State University*—Emotions have evolved to serve certain functions, including detection

of cheaters and avoidance of contagion. To serve those functions, discrete emotional reactions may have differential effects on memory. In Experiment 1, we tested whether people differentially learn the association between a face and behavior when the behavior provokes disgust, anger, positive or neutral reactions. We also tested whether individual differences in disgust sensitivity modulate memory for disgusting behaviors. Experiment 2 tested whether there is an associational deficit for highly arousing pairs of negative behaviors compared to positive or neutral behaviors.
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(3144)

Valence of an Associated Behavior Improves Person Recognition and Source Memory. TANYA J. KARAM, SEAN M. LANE and AUDRA COOK, *Louisiana State University*—Memory supports everyday social decisions, for example, keeping track of people who cheat or share with us. One factor in such decisions is the emotion engendered by a person's behavior, and prior research suggests it improves source memory, but does not affect person recognition (e.g., Bell & Buchner, 2010). Participants in these studies see faces associated with positively, negatively and neutrally valenced behaviors. We extended prior research by employing a more sensitive face recognition test (i.e., using lure faces highly similar to target faces) and a more extensive source test that involved remembering the valence of the associated behavior and the specific behavior itself. Results revealed that source memory (whether general or specific) was enhanced for negative behaviors. Person recognition was enhanced for faces associated with negative behavior when the encoding task focused on participants' emotional reaction (Exp. 1), but not when the encoding task did not (Exp. 2). These findings suggest that emotionally arousing associations affect memory in more complex ways than previously assumed.
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(3145)

Effects of Emotion on Memory and Time Perception. LAURA W. JOHNSON and DON G. MACKAY, *University of California, Los Angeles*—In two experiments, participants saw a taboo and a neutral word of different durations presented sequentially and guessed which word had longer duration. In Experiment 1, participants correctly chose longer-duration taboo words reliably less often than longer-duration neutral words, suggesting underestimation of taboo word durations. Experiment 2 was identical except that we added confidence ratings and a condition with pairs of same-duration words. The results replicated Experiment 1 and provided further evidence that taboo word durations are underestimated: In the same-duration condition, participants chose the taboo word as longer reliably less than half the time, and in the different-duration conditions, correct responses received reliably lower confidence ratings for longer-duration taboo words than longer-duration neutral words. However, in surprise free recall tests that immediately followed Experiments 1 and 2, participants recalled reliably more taboo than neutral words. Together these results suggested that emotion-linked memory encoding took priority over the time-estimation task, resulting in better recall but shorter perceived durations for taboo than neutral words.
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(3146)

The Influence of Valence and Arousal of Emotional Pictures on Attentional Processes. YONGNA LI, *Renmin University of China,* JEANETTE ALTARRIBA, *University at Albany, SUNY* (Sponsored by Ludmila Isurin)—Emotional stimuli often bias attentional processes. However, it is not abundantly clear whether emotionality, negativity, or some other attribute (e.g., arousal) of emotion motivates these effects on attention. The present experiments used a dot-probe paradigm to investigate the effect of valence and arousal on attention. In both horizontal displays (one picture is on the left of the fixation and the other is on the right) and vertical displays (one picture is above the fixation and the other is below), two emotional pictures served as a cue to the probe. Valence and arousal level of the pictures were manipulated. Negatively valenced stimuli slowed down responses only in the vertical displays but not in the horizontal displays. Also, the effect of valence on attention was dependent upon the type of picture pairs (i.e., two pictures having the same valence or the same level of arousal).
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(3147)

Safety First! Attentional Prioritization of Safety Over Threat Signals. JULIA VOGT, *The University of Chicago; Ghent University,* ERNST H.W. KOSTER and JAN DE HOUWER, *Ghent University*—Threatening events bias attention. It is currently debated whether attention to threat is stimulus-driven or caused by top-down factors. The present study tested a top-down account of attention to threat: When confronted with threat, the goal to reach safety guides attention. Therefore, stimuli that allow avoiding threat will also bias attention. To test this assumption, we implemented a cueing paradigm with colored squares as cues. One color was fear conditioned generating a threatening event. In order to create safety cues, participants were informed that responses to another color in a secondary task would allow to avoid the presentation of the threat (i.e., aversive noises). The results of two experiments confirm that attention is allocated towards both threat and safety cues. Importantly, when threat and safety cues were presented in parallel, attention prioritized safety signals. These results suggest that the goal of coping with threat underlies the threat priority effect.
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(3148)

Emotional Processing of Sentence Prosody: An ERP Study. SHIH-TSENG TINA HUANG and MING CHUN LEE, *Natinal Chung Cheng University* (Sponsored by Gary C.-W. Shyi)—The present study investigated emotional processing of sentence prosody using event-relates potentials (ERPs). Twenty young adults heard passively sentences that were

uttered with different emotional tones, 80% with a neutral and 20% with various emotionally expressive tones, while ERPs were recorded. ERP data were analyzed in three temporal phases, namely the initial phase (100-300 ms after stimulus onset), the morpho-syntactic phase (300-500 ms), and the integration phase (500-1000 ms). The results showed that, comparing to a neutral prosody, the peak amplitudes of N170 on Cz, Fz, and PO8 were greater for processing prosody of anger. Furthermore, the mean amplitude (MA) of P3 was greater on Fz but was lower on PO8 in processing angry tone. Finally, during the integration phase, greater MAs on Cz and Fz but lower MA on PO8 were found in processing prosody of surprise. These findings implicate both autonomous and interactive emotional processing of sentence prosody.
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(3149)

The Salient Stimulus Benefit for Attentional Capture is Greatest When it is Unattended. ROBERT DOWMAN and ALYSSA TOIA, *Clarkson University*—Electrophysiological, behavioral, and computational modeling studies in our laboratory have provided evidence that the threat benefit for attentional capture is due to a stimulus-driven threat feature detection and orienting process, and that this process is greatest when the threat is presented outside the focus of attention. In the present study we used an endogenous cuing paradigm to determine if the benefit for attentional capture is also seen for visual stimuli that have positive emotional valence. The results show that reaction times are faster for erotica targets than neutral non-body targets (e.g., buildings, household objects), but only when they are presented outside the focus of spatial attention (invalidly cued). This effect was not seen with emotionally neutral human body target stimuli. These results suggest that any salient stimulus, regardless of its emotional valence, is more effective at capturing attention than neutral stimuli, but only when it is unattended.
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(3150)

Positive Affect Versus Reward: Comparing Emotional and Motivational Influences on Cognitive Control. KIMBERLY S. CHIEW and TODD S. BRAVER, *Washington University in St. Louis* (Sponsored by Deanna Barch)—Affective influences can contribute strongly to goal-oriented behaviour, but much work is still needed to characterize these influences and the mechanisms by which they contribute to cognition. An important question concerns the nature of emotional manipulations (i.e., induction of valenced subjective experience) versus motivational manipulations (e.g., performance-contingent incentives) and their relative influences on cognitive control. The present study used a within-subject design to compare the effects of closely matched contextual (blockwise) and trial-by-trial manipulations of positive emotion (mood induction, pre-trial IAPS picture presentation) and reward motivation (incentive blocks, pre-trial incentive cues) on performance of the AX-CPT task. Performance was analyzed in terms of behavioral, individual differences, and pupillometric indices of proactive and reactive control. Preliminary results indicate that reward motivation may promote proactive control while positive emotion does not, suggesting dissociable influences.
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(3151)

On the Control of Spatial Attention: Is There an Attentional Bias Toward Negative Emotion? ROBINSON TAYLOR and MEI-CHING LIEN, *Oregon State University,* ERIC RUTHRUFF, *University of New Mexico*—We used a cuing paradigm to examine whether fearful faces capture spatial attention. Participants searched a target display for either a letter in a specific color or a face with a specific emotional expression. The target display was always preceded by a non-informative cue display, which contained either a fearful face or neutral face. The cue face appeared in the same location as the target (valid trials) or different (invalid trials). For both of these conditions, target response times were equivalent for fearful and neutral faces, even when the target task was itself about emotion. Our findings suggest that, in contrast to previous studies, negative stimuli do not generally have the inherent power to capture our attention against our will.
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(3152)

Individual Differences in Processing Emotion Words during Reading: Evidence From Eye Movements. HUGH KNICKERBOCKER, *University at Albany, SUNY*, REBECCA L. JOHNSON, *Skidmore College*, JEANETTE ALTARRIBA, *University at Albany, SUNY*—Recently, Scott, O'Donnell, and Sereno (2012) reported that words of high arousal and extreme valence are processed with greater ease than neutral words during sentence reading. We examined whether these effects can be moderated by readers' depression and/or anxiety levels. We compared the eye-movement record while participants read sentences that contained a neutral target word (e.g., yellow) or an emotion word. Readers were able to process both positive (e.g., terrific) and negative emotion words (e.g., distressed) faster than neutral words. This was true across a wide range of measures, including those that were early (e.g., first fixation durations) and very late (e.g., total times on the post-target region). Furthermore, although readers' scores on the Beck Depression Inventory (BDI-II) did not interact with the emotion effect, their scores on the State Trait Anxiety Inventory (STAI) did. Specifically, negative emotion words were processed more easily when readers were in a more anxious mood.
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(3153)

Hemispheric Asymmetries in Motivation Neurally Dissociate Self-Description Processes. KATIE L. BROADWELL, COLIN G. DEYOUNG, W. SCOTT DOMANSKY, REBECCA G. DEASON and CHAD J. MARSOLEK, *University of Minnesota*—When people describe themselves by responding to personality questionnaires,

typically they endorse likeable traits and reject unlikeable traits. In one case, people use previously stored information about themselves to judge that likeable traits describe them well, and in the other, they use previously stored information to judge that unlikeable traits do not describe them well. We report evidence that these processes are neurally dissociable, with the former benefiting from engaging left-hemisphere processes and the latter benefiting from engaging right-hemisphere processes. Hemispheric asymmetries in self-description are not unidirectional and do not differ across different personality traits, but do differ between endorsing likeable items and rejecting unlikeable items. Thus, we are not dispassionate when we describe ourselves. Dissociable, basic motivational processes are involved in the neural architecture underlying self-description. We also report tests of whether this pattern of results is specific to self-description or is also observed when participants describe other people.
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(3155-3156)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION IV

Saturday Noon,
Minneapolis Convention Center, Ballroom A
Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• ACTION AND PERCEPTION III •

(4001)

Differences in the Frontal-parietal Mirror Circuit When Planning and Maintaining Actions to Abstract Vs. Biological Stimuli: An EEG Study. LAWRENCE P. BEHMER, JR. and LISA R. FOURNIER, *Washington State University* (Sponsored by John Hinson)—Research shows that the frontal-parietal mirror circuit (FPMC) is active when individuals view and respond to abstract stimuli associated with a learned motor response. This activity is similar to that found when individuals view or imitate goal-directed biological actions. However, no study has directly compared FPMC activity between abstract and biological stimuli using a within-groups design with appropriate controls. This study employed EEG to measure differences in mu-Event Related Desynchronization (mu-ERD) when 1) viewing a biological action vs. an abstract stimulus (with an associated, learned response), and when 2) planning and maintaining an action plan to these different stimuli in working memory. Stimulus duration and motor responses to the different biological actions and abstract stimuli were identical. Differences in mu-ERD between stimulus conditions will be discussed in terms of neural efficiency and resonance.
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(4002)

It Takes Two to Imitate: Imitation and Anticipation in Social Interaction. ROLAND PFISTER, MARKUS JANCZYK and DAVID DIGNATH, *University of Würzburg,* BERNHARD HOMMEL, *Leiden University,* WILFRIED KUNDE, *University of Würzburg* (Sponsored by Thomas Kleinsorge)—Imitation is assumed to serve crucial functions in social interaction, including action understanding, empathy, and learning; yet all these functions only apply to the imitating observer. Here, we reveal a distinct function of imitation for the action model: Anticipating to be imitated facilitates the production of one's own motor actions. Specifically, anticipated motor responses of social counterparts serve as mental cues to retrieve corresponding motor commands in order to orchestrate one's own actions.
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(4003)

Self-Organization of Spontaneous Synchronization while "Maraca-ing". ALEXANDER P. DEMOS, ROGER CHAFFIN and KERRY L. MARSH, *University of Connecticut*—In previous research, hearing another's movements induced spontaneous synchronization with a partner (Demos et al., 2012). In new experiments, we examined the effect of auditory information on spontaneous synchronization between two people each shaking a maraca. Participant pairs (n = 28) were first asked to maintain their own tempo by themselves (baseline), then to maintain their own tempo in the presence of a partner (spontaneous) then to synchronize with the sound of the partner's maraca-ing (intentional). Intentional and spontaneous synchronization were significantly greater than baseline. Five dyads (18%) were unable to intentionally synchronize. Of those dyads that were able to synchronize intentionally, 43% did so nearly as strongly in the spontaneous and intentional conditions. Most of these dyads also slowed down in the intentional condition, presumably in order to facilitate synchronization. Synchronization appears to occur when allowed to develop automatically, suggesting that it is governed by principles of self-organization.
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(4004)

Psychometric Functions With Response Confidence Under the Balance Condition: Theory and Data. YUNG-FONG HSU, *National Taiwan University*—One of the long-standing interests in psychophysics is the study of thresholds for discriminability. While threshold theories embrace the concept of discrete-state thresholds, signal detection theory discounts such a concept. Up to the present the meaning of thresholds has yet to be fully understood. We are concerned with the practical issue of estimating threshold values. In doing so, we clarify the concept germane to the psychometric function, which is customarily constructed using psychophysical methods with a binary-response format. We question this response format and argue that response confidence also plays an important role in the construction of psychometric functions, and thus should have some impact on threshold estimation. We motivate the discussion from a threshold-theory viewpoint by adopting a three-state threshold theory for response confidence proposed by Krantz (1969), which is a modification of Luce's (1963) low-threshold theory. Especially, we discuss the case in which the practice of averaging over order (or position) is enforced in data collection. We illustrate the fit of the Luce-Krantz threshold theory to data from a line-discrimination task with response confidence.
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(4005)

Action Effects in Saccade Control. LYNN HUESTEGGE and MAGALI KREUTZFELDT, *RWTH Aachen University*—Action preparation is known to involve the activation of associations between actions and their learned effects (ideo-motor principle). However, there is only sparse research on the role of action effects in saccade control. In the present study, participants responded to lateralized auditory stimuli with spatially compatible saccades towards peripheral targets (e.g., a rhombus in the left hemifield and a square in the right

hemifield). Prior to the imperative auditory stimulus (e.g., a left tone), an irrelevant central visual stimulus was presented which was either congruent (e.g., a rhombus), incongruent (e.g., a square), or unrelated (e.g., a circle) to the peripheral saccade target (i.e., the visual effect of the saccade). Saccade targets were present throughout a trial (Experiment 1) or appeared after saccade initiation (Experiment 2). Results showed faster RTs and fewer errors in congruent (vs. incongruent) conditions, suggesting that associations between oculomotor actions and their visual effects play an important role in saccade control.
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(4006)

When the Joint Picture-Word Task Eliminates the Semantic Interference Effect. ROBERTA SELLARO, BARBARA TRECCANI and ROBERTO CUBELLI, *University of Trento* (Sponsored by Cristina Cacciari)—A joint version of the picture-word paradigm was used to investigate whether task sharing affects individual performance. Participants were required to name a target picture while ignoring a written word that could be either semantically related or unrelated and written in two different formats: alternated case (e.g., mOuSe) and upper case (e.g., MOUSE). Participants performed the task both individually and co-acting with an alleged partner who was thought to read the distractor word. Results showed that the social manipulation reduced response times and eliminated the typical semantic interference effect only with alternated-case distractor words. These results can be accounted for by assuming that task sharing leads participants to ignore the distractor words because another person is in charge of them. Such a division-of-labor strategy allows preventing the competition with the alternative response but it is effective only when written word recognition is impaired by case alternation.
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• TESTING EFFECTS II •

(4007)

Does Repeated Retrieval Practice Produce Symmetric Gains in Associative Memory? KALIF E. VAUGHN and KATHERINE A. RAWSON, *Kent State University*—Increasing the number of successful retrievals during cued recall practice improves associative memory. Is this gain symmetric? According to the Associative Symmetry Hypothesis (ASH), cue-target information is associated with one bidirectional link, and any gains produced in the forward direction (i.e., cue-to-target) equally accrue in the backward direction (i.e., target-to-cue). In contrast, the Independent Association Hypothesis (IAH) posits that cue-target information is associated with two separate, unidirectional links, allowing for patterns of associative asymmetry. In Session 1, participants were presented with unrelated word pairs for forward cued recall practice (with restudy) until correctly recalled 1-5 times. In Session 2, we administered various recall and recognition tests to evaluate the predictions of ASH and IAH. Gains across criterion level were asymmetric in forward versus backward cued recall, and this asymmetry was not due to differential gains in cue or target memory. Thus, our results are most consistent with IAH.
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(4008)

The Effects of Testing on Knowledge Structure Formation. MILTON E. PICKLESIMER and NEIL W. MULLIGAN, *University of North Carolina at Chapel Hill* (Sponsored by Peter Ornstein)—Compared to restudying, testing has often been found to enhance memory. This is called the testing effect. However, it is not clear how testing affects the formation of an integrated knowledge structure. The current study employed a transitive inference paradigm to teach participants a novel, highly inter-related knowledge structure comprised of several basic premises. Encoding strategy was manipulated between subjects. Both groups took a final test that assessed memory for the basic premises and their ability to make transitive inferences about them. Experiment 1 found that restudying yielded superior performance on transitive inferences on an immediate test, whereas Experiment 2 found no difference in transitive inferences after 48 hours. Additional analyses revealed the restudying group's advantage in Experiment 1 was exclusive to those participants who expressed no clear awareness of the relational structure. Thus, the current study identified conditions under which testing fails to enhance inferential ability or memory for the unifying structure of the memoranda.
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(4009)

Encoding Variability vs. Repeated Testing: Their Effects on Immediate and Delayed Free Recall Tests. CHI-SHING TSE, *The Chinese University of Hong Kong,* JEANETTE ALTARRIBA, *University at Albany, SUNY*—This study compared the effect of encoding variability in repeated study and the effect of repeated testing on immediate and delayed free recall. Participants acquired unrelated words in 20 study/test trials. For the restudy with low or high encoding variability groups, the proportion of study and free recall test trials was 3:1, and participants studied words via 1 or 11 types of orienting tasks, respectively. For the repeated testing group, the proportion was 1:3 and participants studied words via 1 type of orienting task. Participants received a final free recall test after either a short delay (20 min.) or a long delay (1 week). Results indicated a dissociative effect of high encoding variability vs. repeated testing in immediate vs. delayed test performance. The restudy with high encoding variability group outperformed other groups on immediate tests, whereas the repeated testing group showed best performance on delayed tests. Implications for encoding variability and elaborative retrieval theories for the testing effect are discussed.
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(4010)

Examining the Testing Effect Across Different Modalities. BENTON H. PIERCE and MELISSA J. HAWTHORNE, *Texas A&M University, Commerce,* DAVID A. GALLO, *The University of Chicago,* ELIZABETH T. BOLSON, *Texas A&M University, Commerce*—In the present study, we asked whether the benefits of intermediate testing on later retention (i.e., the testing effect) generalize to different modalities. Participants studied five lists of unrelated words. Those in the study-only condition performed a two-minute distractor task following lists 1-4, whereas those in the testing condition completed a one-minute distractor task and then attempted to recall each list following study. Following a two-minute distractor task, both groups were tested on list 5 and received a cumulative free-recall test 30 minutes later. Additionally, half the participants studied the lists visually and half studied them auditorily. For both list 5 and cumulative recall, we found a modality effect (visual > auditory) and a testing effect (testing > study only). However, the testing effect did not interact with study modality, suggesting that testing provides similar benefits regardless of whether material is presented in a visual or auditory format.
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(4011)

When Testing Hurts Memory: Retroactive Interference in A-B/A-C Paired Associate Learning. KATHERINE M. WEBER, GEORGE A. SEROR and W. TRAMMELL NEILL, *University at Albany, SUNY*—Testing may improve memory for the tested material, relative to repeated study (Roediger & Karpicke, 2006). Paradoxically, testing can also increase susceptibility to subsequent misinformation—a "negative testing effect" (Chan, Thomas & Bulevich, 2009). Our subjects studied an initial list of Swahili-English translations. A "test" group then received a cued-recall test on that list, whereas a "study" group studied the list again. A second list included some List 1 Swahili words re-paired with new English words, and all-new translation pairs. Subjects received a final test on List 1 or List 2. The test group exhibited greater retroactive interference on List 1, but also performed worse on items that were not re-paired. However, the test group exhibited less proactive interference on List 2, and also performed better on the new items. Testing may shift encoding strategies such that new material is learned at a cost to memory for older material.
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(4012)

Analogical Learning and the Testing Effect: Can Retrieval Practice Amplify the Benefits of Comparison for Long-Term Transfer? LINSEY SMITH, MICAH GOLDWATER and SCOTT HINZE, *Northwestern University*—Comparing two examples can facilitate transfer (Gick & Holyoak, 1983; Hattikudur & Alibali, 2010). However, few studies have looked at the durability of transfer effects over long delays (but see, e.g., Loewenstein, Thompson, & Gentner, 1999); those that have report smaller effect sizes (e.g., Durkin & Rittle-Johnson, 2012) for delayed (vs. immediate) transfer, suggesting that comparison's utility is reduced at longer retention intervals. In the current research, we test whether retrieval practice can improve comparison's effects on delayed transfer. Our application of retrieval practice to spontaneous transfer is novel—studies of the testing effect typically focus on retention of the same material (Roediger & Karpicke, 2006) or cued transfer (Butler, 2010). Participants compared analogous problems and summarized the common solution or summarized each problem separately; after a delay they studied or retrieved their earlier elaborations. One week later, participants completed an transfer task (without cues the studies materials). Preliminary results indicate distinct advantages for comparison and retrieval practice.
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(4013)

The Risks and Benefits of Test-Enhanced Learning From Scientific-Seductive Texts. MICHAEL C. MENSINK, *Northern Illinois University,* SCOTT R. HINZE, *Northwestern University,* MARK R. LEWIS, *University of Minnesota,* KIRK WEISHAAR, *Northern Illinois University*—Retrieval practice enhances long-term retention of text materials. However, not all content within informational texts is beneficial for readers' understanding. For example, interesting but irrelevant information (i.e., seductive details) is often recalled at the expense of more important content. We explored whether testing would reduce or exacerbate the recall of seductive details after a delay. Participants read a text on severe weather formation that included important scientific content and seductive details, and then either reread or recalled the text. After a 7-day delay, a final recall test demonstrated a significant testing effect. However, the advantage for testing held only for seductive details and not for important content. Although testing increases readers' ability to recall material after a delay, the content of the text itself also plays an important role in the quality of test-enhanced learning, as the presence of seductive details in scientific texts may cause testing to harm readers' understanding.
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(4014)

Variability and Testing During Learning: Redundant or Additive Effects? NATHAN S. ROSE, *University of Toronto,* ANDREW C. BUTLER, *Duke University,* LUDMILA D. NUNES, *University of Lisbon,* HENRY L. ROEDIGER, III, *Washington University in St. Louis* (Sponsored by David Elmes)—Practicing retrieval during learning benefits memory relative to re-studying (the testing effect). One explanation for this benefit is that retrieval practice produces encoding variability, which leads to elaboration of the memory, whereas repeated studying yields encoding stability. Introducing encoding variability during repeated study has been shown to benefit memory, such as varying speaker characteristics when learning a foreign language. Our study investigated whether introducing variability and repeated retrieval practice during learning produces redundant or additive effects on memory. Subjects learned Russian-English word pairs ("klubnika" – strawberry) through either repeated studying (SSSS) or testing (STTT). In each learning condition, the Russian word was either spoken by the same speaker or a different speaker on each presentation. A transfer test with a new speaker was

used to assess memory for the English word. Introducing variability and repeated testing during learning both produced benefits. However, the benefit of testing did not interact with variability. That is, learning with variability and retrieval practice produced additive effects.
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(4015)

Absence of a Testing Effect in Immediate and Delayed Recall. EEVIN JENNINGS and ROMAN TARABAN, *Texas Tech University*—The testing effect represents an advantage for retrieval of previously studied information when the information is tested instead of re-studied before a final test. Testing effects are typically more robust after a delayed compared to immediate test. In two experiments participants studied expository texts—one intact and one scrambled (by sentence). The testing group studied and recalled a text repeatedly and the study group simply studied the text; then all took a free-recall test. There was a significant recall disadvantage due to delayed testing and scrambling. Contrary to the typical testing effect, study participants recalled significantly more, immediately and at a one-day delay. The recall advantage for study vs test participants was consistent with final-test recall times and meta-judgments of comprehension and recall. The absence of Test-vs-Study X Delay interactions suggests the nature of the final test may be a factor in whether robust testing effects emerge after a delay.
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(4016)

Does Test Anxiety Influence the Effectiveness of Test-Enhanced Learning? It Depends on Working Memory Capacity. CHI-SHING TSE and XIAOPING PU, *The Chinese University of Hong Kong*—Despite being viewed as a better way to enhance learning than repeated study, it has not been clear whether repeated testing is equally effective for students with a wide range of cognitive abilities. The current study explored how college-student participants' working memory capacity (WMC) and trait test anxiety (TA) modulate the effectiveness of test-enhanced learning. They acquired Swahili-English word pairs (half via repeated study and half via repeated testing) and performed a delayed cued-recall test for all pairs about one week after acquisition. Their WMC and TA were estimated by Unsworth et al.'s (2005) operation span task and a Chinese version of Spielberger's (1980) Test Anxiety Inventory, respectively. Regression analyses showed that (a) relative to other participants, those with lower WMC and higher TA made more intralist intrusion errors (i.e., recalling a wrong English translation to a Swahili word cue) in the acquisition phase and (b) the testing effect was negatively correlated with TA for participants with lower WMC, but was not correlated with TA for those with higher WMC, thus indicating a boundary condition for the benefit of test-enhanced learning. Both theoretical and educational implications are discussed.
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(4017)

Why Do Prior Tests Enhance Subsequent Learning? KATHLEEN M. ARNOLD and KATHLEEN B. MCDERMOTT, *Washington University in St Louis*—Taking an initial test enhances learning on a subsequent study trial, a phenomenon known as test-potentiated learning (Izawa, 1971). However, the mechanism underlying this effect is unknown. One hypothesis is that taking initial tests improves metacognitive knowledge, which can then be used to improve learning during a subsequent study opportunity. In two experiments, we provide preliminary evidence supporting this hypothesis. When participants restudied items they could not previously recall, those who had taken 5 previous tests spent more time studying the items relative to participants who had taken only two previous tests. In contrast, the number of prior tests did not affect study time for items that had been previously recalled. Taking the additional tests changed participants' subsequent study strategies for items not previously recalled, implicating improved metacognition as a factor contributing to the effect.
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(4018)

Variations in Learning Trajectories Predict Generalization. MATTHEW G. WISNIEWSKI, EDUARDO MERCADO III and BARBARA A. CHURCH, *University at Buffalo, SUNY*—Learning to distinguish differences in events can impact how a person generalizes. Sometimes training can cause novel events to appear more familiar than those actually experienced during training, evidenced by a shift in generalization. The present study examined whether individual differences in performance during learning led to predictable generalization patterns. We trained participants to identify simulated birdsongs, and then tested them on their ability to identify a target song when it was presented among several similar songs. Our results show that both the extent of learning and the level of performance reached at the end of training are relevant to predicting generalization dynamics. Simulations using a connectionist model that gradually modifies stimulus representations suggest that: 1) generalization differences may reflect differences in the balance of representational reweighting and reorganization learning mechanisms and 2) identical training can lead to either non-existent, temporary, or long-lasting generalization shifts in different individuals.
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• ASSOCIATIVE LEARNING •

(4019)

Thorndike's Law of Belongingness in Item-Context Binding. ARLO CLARK-FOOS, CHRISTOPHER DRAHEIM and KACIE MENNIE, *University of Michigan, Dearborn*—Thorndike's Law of Belongingness suggests that for a cue to be maximally effective at eliciting a behavior it must be relevant or related to the behavior. In two source monitoring (SM) experiments that manipulated both the source and

content (language) of studied words we find evidence for belongingness in item-to-context associations. That is, words presented in English (as opposed to German) have an advantage in binding of gender voice sources but the reverse is true for a visual font color sources, $F(3, 173) = 4.95$, $p = .027$. We suspect that when one understands semantic content of items (English), they are more easily bound to semantic sources. In the absence of semantic understanding (German) the items are stored perceptually and are more easily bound with a perceptual source. Ongoing work is using other item-context pairings to further explore the idea of belongingness in SM.

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(4020)

Taxing Attentional Resources Amplifies Cue Competition in Associative Learning. MATTHEW J. WEBER, *University of Pennsylvania,* SAMUEL B. MESSING, *Columbia University,* SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Highlighting is a trial order phenomenon in associative learning. Subjects learn early that a compound cue AB invites a response X, and later that a new compound AC (sharing cue A with the early compound) invites a new response Y. Subjects should be equivocal in their preferred responses to the novel compounds A and BC; in fact, they prefer response X for A and response Y for BC. One influential model of cue competition proposes an attentional mechanism for highlighting. We sought to confirm the role of attention in highlighting by taxing attentional resources, first with transcranial direct current stimulation (tDCS) and then with salience and dual-task manipulations. All three manipulations increased highlighting, with parameter fits suggesting increased overlap in the representations of the compounds, forcing a greater attentional shift. We then turned to a competing model, which holds that highlighting arises not from attention, but from imperfect information about cue covariance, and should be negatively correlated with backward blocking. Across subjects, highlighting and backward blocking were in fact strongly positively correlated. Our results endorse an attentional account of cue competition.

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(4021)

Associative Relationship for Proper Name With a Proactive Interference Paradigm. VÉRONIQUE GERMAIN-MONDON and MARIE IZAUTE, *Université Blaise Pascal*—It is controversial whether the organization of semantic information relating to known persons is categorical (Darling & Valentine, 2005) or associative (Barry et al, 1998). With a modified proactive interference paradigm, Darling and Valentine (2005) obtained a semantic-specific categorical interference effect and suggested that these results reflect the underlying memory structure. However, they manipulated categorical variables only. The aim of the present study was to compare two different conditions (categorical - same occupation - vs associative - interpersonal link) with a similar paradigm. As expected, our results showed a proactive interference effect not only in the categorical condition but also in the associative condition. In fact, the performances were even better in this latter condition, in agreement with the proposal of a dominant associative organization in identity-specific semantic memory (Barry et al, 1998) and not of a category-specific organization alone (Darling & Valentine, 2005).

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(4022)

Mnemonic Learning of Representational and Abstract Art. RUSSELL N. CARNEY, *Missouri State University,* JOEL R. LEVIN, *University of Arizona,* MARK J. DYN and KIRANI U. LOCKE, *Missouri State University,* AARON S. RICHMOND, *Metropolitan State College of Denver*—Beyond its namesake application, the face-name mnemonic strategy has been shown to facilitate artwork learning when applied to primarily representational paintings. However, would the strategy be less effective with abstract paintings (which lack concrete elements for use in interactive images)? To examine this, we randomly assigned undergraduates to one of three groups: own best method (control), fully imposed mnemonic, and partially imposed mnemonic. Students used their strategy to study 28 paintings by 14 artists (two paintings per artist: one representational and one abstract). On immediate and delayed tests over all 28, students in both mnemonic conditions statistically outperformed control participants. Further, although the abstract painting sets were statistically more difficult to remember than the representational sets across the board, analyses of the two 14-item subsets yielded comparable mnemonic facilitation.

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(4023)

Links Between Errors and Correct Answers: Does Remembering an Error Lead You Astray or Mediate Correct Recall? BARBIE J. HUELSER and JANET METCALFE, *Columbia University*—We investigated whether errors can serve as explicit mediating links to correct responses, using word triplets that were either congruent (hand-palm-WRIST) or incongruent (hand-palm-TREE). We reasoned that when asked to generate a response to (hand-palm-?) people might produce the error 'finger' which could serve as a semantically related mediator to both palm and WRIST in the congruent case. However, in the incongruent case, the error (finger), while related to the polysemous item (palm), is not semantically related to TREE; thus, it should not elicit the target. The error generation conditions were compared to a read condition, in which all three words were presented and no errors were produced. On a final memory test, participants were given the cues (e.g., hand-palm) and asked to provide the target they had seen as well as the error if applicable. Correct target recall was better in both error generation conditions than in the read condition. When participants could not remember the errors, memory was better in the congruent condition than in the incongruent condition. However, when the error was remembered, it served as a mediator – increasing target recall – in both the congruent and the in both the congruent and the incongruent condition, contrary to our hypothesis.

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(4024)

Constraint on Semantic Flexibility in Visual Statistical Learning. SACHIO OTSUKA, *Kyoto University,* MEGUMI NISHIYAMA and JUN KAWAGUCHI, *Nagoya University*—We examined whether the expression of visual statistical learning (VSL) is flexible at the categorical (superordinate) level. In the familiarization phase, participants viewed a sequence of line drawings. In the subsequent test phase, participants observed two test sequences (triplets vs. foils) that consisted of the same objects as those presented during the familiarization (the same condition) or different objects that shared the same category at the superordinate level with drawings during the familiarization (the different condition), and decided whether the first or second sequence was more familiar. Half of the participants took the test of line drawings; the other half did the test of word stimuli representing line drawings. The results showed greater familiarity above chance levels for triplets in the same condition, and no significant VSL in the different condition, irrespective of the stimuli type. Our findings suggest that the flexibility of VSL is limited to the basic-level category.

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(4025)

Suppression Effects in the Think/No-Think Paradigm: Fast vs. Slow Responders. KIMBERLY R. KLEIN and ANNE M. CLEARY, *Colorado State University*—The suppression effects found in the think/no-think paradigm (Anderson, Bjork, & Bjork, 1994) have been difficult for other laboratories to replicate (Bulevich, Roediger, Balota, & Butler, 2006), with no obvious differences between samples that could explain the presence or absence of the effect across studies. In the present study, we sought a potential explanation for why some researchers detect the suppression effect, while others fail to replicate it. Our findings suggest that subjects that respond quickly to independent cues tend to show the suppression effect, while subjects that respond more slowly (spending more time before answering) tend not to show the suppression effect. These data not only help to inform the literature on possible reasons why some laboratories find suppression effects and others do not, but also may provide clues as to the mechanisms responsible for suppression effects when they do occur.

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(4026)

Aging and the Use of Reward Cues in Item and Associative Memory. KRISTEN L. CUSHMAN, SHARON A. MUTTER, RICHARD M. OWEN and ALLISON A. STEEN, *Western Kentucky University*—Older adults perform as well as younger adults on tests of item memory, but worse than younger adults on tests of associative memory. These findings suggest that older adults are deficient in binding individual items into a cohesive unit (Naveh-Benjamin, Hussain, Guez, & Bar-On, 2003). Additionally, reward motivation has been shown to enhance younger adults' performance on tests of item memory; i.e., when presented with reward cues that precede single stimuli, young adults remember more stimuli associated with high versus low value reward cues (Adcock, Thangavel, Whitfield-Gabrieli, Knutson, Gabrieli, 2006). The current study examined how reward motivation influences the item and associative memory of younger and older adults. No age differences were observed on the test of item memory and both groups remembered more stimuli associated with high than low reward cues. In contrast, younger adults performed better than older adults on the test of associative memory and reward cues had no effect on the performance of either group. These findings suggest that, for both young and older adults, reward motivation increases individual item distinctiveness, but does not enhance the formation of associations between items.

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(4027)

Recollection and Unitization in Associating Actors With Actions. ALAN W. KERSTEN, JULIE L. EARLES and JOHANNA D. BERGER, *Florida Atlantic University*—Kersten (1998; 2003) proposed that manner of motion information is integral to animate object representations, whereas path information is stored separately. The present research tested whether human manners of motion are stored together with identity information in unitized memory representations, allowing for the discrimination of old and new combinations of people and manners of motion on the basis of familiarity. It further tested whether path and identity information are stored separately, thus requiring recollection of which people were associated with which paths. Participants viewed videos of actors moving in different manners along different paths. In a subsequent recognition test, participants discriminated old videos from novel combinations of actors with the motions of other people. Yonelinas' (1999) dual-process source memory model was fit to recognition judgments and confidence ratings to yield estimates of familiarity and recollection. As predicted, discrimination of old and new combinations of actors and manners of motion relied primarily on familiarity, whereas discrimination of old and new combinations of actors and paths was associated with reduced influences of familiarity and larger influences of recollection.

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• EXPLICIT MEMORY II •

(4028)

Recollection Facilitates Relearning: Evidence From the AB/AC Paradigm. JASON D. OZUBKO, GORDON WINOCUR and MORRIS MOSCOVITCH, *Rotman Research Institute*—Using an AB/AC list learning paradigm, we test the notion that recollective representations are flexible, in that their component parts can be easily manipulated and recombined with other components, whereas representations based on familiarity are more rigid. In two experiments, participants first studied a list of AB word pairs and were then tested using a recall-then-"remember"/"know" paradigm. Subsequently, subjects learned and were tested on AC word pairs. In both experiments, subjects were better able to recall AC word pairs when the corresponding AB pairs were previously recollected, as opposed to being merely familiar. Early results from a

recognition follow-up (again using "remember"/"know" responses) confirm these findings, and suggest that despite the relative strength of recollective traces, recollective memories interfere less with, and may even facilitate, the flexible recombination of older memories into new ones.
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(4029)

Threshold Priming Influences Recollection in Cued Recall Performance. GEOFFREY B. MADDOX and DAVID A. BALOTA, *Washington University in St. Louis* (Sponsored by Janet Duchek)—The present study extends our previous work on the influence of threshold priming on recollection-based cued recall performance. Participants initially studied a list of unrelated paired associates (DOG-CHAIR) and then completed an immediate cued recall test in which each test trial (DOG-?????) was briefly primed (and both forward and backward masked) with the target word (CHAIR), an associatively related word (TABLE), or an unrelated word (APPLE). Results on the immediate cued recall test indicated a significant identity priming benefit, whereas, conditional analyses of a non-primed delayed cued recall test yielded a reversal of the effect. An additional experiment compared identity and recombined priming (i.e., a studied target item served as the prime for a different cued recall pair). Results from this study indicated that participants were not simply biased to report the degraded prime.
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(4030)

Does a Cued-Recall Memory Test for a Word Enhance Later Memory for its Perceptual Details? KIT W. CHO and JAMES H. NEELY, *University at Albany, SUNY*—We explore whether the facilitation in word memory produced by a memory test vs. re-studying a word will be accompanied by facilitated memory for its perceptual features when that word is re-studied with a semantic cue or receives a semantically cued, word-fragment cued-recall test given in either its original, studied perceptual format (red, large font above fixation or green, small font below fixation) or in a different, "default" perceptual format (white, normal-sized font at fixation). After free recalling the studied words, subjects received one of two types of "perceptual format" memory tests. In the cued-recall version, the word was presented in the "default" format and subjects recalled its color. In the recognition version, the word was presented in its original or "opposite" format and subjects indicated whether its format matched or mismatched its original format. The implications of the results for various accounts of the testing effect will be discussed.
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(4031)

Consistency of Handedness and the Use of Recollection. DONNA J. LAVOIE, BRIANNA OLBINSKI and ANGELA GUPTA, *Saint Louis University,* ALENA PERSZYK, *Vanderbilt University*—Recent research indicates differences in memory between consistent or strong right-handed (Sr) individuals versus those with mixed or inconsistent handedness (nSr); nSr individuals demonstrate greater correct free recall, greater paired associate recall, greater source memory, and less false recall relative to Sr individuals. In two experiments (Experiment 1: full attention; Experiment 2: divided attention), we tested whether these observations would extend to recollection-rejection, a memory editing mechanism that allows individuals to reject related lures on a recognition test, by recollection of that lure's instantiating studied item. We employed a modified conjoint recognition paradigm and multinomial processing tree (MPT) models to the data to assess for handedness differences in the use of recollection processes, predicting that nSr individuals would make greater use of recollection processes than sR individuals. MPT estimates of recollection processes were higher in nSr individuals relative to sR individuals, consistent with our predictions.
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(4032)

The Benefits of Generating Errors During Learning. ROSALIND POTTS and DAVID R. SHANKS, *University College London*—In a series of experiments participants learned definitions for unfamiliar English words, or translations for foreign vocabulary, either by generating a response and being given corrective feedback, or by reading the word and its definition/translation, or by selecting from a choice of definitions/translations followed by feedback. In a final test of all words, generating errors followed by feedback led to significantly better memory than either reading or making incorrect choices, suggesting that the benefits of generation are not restricted to correctly generated items. Even when information to be learned is novel, errorful generation may play a powerful role in potentiating encoding of corrective feedback. However, participants were strikingly unaware of this benefit, showing a dissociation between predicted and actual final test performance. Predictions reflected participants' subjective experience during learning. If subjective difficulty leads to more effort at encoding, this could at least partly explain the errorful generation advantage.
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(4033)

Constraining Retrieval: Retrieval Monitoring in a Modified Memory-for-Foils Paradigm. STEPHEN J. GRAY, REBECCA E. K. FISHMAN and DAVID A. GALLO, *The University of Chicago*—According to early selection theories, memory search is constrained to prevent retrieval of error-prone information. In contrast, late correction theories emphasize the use of post-retrieval monitoring after error-prone information is retrieved. We tested between these accounts using the memory-for-foils task of Jacoby and colleagues. Participants studied words under deep or shallow processing, and were given tests that selectively queried each of these sources. The familiarity of the foils was parametrically varied by repetitions in a pre-experimental list. Foils from the deep test were better remembered than foils from the shallow test on a final memory test. Critically, this memory-for-foils effect did not interact with foil familiarity. These results suggest participants did not use monitoring strategies based on foil difficulty, as predicted by late correction. Instead, they suggest

participants changed their retrieval orientation for all test items, as predicted by an early selection theory. Implications for retrieval constraint mechanisms are discussed.
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(4034)

The Opposite Effects of Semantic Retrieval on Prior and Future Learning. KRISTIN M. DIVIS and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—There has been renewed interest in the effects of testing on memory. In this set of experiments, we examine the effects of interleaved semantic retrieval on previous and future learning within a multi-list learning paradigm. Interleaved retrieval led to enhanced memory for lists learned following that retrieval. In contrast, memory was impaired for lists learned prior to retrieval (Experiment 1). These results are consistent with recent work in multi-list learning and in the list-before-the-last paradigm, both of which reveal a crucial role for retrieval in enhancing list segregation. This pattern of results also follows clearly from a theoretical perspective in which retrieval drives internal contextual change, and contextual overlap between study and test promotes better memory. Consistent with that perspective, a 15-minute delay before the final test eliminated both effects (Experiment 2). Experiment 3 replicated the results of Experiment 1 with materials more appropriate for educational settings: interleaved semantic retrieval led learners to be more able to answer questions correctly about later texts but less likely to do so about earlier texts.
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(4035)

The Effect of Combined Retrieval on Memory. KYUNG HWA KIM and JOOYONG PARK, *Seoul National University*—It has been shown that retrieval effectively enhances memory. Testing phenomenon and pretesting effect are examples that demonstrate this. However, previous research examining these effects used only one mode of retrieval. The present study investigates whether combining two different modes of retrieval enhances memory more than employing just one mode when the total retrieval time is equal. In a paired associate learning task, after a repeated presentation of the cue-target pairs, test sessions were carried out in two different ways. In the combined retrieval condition, participants were asked to recall the target on a given cue and then choose the target among given options in a multiple choice format. In the single retrieval condition, participants were asked to recall the target during the same amount of time. Results show enhanced memory performance in the combined retrieval condition when compared to the single retrieval condition.
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(4036)

Repeated Retrieval Practice vs. Repeated Studying: A New Twist on an Old Problem. JOHN F. NESTOJKO and HENRY L. ROEDIGER, III, *Washington University in St Louis*—In recent years many experiments have demonstrated that repeated retrieval practice enhances long-term retention more than does repeated studying. In prior research the number of study and retrieval practice trials are often confounded. In the current experiment, the number of study trials (1, 2, or 4) and the number of free recall test trials (0, 1, 2, or 4) were manipulated between subjects in a factorial design. A main effect of both types of practice emerged on both initial tests and tests given two days later. Nonetheless, tests during initial acquisition produced a greater effect on delayed retention than did study trials: Despite subjects recalling only 40% of the words on the tests in the initial phase, the boost in delayed recall was as great as from study trials (with 100% presentation). Even when the factors are unconfounded, test trials are more potent for long-term retention than study trials.
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(4037)

Goal-interruption and Episodic Retrieval. MIHÁLY RACSMÁNY, PÉTER PAJKOSSY and ÁGNES SZŐLLŐSI, *Budapest University of Technology and Economics*—Based on the pioneering work of Zeigarnik (1927) we developed a novel paradigm to test the role of goal-attainment in episodic memory consolidation. In this task subjects have to complete word stems of category exemplars belonging to a given category. Subjects are informed that the task measures mental speed and if they cannot finish a given category in time, the task will be interrupted. During the word generation phase, the completion of words were randomly interrupted in half of the categories. Following 10 minutes delay an unexpected free recall or category-cued recall task was conducted. The results show that subjects tend to recall more items from the interrupted categories in the free recall task whereas such difference is absent in the category-cued recall task. These results suggest that task-completion in comparison to task-interruption leaves associated memories in an available, but in a less accessible form for later retrieval.
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(4038)

Look Both Ways Before Crossing Memory Lane: Bilateral Saccades Reduce Retrieval-Induced Forgetting. KEITH B. LYLE and JAMES M. EDLIN, *University of Louisville*—Numerous studies have shown that repeatedly making alternating left-right saccades enhances the subsequent retrieval of memories by either increasing correct retrieval or decreasing false retrieval. Saccade-induced retrieval enhancement has been obtained on a wide variety of memory tests. Here, for the first time, we examined the effect of saccades on retrieval-induced forgetting, which is the effect whereby retrieving some items from a category impairs retrieval of other items from the same category. We found significant retrieval-induced forgetting when subjects were tested immediately following a 30-second period during which they did not make saccades. When subjects were tested following 30 seconds of bilateral saccades, retrieval-induced forgetting was significantly reduced. This finding is consistent with the idea that saccades enhance retrieval by activating brain regions involved in modulating the activation level of neural representations.
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(4039)

Examining the Relationship between Retrieval-induced Forgetting and Stop-Signal Response Inhibition. CHRISTOPHER J. SCHILLING, *University of Illinois at Chicago,* BENJAMIN C. STORM, *University of California, Santa Cruz*—The retrieval of a subset of items can cause the forgetting of other items, a phenomenon referred to as retrieval-induced forgetting (RIF). Some have argued that RIF is the consequence of an inhibitory process that resolves competition during retrieval practice. Others have argued that RIF is the consequence of blocking or strength-based interference occurring at final test. Complicating matters is that the RIF observed on different types of tests (e.g., category-cued recall vs. category-plus-stem-cued recall) may not be measuring the same thing, a possibility supported by the results of the present study. We found that RIF measured using a category-plus-stem-cued-recall final test correlated positively with the ability to inhibit responses on a stop-signal task, whereas RIF measured using a category-cued-recall final test correlated negatively with the ability to inhibit responses on a stop-signal task. These results have important theoretical and methodological implications for the study of RIF.
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(4040)

Incubation Moderates the Relationship between Retrieval-Induced Forgetting and Overcoming Fixation. REBECCA H. KOPPEL, *University of Illinois at Chicago,* BENJAMIN C. STORM, *University of California, Santa Cruz*—In the Remote Associates Task (RAT, Mednick, 1962), participants are asked to generate a target word (e.g., cheese) that is related to each of three cue words (e.g., mouse, sharp, blue). Although performance on the RAT can be impaired by exposure to associations that cause mental fixation (e.g., mouse-cat, sharp-dull, blue-sky; Smith & Blankenship, 1991), recent work suggests that individual differences in retrieval-induced forgetting can predict a person's ability to overcome fixation (Storm & Angello, 2010). Presumably, participants who exhibit larger effects of retrieval-induced forgetting are more capable of overcoming fixation because they are better able to inhibit or reduce the accessibility of fixation-inducing associations. We replicated this finding in the present research but also found that implementing an incubation period between an initial problem-solving attempt and a subsequent problem-solving attempt eliminated the relationship between retrieval-induced forgetting and RAT problem-solving performance.
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(4041)

Forgetting and the Spacing Effect in Free Recall. PETER F. DELANEY and NAMRATA R. GODBOLE, *University of North Carolina at Greensboro,* PETER P.J.L. VERKOEIJEN, *Erasmus University,* YOOJIN CHANG, *University of North Carolina at Greensboro*—We present a series of experiments examining free recall of words repeated in either a spaced or massed fashion after a delay of several days. In immediate tests, there is a spacing effect such that spaced items are better recalled than massed items. Despite abundant evidence that the spacing effect gets larger with a delay, there is little research on what happens in free recall. Earlier studies on the spacing effect at a delay mainly used cued recall. The few free recall studies did not control encoding strategy, and so may have been vulnerable to rehearsal borrowing effects. Some theories of spacing predict that in free recall, spacing effects should diminish with a delay. However, consistent with other studies, we found that on mixed lists, spacing effects tend to remain the same size or grow with a delay (depending on how one interprets the scaling effect).
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(4042)

Exploring the Relationship Between Perceptual Binding and Long-Term Episodic Binding. JASON L. HICKS, *Louisiana State University,* MICHAEL R. DEWITT, *University of Georgia*—Previous research has shown that contextual attributes which are visual/spatial in nature become attentionally bound to objects during perceptual processing. The current research was conducted to examine the relationship between lower-level perceptual binding abilities and long-term source memory for similar attributes (i.e., episodic binding). We applied an individual differences perspective to this research question. Using change detection tasks to measure perceptual binding and traditional source memory tasks to measure episodic binding, our results suggest that variation in perceptual binding across individuals accounts for a significant amount of variance in source memory binding (e.g., word color). People better at perceptual change detection tasks were generally better at source memory tasks. Preliminary results further suggest that this relationship is independent of a more domain-general working memory capacity. Overall, these results suggest that early, perceptual feature-to-object binding plays a role in the encoding of long-term feature-to-object source memory binding.
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(4043)

A Chaining-Based Model of Serial Recall. SIMON J. DENNIS, *The Ohio State University*—Henson (1996) has argued that several results including ***llin effects, patterns of protrusions and performance on lists of alternating similar and dissimilar items (the sandwich effect) preclude a model of serial recall that relies on chaining associations between items. However, this conclusion is at odds with other data showing that serial recall improves dramatically when study lists approximate language at the letter and word levels and also is improved when spin lists that maintain chaining information, but confound positional information are repeated. I demonstrate that the objections to chaining models can be overcome if one assumes that associations act as constraints on a whole of list resolution process, rather than acting in a purely feedforward fashion. Furthermore, by resolving the chaining issue in this fashion one can create a model that is more similar to models of other episodic tasks.
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(4044)

A Single-Store Account of the Negative Recency Effect in Final Free Recall. JOEL R. KUHN, LYNN J. LOHNAS and MICHAEL J. KAHANA, *University of Pennsylvania*—The negative recency effect in final free recall has served as one of the main sources of support for dual-store accounts of the serial position effect. In a final free recall study we replicate the basic negative recency effect for the within-list serial position curve, and the positive recency effect for the between-list serial position curve. We find a prominent negative recency effect for items that were recalled early in the initial recall period, but a much weaker negative recency effect for items recalled late in the recall period. When considering initial recall as a second presentation of the item that is to be recalled during FFR, it is seen that as the lag (observed as the number of items between initial presentation and initial recall) increases, the probability of final free recall increases. We suggest that negative recency may be another reflection of the spacing effect, where end-of-list items recalled early constitute massed repetitions, and end-of-list items recalled late are spaced repetitions.
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(4045)

Manipulating the Forward Asymmetry of the Contiguity Effect With Categorized Stimuli. NEAL W. MORTON and SEAN M. POLYN, *Vanderbilt University*—In free recall, after an item is recalled, the next recall tends to be the item that was presented immediately after it. The context maintenance and retrieval (CMR) model proposes that this forward asymmetry is due to the integration of item-specific information into a temporal context representation, which is later used as a cue during recall. CMR predicts that the magnitude of the forward asymmetry should be sensitive to the similarity structure of the stimuli. In a categorized free-recall experiment, we estimate the neural similarity of the studied material using multivariate pattern analysis of oscillatory activity in scalp EEG. We find that, in line with CMR's predictions, categories with higher classification performance (suggesting higher inter-item similarity) show a diminished forward asymmetry, as well as increased overall recall. We present a version of CMR that can account for these interactions between temporal and semantic information during memory search.
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(4046)

Spontaneous Images in a DRM Task: Hypothetical and Autobiographical Events Compared. REBECCA B. BAYS and MARY A. FOLEY, *Skidmore College*—Writing imagery descriptions of false events can lead to memory inaccuracies with people believing these events might have occurred. We wondered if writing descriptions of events without explicit imagery instructions leads to memory inaccuracies as well. Using a modified DRM (Deese-Roediger-McDermott) paradigm, 36 participants wrote descriptions of hypothetical events that could happen or past events that have happened. Each event centered on a list of thematically related DRM items. No significant encoding duration differences emerged based on event type, and all but one participant reported experiencing vivid imagery while writing descriptions. False recognition errors were significantly higher for lures inadvertently mentioned in written descriptions of hypothetical events. In contrast, participants writing memories of actual experiences were least susceptible to lures included in their descriptions. Experiencing spontaneous imagery while writing about past events protected participants from false recognition errors, highlighting a potential benefit of imagery encoding on autobiographical memory.
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(4047)

Dividing Attention at Test Effects Subsequent Free Recall Performance. MARYELLEN HAMILTON, *Saint Peter's College*—Dudukovic, DuBrow & Wagner (2009) found that dividing attention at test impaired performance on a subsequent recognition test. The current work examined whether a similar effect would happen on a free recall test where there was no re-exposure to studied items that were not remembered. Specifically, all participants were presented with pictures under full attention, initial free recall happened under either divided or full attention, followed by a second free recall test under full attention. It was found that the effect of dividing attention at initial recall was not always apparent when looking at total items recalled on the second test. However, there was a consistent significant benefit for the divided attention group when looking only at new items recalled on test two (items not previously recalled). Implications of these finding will be discussed.
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(4048)

Semantic Similarity in Auditory Distraction: Encoding and Retrieval Processes. MACIEJ HANCZAKOWSKI, *Cardiff University,* PHILIP BEAMAN, *University of Reading,* DYLAN M. JONES, *Cardiff University*—In the literature on auditory distraction, the semantic similarity effect (SSE) is an observation of a greater disruption in memory performance caused by irrelevant distractors that are semantically related to the to-be-remembered material as compared to distractors with no semantic relationship to memoranda. Although the semantic similarity effect has been consistently obtained in studies examining free recall, the mechanisms of this effect are not well understood. The proposed accounts of this effect focus either on encoding operations, assigning the SSE to the overhead of recruiting inhibitory processes or attentional reorientation, or retrieval processes, focusing on changes in distinctiveness of to-be-remembered items and disruption of retrieval strategies. The purpose of the present experiments was to assess the contributions of the postulated mechanisms to the SSE. The recognition tests were employed to assess encoding hypotheses of the SSE and recall latencies were measured to gain insight into the dynamics of retrieval operations. The results of the experiments are most consistent with the retrieval strategy disruption mechanism.
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(4049)

Testing the Role of Source Credibility on Memory for Inferences. JIMMEKA J. GUILLORY, *Spelman College*—Research shows that people have difficulty forgetting inferences they make after reading a passage, even when the information that the inferences are based on is later known to be untrue. This study examined the effects of these inferences on memory and tested if the credibility of the source of the correction influences whether people use the correction, or continue relying on the original information when making inferences. According to source credibility theory, there are two main factors that contribute to credibility; expertise & trustworthiness. Experiment 1 examined credibility as a function of both expertise and trustworthiness. This experiment showed that having a correction from a source who is high on both factors significantly decreased the use of the original information. Experiment 2 examined credibility as a function of expertise. The Experiment 2 results showed that source expertise alone is not sufficient to reduce reliance on the original information. Experiment 3 showed that when you hold expertise neutral and manipulate only trustworthiness you can get a significant decrease in the use of the original information when the source is high on trustworthiness, compared to when the source is low on trustworthiness.
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(4050)

Retrieval Variability Promotes Superior Transfer of Learning. ANDREW C. BUTLER and ELIZABETH J. MARSH, *Duke University*—Many psychological theories posit that variability during learning should enhance long-term retention and transfer, but efforts to test this prediction have produced mixed results. In two experiments, we investigated whether retrieval practice with different examples of a concept promotes greater transfer than repeated retrieval practice with the same example. Subjects watched a lecture about geological science and answered application questions about concepts: either the same question three times or three different questions. Experiment 2 also included a condition that involved studying the information from the application questions (i.e. either the same example or three different examples). Two days later, subjects took a final test with new application questions. Both experiments showed that retrieval variability produced superior transfer. Experiment 2 also showed a testing effect and a benefit of encoding variability in the study condition. Introducing variability during learning may have improved understanding of the concepts, thus facilitating subsequent transfer.
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(4051)

Eyes Wide Open: Enhanced Pupil Dilation When Selectively Studying Important Information. ROBERT ARIEL, *Kent State University,* ALAN D. CASTEL, *University of California, Los Angeles* (Sponsored by Christopher A. Was)—Remembering important information is imperative for efficient memory performance, but it is unclear how we encode important information. In the current experiment, we measured changes in learners' pupil diameter while studying information that varied in terms of value. Participants performed a selectivity task that involved studying lists consisting of words associated with different point values. They were instructed to maximize their score on a free recall task that they completed after studying each list. Participants' pupils dilated more when studying high-valued than low-valued words within each list and these changes were associated with better memory for high-valued words. Moreover, participants increased their selectivity across lists, but changes in pupil diameter could not completely account for this increased selectivity. These results suggest that learners allocate cognitive resources differently to items as a function of their value, and that various processes and operations contribute to value-based remembering.
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(4052)

What Forgetting Tells Us About Remembering: Hemispheric Differences in Memory Retrieval. MICHAEL J. TAT and TAMIKO AZUMA, *Arizona State University*—The Production Affects Reception in the Left Only (PARLO; Federmeier, 2007) framework predicts the left hemisphere (LH) is more efficient in the encoding of verbal memories compared to the right hemisphere (RH). However, PARLO does not specify how the hemispheres retrieve items that were actively learned or suppressed during encoding. In the current experiments, participants studied a list of centrally presented words and were cued to remember some words and to forget others. Later, participants were tested on their recognition memory for all of the words. Memory test items were presented in a divided visual field format. Overall recognition accuracy was higher in the LH than in the RH. Additionally, the LH was faster to retrieve actively studied items and slower to retrieve actively suppressed items relative to the RH. The current results extend PARLO and suggest that the LH is more efficient in retrieving actively studied items from memory.
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• FALSE MEMORY/ MISINFORMATION EFFECT •

(4053)

Production of False Memories in the DRM Paradigm Using Lists With Two Critical Items. HELENA OLIVEIRA, *Maia Institute of Higher Education,* PEDRO B. ALBUQUERQUE and ARMANDO MACHADO, *University of Minho*—The production of false memories through the DRM paradigm has been studied by presenting associated words followed by recall and recognition tests. In this paradigm each list of words is associated with a critical item, which is not part of the list. A false memory occurs when the participant recalls or recognizes the critical item as a list member (Roediger & McDermott, 1995). In our experiments, participants were exposed to lists of 12 words associated with two critical items (e.g., the first six words were associated with "slow" and the other six with "sweet"). The aim of these studies was to determine the limits

of the false memory effect considering that in this task each list contained two themes. Results showed that the amount of false memories is significantly higher for the critical items associated with the first half of the lists.
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(4054)

Negatively Valenced False Memories Can and Do Have Positive Consequences. SAMANTHA WILKINSON and MARK L. HOWE, *Lancaster University*—False memories have a tendency to persist over time, while true memories decline. Research has also shown that: (1) false memories generated using the Deese/Roediger-McDermott (DRM; 1995) paradigm are more effective than true memories at priming insight-based problem solutions (compound remote associates task or CRAT) following a one-week delay; and (2) when valence is manipulated, false-negative memory rates increase over a delay interval. The current study examined the efficacy of true and false memory primes for positive and negative DRM lists on a set of CRATs. Two hundred and seventy participants studied either positive- or negative-themed DRM lists whose critical lures were also the solutions later CRATs that they attempted to solve either immediately or one week later. The critical lures were either generated by the participants (false memory) or included as part of the list (true memory). We found that false-negative memories were more effective problem-solving primes than true or positive memories particularly following a one-week delay.
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(4055)

False Memory in Immediate Backward Serial Recall for Phonological and Semantic Associations. RACHAEL A. WYNNE and GEORGINA A. TOLAN, A*ustralian Catholic University,* GERALD TEHAN, *University of Southern Queensland*—The use of the DRM paradigm to elicit false memory effects has been well documented (Roediger & McDermott, 1995). Effects have been demonstrated in the short term when words lists are semantically (Tehan, 2010) and phonologically (Sommers & Lewis, 1999) associated to a non-represented lure and also in combined phonological-semantic associate 'hybrid' lists (Watson, Balota & Roediger; 2003). This study explored the false memory effect under immediate backward serial recall within a modified DRM paradigm. Participants were randomly allocated to forward (N = 20) or backward (N = 20) serial recall and were presented with six-item word lists. Four types of word lists were utilised; alternating semantic and phonological associates, phonological followed by sematic associates, sematic followed by phonological associates and a control condition. The results are discussed in relation to the Primacy Model (Page & Norris, 1998) which maintains that there should be no difference between forward and backward recall.
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(4056)

Sleep Can Increase and Decrease Susceptibility to Misleading Information. KIMBERLY M. FENN, *Michigan State University,* MARIA S. ZARAGOZA, *Kent State University*—Previous research has established that although sleep may consolidate declarative memory, the role of sleep in the consolidation of false memory is unclear. Some work shows that sleep increases false memory whereas other work shows that sleep decreases false memory, in the DRM paradigm. Here, we used a suggested memory paradigm and presented misleading post-event information to participants. When conflicting information was presented after sleep, memory was more resistant to distortion compared to a waking control group, consistent with the view that sleep stabilizes memory to resist interference. However, when the same information was presented prior to sleep, false memory was higher than a wake group. This suggests that sleep may protect memory against distortion but that if conflicting information is presented prior to sleep, sleep may consolidate and integrate information from multiple sources which can serve to increase memory distortion.
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(4057)

Short- and Long-Term Consequences of Directed Forgetting. SARA B. FESTINI and PATRICIA A. REUTER-LORENZ, *University of Michigan*—The mechanisms and memorial consequences of directed forgetting implemented within a working memory (WM) task are not yet understood. Using a modified item-recognition task, this study investigates how the instruction to forget one of two short lists of converging associates influences the occurrence of short and long-term memory distortions, as well as the long-term memorability of list items. Experiment 1 tested WM only and demonstrated that directed forgetting reduces false recognition errors and semantic interference. Experiment 2 replicated these WM effects and a surprise long-term memory test (LTM) demonstrated that veridical memory for to-be-remembered lists was better than memory for to-be-forgotten lists—the classic "directed forgetting effect." Moreover, fewer false memories emerged for to-be-forgotten lists than for to-be-remembered lists in LTM as well. These results indicate that directed forgetting during WM reduces semantic processing of to-be-forgotten lists over the short and long term. Implications for theories of false memory and the mechanisms of directed forgetting will be discussed.
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(4058)

Working Memory, Source Monitoring and False Memory: An Individual Differences Perspective. KERRI A. GOODWIN, *Towson University,* LATASHA R. HOLDEN, *Princeton University,* KAITIN M. ENSOR, *Towson University*—The present study examined the relationship between working memory capacity (WM) and false memory (FM) with source monitoring ability (SM) as a mediator. Working memory tasks included operation span (OSPAN) and reading span (RSPAN). False memory was assessed using the DRM paradigm, including word lists presented from

audio and visual sources. Source monitoring was assessed based on items correctly recognized as audio or visual sources within the DRM paradigm. The high spans were predicted to have fewer false memories relative to average or low span participants. In addition, higher span was predicted to be associated with more accuracy in source monitoring ability. Bivariate correlations found higher WM span was directly related to SM, but for RSPAN only. Furthermore, RSPAN and SM were predictors of false recognition. Explanations based on the activation-monitoring-framework are discussed.
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(4059)

Accessibility of Prior Knowledge and Susceptibility to Semantic Illusions. HILLARY G. MULLET, SHARDA UMANATH and ELIZABETH J. MARSH, *Duke University*—People incorporate errors into their knowledge bases (e.g., the capital of Russia is St. Petersburg) even when they have the correct knowledge stored in memory (e.g., Fazio et al., in press). One explanation for this surprising finding is that exposure to errors increases their accessibility, making those errors come to mind more easily than long-held but infrequently accessed beliefs. To test this, we manipulated when participants accessed their prior general knowledge, either one week (low accessibility of prior knowledge) or a few minutes (high accessibility of prior knowledge) before reading stories that contained misleading answers to target general knowledge questions. Surprisingly, retrieving prior knowledge directly before the story-reading phase did not protect against the learning of story errors. Retrieving prior knowledge may temporarily increase the malleability of those memories and/or attract participants' attention to relevant details in the stories.
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(4060)

The Roles of Associative Activation and Thematic Extraction in False Memories. PAULA CARNEIRO, *Universidade de Lisboa,* ANGEL FERNANDEZ, *Univesidad de Salamanca,* PEDRO ALBUQUERQUE, *Univesidade do Minho,* LEONEL GARCIA-MARQUES, *Universidade de Lisboa*—The main aim of this study was to analyze whether false memories in the DRM paradigm are driven by associative activation, thematic extraction or by both processes. Associative lists with two different types of critical items (CI) were used: one, associative, corresponding to the word most strongly primed by its associates; and another, thematic, which best describes the theme of the list. Following 3 different types of encoding instructions (standard, warning or strategic), false recognition for these two types of CI was analyzed in either self-paced or speeded-response tests. The results showed considerable levels of false memories for both types of critical items. However, false recognition was higher for associative than for thematic items, which suggests that associative activation plays a higher role in false memory formation. Thematic items were more prone to be rejected, reinforcing the argument that thematic identifiability has a major role in the rejection of false memories.
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(4061)

Divergent False Memories: Inferential Costs of the Centrality Effect. LUDMILA D. NUNES, LEONEL GARCIA-MARQUES and MÁRIO B. FERREIRA, *University of Lisbon*—We used an extension of a false-memory paradigm to study the impact of central personality traits in memory. We developed lists containing several traits of one dimension (social or intellectual) and valence (positive or negative) and one central trait highly representative of the opposite dimension and valence of the other list traits. Participants were instructed to either form impressions of personality or to memorize the list. Recognition tests showed that impression formation relative to memory participants produced not only higher levels of false memories congruent with the list traits but also produced more false memories congruent with the central trait, especially under time pressure at test. Thus we obtained false memories presenting only one trait-word that was from the opposite valence of the other traits in the list. So, we showed that it is possible to obtain a false memory effect by divergent activation of associated words to a single word. This effect was only possible due to the activation of the associative structure underlying the implicit theory of personality, which is conditional to impression formation goals. The implications of these results to gist-based and activation-based memory theories are discussed.
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(4062)

Hemispheric Asymmetries in the Activation and Monitoring of Memory Errors. JEANNETTE GIAMMATTEI, JASON ARNDT and DIVYA DETHIER, *Middlebury College*—Previous research suggests that the right hemisphere's tendency to produce more memory errors than the left hemisphere reflects hemispheric differences in semantic memory activation. However, all prior research that has examined the lateralization of memory errors has used self-paced recognition judgments, which likely reflect the combined influence of fast-acting memory processes (activation) and slower memory processes, such as strategic monitoring processes. This study separated the influence of activation from monitoring by manipulating the time subjects were given to make memory decisions. The results indicated that when retrieval was fast, the right hemisphere produced more memory errors than the left hemisphere. However, when retrieval was slow, the left hemisphere's error-proneness increased compared to the fast retrieval condition, while the right hemisphere's error-proneness remained the same. These results suggest that the right hemisphere's errors are largely due to activation, while the left hemisphere's errors are influenced by both activation and monitoring.
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(4063)

The Relationship Between Recall and Recognition in Phonological False Memory. SHAN RIEVAN SALLEH and WINSTON D. GOH, *National University of Singapore*—In this study, we looked at words with low or high confusable phonological associates and their susceptibility to false recall and recognition. The relationship between recall and

recognition was investigated by examining the extent to which false and veridical recognition was dependent on prior false and veridical recall. Previous studies have shown that words with highly confusable associates tended to have much higher false recall and recognition rates than words with low confusable associates. This study found similar results, however, false recognition tended to be lower if participants had falsely recalled it earlier. This is unlike veridical recognition that produced higher recognition rates when previously recalled. The pattern of results suggests that the underlying processes for veridical and false recognition of phonological associates are not the same.
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• WORKING MEMORY III •

(4064)

Further Investigation of Phonological Similarity Effects in Complex Working Memory Span. MICHAEL A. CHOW, BROOKE MACNAMARA and ANDREW R.A. CONWAY, *Princeton University* (Sponsored by Jason Chein)—The phonological similarity effect refers to impaired serial recall for lists of phonologically similar items relative to lists of dissimilar items. This robust finding serves as a key consideration in most theories of short-term memory and is a benchmark for models of serial recall. However, in complex working memory span, where a secondary task is interleaved between to-be-remembered (TBR) items, the effect of phonological similarity is less clear; in some cases the classic impairment is observed but in other cases there is no effect, and in others there is facilitation. In order to provide a principled account of the effect of phonological similarity in complex span, we manipulated the nature of the secondary task, specifically the type of process required and the stimulus content, while holding TBR items constant. Both process and content of the secondary task influence the phonological similarity effect in complex working memory span.
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(4065)

Dissociating Levels of Linguistic Representation in Short-Term Memory. YINGYING TAN, *Rice University,* DANIEL J. ACHESON, *Max Planck Institute for Psycholinguistics,* RANDI C. MARTIN, *Rice University*—This study assessed the role of semantic, phonological, and grammatical levels of representation in short-term list recall through a 2 (meaningfulness) × 2 (phonological similarity) ×2 (grammaticality) manipulation. Two groups of undergraduate subjects recalled lists consisting of three or four word-pairs. Within each list, meaningfulness was manipulated by pairing adjectives and nouns in a meaningful ("bright light") or non-meaningful ("sour pan") way; phonological similarity was manipulated through the degree of phonological overlap between words; grammaticality was manipulated through the order of the adjective and noun within each word pair (e.g., "salty meat" vs. "meat salty"). Subjects showed better recall for words in the meaningful, phonologically dissimilar, and grammatical conditions. In the 8-item lists, the phonological effect was especially large for meaningful lists. As a future direction, we will investigate whether individual differences in the size of these effects relate to semantic vs. syntactic processing abilities in sentence comprehension.
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(4066)

Role of Serial Order in Auditory Distraction in Children and Adults. EMILY M. ELLIOTT, *Louisiana State University,* ROBERT W. HUGHES, *Royal Holloway, University of London,* WILLIAM J. MACKEN, *Cardiff University,* ALICIA M. BRIGANTI and KERI L. KYTOLA, *Louisiana State University*—Irrelevant sound impairs serial recall in both children and adults; however, it is unclear whether the mechanism of distraction is the same for the two populations. Here, we investigated the role of focal serial processing in auditory distraction in children and adults. We found that children are as disrupted by sound (compared to quiet) regardless of whether focal serial order processing is required and regardless of whether the sound is changing or unchanging. Adults, however, were only disrupted by sound (compared to quiet) when serial order processing was required and were particularly disrupted by changing-state sound (this effect disappeared when focal serial order processing was impeded through articulatory suppression). The results suggest that children are susceptible to auditory distraction due to some general attentional cost whereas adults' susceptibility is mediated by a specific conflict between similar processes being applied to the sound and the task.
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(4067)

Working Memory Span Task Administration and Predicting Higher Cognitive Function. TESSA M. ANDERSON, TINA M. MIYAKE and KANDI J. TURLEY-AMES, *Idaho State University*—WM capacity has been measured through several different means. The operation span task (Ospan), a commonly used WM task, has been administered using various techniques (i.e., original, Turner & Engle, 1989; with strategy training, Turley-Ames & Whitfield, 2003; completely automated (Aospan), Unsworth, Heitz, Schrock, & Engle, 2005). There are a number of differences between these varying techniques that may affect the Ospan's ability to predict higher cognitive functioning (HCF). Given these differences, it is questioned how well each of these tasks are measuring the same construct, WM. The present study established that there is a relationship between these three different administration techniques for the Ospan and with measures of HCF. Results indicated that using a strategy with the Ospan proved to be the best predictor of HCF. Differences in task administration, and practical and theoretical considerations are discussed.
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(4068)

Memory Span and Individual Differences in Activation: Implicit and Explicit Measures. LINDSEY LILIENTHAL and ELAINE TAMEZ, *Washington University in St. Louis,* NATHAN ROSE, *Rotman Research Institute,* JOEL MYERSON and SANDRA HALE, *Washington University in St. Louis*—Unsworth and Engle (2007) hypothesized that

low-span individuals retrieve relevant items from secondary memory less efficiently than high-span individuals because retrieval cues are more likely to activate irrelevant information (e.g., items from previous lists). Two experiments tested this hypothesis using explicit (Exp. 1) and implicit (Exp. 2) activation of memory items. In Exp. 1, participants performed an operation span task and made list-source judgments for previously seen words. As predicted, low-span individuals were less able than high-span individuals to distinguish words on the current list from those on the previous list. In Exp. 2, participants performed an operation span task and either recalled the memory items or made lexical decisions regarding current and previous memory items as well as new words and nonwords. Contrary to Unsworth and Engle's hypothesis, lexical decision RTs revealed no differences between low and high spans in the pattern of activation for current and previous items. Thus, low spans and high spans do not appear to differ in the activation of memory items, but do appear to differ in their ability to filter items once they are retrieved from secondary memory.
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(4069)

Word Length and Response Modality in Immediate Memory: New Insights on Retrieval Processes. JEAN SAINT-AUBIN and KATHERINE GUÉRARD, *Universite de Moncton*—The current study is aimed at understanding the contribution of retrieval processes to immediate serial recall performance by investigating the word length effect. Specifically, it has been claimed that the limit in recall is partly due to the duration of spoken output (see, e.g., Cowan, 1995). We tested this hypothesis by manipulating word length, recall direction (forward vs. backward) and response modality in an order reconstruction task. At recall, all words reappeared simultaneously on the screen in a random order and 20 participants answered by clicking on them, while 20 answered by saying them aloud. Results revealed an interaction between word length and recall modality with a larger word length effect when participants clicked on the words than when they recalled them orally. This result is contrary to previous findings with children (e.g., Henry, 1991) and its implications for models of immediate memory are discussed.
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(4070)

Presentation Style Influences Time-Based Forgetting in Working Memory. TIMOTHY J. RICKER and NELSON COWAN, *University of Missouri*—In the last decade a debate has been ongoing concerning whether longer retention intervals necessarily result in more forgetting in working memory. A potential obstacle to directly comparing conflicting reports is a divergence in methodology across studies. Studies which find no forgetting as a function of retention-interval duration tend to use sequential presentation of memory items, while studies which find forgetting as a function of retention-interval duration tend to use simultaneous presentation of memory items. Here we manipulated duration of retention and presentation style of memory items, either sequential or simultaneous, while keeping all other factors the same. We found that presentation style strongly influenced memory performance. These finding help explain many of the conflicting time-based findings in the literature and allow for a more complete understanding of forgetting processes in working memory.
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(4071)

Knowledge Biases Recall Over the Short Term: Familiar Objects and Faces. MARIE POIRIER, LOUISE TAYLOR, DANIEL HEUSSEN and JAMES HAMPTON, *City University London*—The present study extends the findings of Hemmer and Steyvers (2009a) by investigating the influence of knowledge on short-term visual memory. We tested how prior knowledge biases short term recall using familiar (vegetables, famous faces) and non-familiar stimuli (random shapes, unknown faces). Participants (Ps) saw lists of six images; each list held images of familiar or less familiar stimuli. Immediately after list presentation, one of the items was presented again, but with a distortion (either in size or in similarity to the presented item). Ps were asked to use a slider bar to re-create the image so that it was as close as possible to the just-presented item. Results showed that memory was supported by prior knowledge. However, there was also clear evidence of false memory and knowledge induced biases. Familiar items were remembered as closer to the well known item than was warranted by the actual, very recent, presentation.
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(4072)

A Modified Velten Procedure: Can Anxiety and Serenity be Maintained? JOSEPH W. HARRIS and EMILY M. ELLIOTT, *Louisiana State University*—The Velten procedure used a series of progressively more-emotional sentences to induce sensations of elation and depression. Sinclair, Soldat, and Ryan (1997) developed a Velten-like procedure to induce anxiety and serenity; their method was replicated in the current study of mood and cognition. The purpose was to determine the extent to which any observed changes in state anxiety (as a separate index of anxiety and serenity levels) were maintained throughout the duration of an experimental procedure which included working memory and Stroop measures. It was found that though anxiety and serenity levels were significantly changed by the Velten-like inductions, the effect was not maintained throughout the testing period (approximately 90 minutes). It was also found that the mood measure developed for evaluating emotional valence and arousal following the induction procedures was unable to accurately detect arousal changes in participants who were induced into a state of anxiety. The implications of these findings are discussed.
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(4073)

Trait Worry and Selection: Irrelevant Thoughts Affect the Updating Process. DANIEL E. GUSTAVSON and AKIRA MIYAKE, *University of Colorado, Boulder* (Sponsored by James A. Kole)—This research investigates the effects of trait worry, a subcomponent of trait anxiety, on the process of updating information in working memory (WM). The leading

theory on anxiety and executive functions (attentional control theory) states that trait anxiety is not related to WM updating. However, preliminary research revealed that, controlling for trait levels of anxious arousal and depression, high trait worry was related to inefficient selection of information on a WM deletion task. To further test this selection-difficulty hypothesis, we modified the design of the task such that we can replicate the initial finding and then rule out additional alternative explanations. Subjects completed the modified WM deletion task, which included an updating phase in addition to memorization and deletion steps, 2 measures of WM span and questionnaires measuring trait levels of mood variables. Results provide evidence for replication of the initial findings and support for the selection-difficulty hypothesis.
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(4074)

When Higher Working Memory Leads to Choking or Excelling under Pressure on a Sensorimotor Skill. MARCI S. DECARO, *University of Louisville*—Different high-pressure performance situations can impact attention in different ways. When individuals perform for an important outcome (monetary reward), attention is often diverted from performance. In contrast, when monitored by others (videotaped), individuals devote greater attention to the steps of performance (DeCaro et al., 2011). Depending on the attentional demands of the task, monitoring-pressure could therefore lead to better or worse performance compared to outcome-pressure. In Experiment 1, monitoring-pressure led to worse performance on a proceduralized sensorimotor skill operating largely outside attentional control (an uncued serial reaction-time task; SRTT). In addition, higher working memory capacity led to worse performance under monitoring-pressure. In Experiment 2, monitoring-pressure led to better performance on a sensorimotor skill that relied more on attentional control (a cued SRTT). Moreover, individuals with higher working memory capacity excelled under monitoring-pressure. Monitoring-pressure and higher working memory capacity can both lead people to focus more explicit attention towards skill performance. Whether this increased attention benefits or harms performance depends on task demands.
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(4075)

Decision-Making and Misinformation: Does Working Memory Capacity Matter? CRINA D. SILASI-MANSAT and DARRELL A. WORTHY, *Texas A&M University*—We examined how working memory capacity (WMC) affected the use of misinformation that was presented as foregone rewards for the non-chosen option in a dynamic decision-making task. Participants repeatedly chose from two options on each trial. The Decreasing option gave larger immediate rewards, but selecting it caused future rewards for both options to decrease. The Increasing option always gave smaller immediate rewards but selecting it caused future rewards to increase, making it the optimal choice. WMC was measured by the Operations Span (OSPAN) task. We found no relationship between WMC and decision-making performance for participants who were not shown foregone rewards, but high WMC capacity was associated with better performance for participants who were shown foregone rewards. Modeling results showed that high WMC was associated with reduced use of the information provided by foregone rewards. This suggests that high WMC is associated with a reduced susceptibility to misinformation in decision-making.
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(4076)

Repetition Schemas in Immediate Serial Recall. SIMON J. FISCHER-BAUM, *University of Illinois, Urbana at Champaign*—Item repetition has been shown to have important effects on accuracy during serial recall. These effects have led some researchers to posit repetition schemas – knowledge that the list contains a specific pattern of repeated items independent of knowledge about which item is repeated. This study uses error analyses to investigate repetition schemas, focusing on both immediately repeated (the Bs in ABBC) and trilled items (the Bs in ABCB). When a target list includes an immediate repetition, participants are more likely to include an incorrect immediate repetition in the response than an incorrect trill, while the opposite pattern is found when the target list includes a trill. Furthermore, participants occasionally intruded immediate repetitions and trills in their responses. These intrusions were preceded by a response that contained different items in the same repetition schema more often then would be expected by chance. Taken together, these results support an independent representation of item-identity and repetition schema information in short-term memory.
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(4077)

The Effect of Working Memory Capacity on Task-Switching Ability. REBECCA WELDON and MYEONG-HO SOHN, *The George Washington University* (Sponsored by Jacqueline Shin)—Working memory capacity (WMC) is often measured in the laboratory using complex span tasks (e.g., Operation span) that involve alternating between maintaining items in working memory and engaging in a secondary processing task (e.g., verifying math equations). Thus, task-switching is a critical component of the span tasks, and therefore, contributes to the measure of an individual's WMC. The present study tests the hypothesis that WMC is related to task-switching abilities. Participants completed a three-task experiment in which color served as the cue. In half of the trials, an advanced cue preceded the presentation of the target stimulus. We found that WMC contributes to effective reduction in switch cost following a task switch, but only in the advanced cue condition. These findings suggest that WMC is related to switching a task under certain conditions.
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(4078)

Central (Re)Construction Processes in Working Memory. EVIE VERGAUWE, NAOMI LANGEROCK and PIERRE BARROUILLET, *University of Geneva* (Sponsored by Anik de ribaupierre)—According to the Time-Based Resource-Sharing

model of working memory, the ephemeral nature of working memory representations of information to be maintained obliges to frequently refresh them. This refreshment by reconstruction of the representations would occupy the executive loop and as such postpone other activities that require this executive loop. From this, the theory predicts that, when processing and storage are combined, the postponement of concurrent processing activities should be a direct function of the number of representations to be maintained. Using a new paradigm in which processing and storage activities are combined, we have recently shown such a memory load-related postponement of concurrent processing for both simple verbal and simple spatial information to be maintained (Barrouillet, Vergauwe, & Camos, submitted). Using this new paradigm, the present study aimed at examining whether this is also the case for more complex information (letters in locations) and whether it takes longer to (re)construct such complex working memory representations than to (re) construct simple working memory representations (letters or locations). The results suggest that this is the case.
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(4079)

A Four-Dimensional Video Game For Measuring Cognitive Ability. AMBER M. SPRENGER, *Center for Advanced Study of Language,* SHARONA M. ATKINS, *University of Maryland,* GREGORY J.H. COLFLESH, *Center for Advanced Study of Language,* TIMOTHY L. BRINER, JACOB B. BUCHANAN, SYDNEE E. CHAVIS, SY-YU CHEN and GREGORY L. IANNUZZI—Many individual difference measures require extensive involvement of the experimenter, are language specific, are not easily administered, scored, or deployed over the internet, and exclude participants who do not score at criterion on the processing component of the task (Turner & Engle, 1989; Conway, et al., 2005). In this paper, we introduce Shapebuilder, a new measure of WM that is instantiated within the context of an internet gaming environment that can be administered in under 7 minutes anywhere with internet access. Shapebuilder requires that participants maintain a four-dimensional representation of a set of serially presented stimuli, and recall those stimuli in sequential order. We present the results of a large factor analysis study and 4 additional experiments examining the properties of Shapebuilder and its relation to other abilities such as task switching, response inhibition, and interference resolution. The results illustrate that Shapebuilder is a valid measure of working memory.
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• METAMEMORY/METACOGNITION III •

(4080)

Metacognition of Multi-Tasking. JASON R. FINLEY and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign,* JASON S. MCCARLEY, *Flinders University*—Risky multi-tasking, such as texting while driving, may occur because people have inaccurate metacognition about the costs of divided attention. In two experiments, participants performed a computerized visual-manual tracking task in which they attempted to keep a mouse cursor within a small target that was moving erratically around a circular track. Later, participants separately performed an auditory n-back task. After practicing both tasks separately, participants received feedback on their single-task tracking performance and then predicted their dual-task tracking performance before finally completing the two tasks simultaneously. Participants correctly predicted reductions in tracking performance under dual-task conditions, but the between-subjects correlation between predicted and actual decrement was near zero (r = -.01). This finding implies that people have no insight on the extent to which they are personally vulnerable to the costs of divided attention. Such poor metacognition may contribute to risky behavior.
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(4081)

Does Performance Monitoring Depend on Cognitive Load? CHRISTOPHER A. STEVENS and RICHARD A. CARLSON, *The Pennsylvania State University*—There is little research on how individuals monitor their performance under high cognitive workload. We examined performance monitoring in a paradigm designed to assess how performance declines as cognitive load increases. Participants monitored one to eight channels of visual information to detect stimuli that met certain criteria. Cognitive load was manipulated in two ways: by varying the number of channels to be monitored and by varying the complexity of the cognitive judgments. Each trial required participants to monitor a rapidly changing display and make multiple responses. At the end of each trial, they reported the percentage of targets they believed they had correctly reported and the percentage of responses they believed had been false alarms. These reports were reasonably accurate for low to moderate cognitive loads, but declined in accuracy with increasing load. These results suggest that monitoring is not automatic but shares cognitive resources with task performance.
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(4082)

Updating Metacomprehension: Selecting Effective Learning Strategies after Experience. ELAINE TAN, DEBORAH K. EAKIN, JARROD MOSS and AARON Y. WONG, *Mississippi State University*—Using effective learning strategies plays a significant role in text comprehension. Research has shown that students are often poor at identifying effective strategies, and are not aware of the benefits of effective strategies (e.g., Karpicke et al., 2009). Poor strategy selection is a failure of metamemory, and can result in poor monitoring of text comprehension, or metacomprehension. The present study investigated whether experience with an effective strategy led students to update their strategy selection to a more effective one. Students chose from among three strategies to learn text: two ineffective--re-reading, highlighting--and one effective--retrieval practice. Students were then trained on retrieval practice, and selected a strategy for a new text. Comprehension accuracy was highest when students switched

from the ineffective strategies to the effective strategy. However, metacomprehension ratings did not always reflect performance. The findings will be discussed in terms of the role metacomprehension plays in text comprehension.
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(4083)

Comprehension Testing Affects Metacomprehension Accuracy and Regulation. KEITH THIEDE and JOSHUA REDFORD, *Boise State University,* JENNIFER WILEY and THOMAS GRIFFIN, *University of Illinois at Chicago*—Two groups of 7th and 8th grade students, who experienced different kinds of tests of comprehension throughout their elementary education, showed very different metacognitive monitoring of texts. A group that regularly took tests of deep comprehension more accurately predicted inference test performance than the other group. The groups did not differ in accuracy for predicting detail test performance. In a second study, the group with greater metacomprehension accuracy made more effective regulation decisions, and had improved comprehension on a subsequent test.
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(4084)

Judgments of Understanding Predict Transfer Performance in a Multimedia Lesson. CELESTE C. PILEGARD and RICHARD E. MAYER, *University of California, Santa Barbara*—Accuracy of judgments in metacomprehension tasks is widely found to be low. The present study extends metacomprehension research by including judgments of understanding, transfer test measures, and multimedia learning materials. College students viewed a multimedia lesson on how a solar cell works and were asked to indicate at five points throughout the lesson either their memory for the material ("How well do you remember [topic]?") or their understanding ("How well do you understand [topic]?"). The lesson was followed by retention and transfer test questions. Judgments of understanding correlated significantly with transfer (r = .75) and retention performance (r = .68). Judgments of remembering correlated significantly with retention (r = .39) but not transfer performance (r = .16). Learners may be better able to assess their level of understanding when they receive challenging multimedia lessons, and when understanding is measured with transfer performance. Further, learners may be able to distinguish between rote versus generative learning, such that judgments of remembering correlate with retention but not transfer, and judgments of understanding correlate most highly with transfer.
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(4085)

Memory and Metacognition for Piano Melodies: Illusory Advantages of Fixed Over Random-Order Practice. BRANDEN F. ABUSHANAB, *University of North Carolina at Greensboro,* ANTHONY J. BISHARA, *College of Charleston*—Some learning schedules can foster an illusion of competence, whereby the learner feels that the skill will be better retained than it actually will be. Consider fixed-order practice, where a person practices a task repeatedly before switching to the next task (e.g., Task A, A, B, B); in contrast, in random-order practice, a person randomly alternates among two or more tasks (C, D, D, C). In the present experiment, participants who had formal training in piano practiced melodies under fixed or random-order conditions (within-subjects), and then returned for a retention test two days later. Initially, participants performed faster on melodies practiced in fixed-order. However, on a retention test two days later, participants were faster with melodies from the random-order condition. Despite the within-subjects design, which facilitates the comparison of practice conditions, participants' metacognitive judgments indicated an illusion of competence, whereby participants erroneously believed that fixed-order practice would result in faster retention performance. Our results suggest that even some trained musicians may use ease of acquisition as a heuristic for predicting future performance.
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(4086)

Delay and Déjà Vu: Both Timing and Repetition Increase the Power of False Evidence. DEBORAH S. WRIGHT, KIMBERLEY A. WADE and DERRICK G. WATSON, *University of Warwick*—False images and videos can induce people to believe in and remember events that never happened. Using a novel method, we examined whether changes in when false evidence is presented (Experiment 1), or how many times it is presented (Experiment 2), make false evidence even more powerful. Subjects completed a hazard perception driving test and were falsely accused of cheating. Some subjects were also shown a fake video or photograph of the cheating either after a 9 minute delay (Experiment 1) or more than once (Experiment 2). Subjects were more likely to falsely believe they had cheated and to confabulate details about how the cheating happened when the false evidence was delayed or repeated relative to controls. There was also an additive effect of repetition over time. Our results refine the metacognitive model of memory and have implications for the disclosure of evidence during police interrogations.
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(4087)

Meta-Awareness of Intrusive Thoughts About Trauma. MELANIE TAKARANGI, *Flinders University,* DERYN STRANGE, *John Jay College of Criminal Justice,* D. STEPHEN LINDSAY, *University of Victoria* (Sponsored by Steve Janssen)—Research examining people's maladaptive responses to traumatic experiences routinely relies on self-reported intrusive thoughts. This method assumes that people can accurately recognize and report the occurrence of such symptoms. However, we know from the mind wandering literature that people are not always aware of the content of their thoughts. For example, they may fail to realize when the object of their thoughts has shifted. We exposed subjects to a traumatic film, followed by a reading task. We instructed subjects to report the occurrence of intrusive thoughts about the film during the reading task. At intervals we also asked them whether they were thinking about the film. As expected,

subjects often spontaneously reported thinking about the film. However, they were also often 'caught' engaging in unwanted thoughts about the film. These data suggest that people may lack meta-awareness of their trauma-related thoughts, and have implications for theory and treatment of trauma-related psychopathology.
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(4088)

False Memory Susceptibility in Operation Enduring and Operation Iraqi Freedom Veterans With and Without PTSD. SARA K. JUBACK and MICHELLE N. DASSE, *Baylor University,* LIANNA D. EVANS and SANDRA B. MORISSETTE, *Veterans Affairs VISN 17 Center of Excellence for Research on Returning War Veterans,* CHARLES A. WEAVER, III, *Baylor University* (Sponsored by William L. Kelemen)—False memory susceptibility was measured in 58 Iraq/Afghanistan Veterans with PTSD (N=21) and without PTSD (N=36) using a modified Deese-Roediger-McDermott (DRM) wordlist paradigm, which included trauma-related critical lures. PTSD was classified using medical record diagnoses. Participants also completed a variety of self-report assessments, including Beck Depression Inventory (BDI), the Dissociative Experiences Scale (DES), the Tellegen Absorption Scale (TAS), and the Anxiety and Stress subscales of the Depression Anxiety Stress Scales (DASS). As anticipated, Veterans with PTSD scored significantly higher on the BDI, DES, TAS, and the Anxiety and Stress subscales of the DASS. All participants had higher false alarms for trauma-related words than for neutral words (on non-critical lures). False recognition for the critical lures, however, displayed an interaction between word type and diagnosis: control participants committed fewer false alarms to trauma-related critical lures than to non-traumatic critical lures; veterans with PTSD showed a slightly higher false alarm rate to trauma-related critical lures. These results suggest differential processing of trauma-related information by those with PTSD.
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(4089)

Knowing the Crowd Within: Combining Theory and Experience in Metacognitive Judgments. SCOTT H. FRAUNDORF and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign* (Sponsored by Gary Dell)—Averaging multiple estimations from the same judge typically improves accuracy, but it is unknown whether people would voluntarily employ this strategy. Participants estimated answers to general knowledge questions on two occasions (e.g., "What percent of the world's population uses the Internet?"), then decided whether their first, second, or average estimate was most accurate. The decision environment was manipulated to emphasize analytic (theory-based) versus nonanalytic (experience-based) judgments. Given only analytic cues (the labels "first guess", "second guess", and "average"), participants mostly averaged, but were no more apt to average on questions where the average was most accurate. Given only nonanalytic cues (numerical values of the three choices), metacognitive accuracy was at chance. Given both cues, participants mostly averaged and showed evidence of selecting the most accurate strategy on a per-question basis. These results reveal some appreciation for the benefits of averaging and demonstrate that metacognition benefits from combining analytic and nonanalytic cues.
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(4090)

The Effect of Domain Knowledge on False Memories. TRAVIS R. RICKS, KIMBERLY M. FENN and ZACH HAMBRICK, *Michigan State University*—This experiment investigated whether domain knowledge protects against false memory for domain-specific information. Participants studied five Deese-Roediger-McDermott (DRM) lists, one list of Major League Baseball (MLB) team names, and one list of National Football League (NFL) team names. There was a recall test after each list, and a recognition test at the end. Participants then completed tests of baseball knowledge, football knowledge, and general knowledge. Independent of general knowledge, sports knowledge (the average of the baseball and football knowledge test scores) negatively predicted false recognition of team-name lures (the average of false alarms across the MLB and NFL lists), but had no effect on false recognition of DRM lures. High-sports knowledge participants were less prone to false memory for sports-related information than were low-sports knowledge participants. We provide a tentative account of how domain knowledge might protect against false memory.
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(4091)

Age Differences in Strategy Use for Everyday Tasks: A Daily Diary Study. DAVID J. FRANK and DAYNA R. TOURON, *University of North Carolina at Greensboro,* CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Skilled performance on many tasks involves a shift from an algorithmic strategy to a retrieval-based strategy. Older adults are reluctant to shift to retrieval-based strategies following learning. This retrieval reluctance has been examined only in laboratory environments and with novel tasks including many massed trials. Everyday tasks involving longer but less intense learning periods (e.g., gradually committing a recipe to memory) may or may not invoke retrieval reluctance by older adults. The current study examined everyday task strategies. For five consecutive days, older and younger adults completed a daily diary survey indicating whether they performed specific everyday activities (e.g., did you cook anything from scratch?). Each activity could be performed using an algorithm (e.g., look up recipe) or retrieval (e.g., cook from memory). Participants indicated their task approach and how frequently they performed the task. Both young and older adults were expected to use retrieval more often on frequently completed tasks. Older adults were expected to show retrieval reluctance and lower retrieval confidence compared to young adults.
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(4092)

Eye Movement Analysis to Examine Students' Knowledge of Their Overconfidence When Studying Key Terms. ANIQUE B.H. DE BRUIN and ELLEN KOK, *Maastricht University,*

GINO CAMP, *Erasmus University Rotterdam*—When students judge their comprehension of key terms from a text, they tend to overestimate themselves particularly for commission errors (i.e., completely incorrect responses). Since students are less likely to restudy the key terms on which they were overconfident (Dunlosky & Rawson, 2012), overestimations lead to poor study regulation, and may cause suboptimal learning. Our previous work has revealed that students have at least partial knowledge of these overestimations. Eye movement analysis can provide further insight into how overconfidence on commission errors occurs. In the present experiment, we examined students' eye movements when judging comprehension of key terms. That is, we examined whether students' eyes more often moved from a lower to a higher judgment for commission errors on which they turned out to be overconfident than for commission errors that were correctly estimated. Moreover, we also examined to what extent these implicit indicators corresponded to explicit confidence about their judgments. Finally, we examined the relation between eye movements during judgments, study regulation and explicit adaptation of judgments.
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(4093)

Extreme Overconfidence: Judging Future Remembering Based on the Present. NATE KORNELL, *Williams College*—People tend to be overconfident in their memories. The research reported in this poster tested the limits of this overconfidence. Participants studied trivia question/answer pairs and predicted their ability to free-recall the answers a week in the future. Predicted recall (86%) was more than 70 percentage points higher than actual recall (13%), possibly setting a record for metacognitive incompetence. This overconfidence appeared to stem from both a stability bias (i.e., discounting future forgetting) and a foresight bias (i.e., discounting changes in the cues that support remembering). These two biases share a core characteristic: Judgments about future remembering over-rely on one's ability to remember right now.
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(4094)

The Pitfall of Latency-Confidence Association in Problem Solving. RAKEFET ACKERMAN, *Technion-Israel Institute of Technology*—Response latency is known to guide confidence when answering knowledge questions, with a negative correlation between them. Does latency also guide confidence in problem-solving tasks, when participants can scrutinize their solutions and enhance their success rates? This study examined the independent relationship between latency and confidence by dissociating the latency-accuracy and latency-confidence relationships. When participants solved misleading problems under an open-ended test format, latency had absolutely no validity as a predictor of accuracy. Solving the same problems under a multiple-choice test format allowed latency to predict accuracy better, with a negative correlation between them. With non-misleading problems the negative correlation between latency and accuracy was even stronger. In all tasks other, more trustworthy, cues underlay confidence, but nevertheless confidence was persistently sensitive to latency. Thus, despite the opportunity to scrutinize solutions, the temptation to have higher confidence in answers reached more promptly is insensitive to variability in latency's validity.
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(4095)

Calibration Bias: Effects of Training, Incentives, and Feedback on Metacognition in the Classroom. ANDREW S. ROBERTS, AIMEE A. CALLENDER and ANA M. FRANCO-WATKINS, *Auburn University*—Students generally exhibit poor calibration when making predictions about future performance. We examined how exam performance was affected by training and feedback in conjunction with incentives as part of course curriculum designed to promote students' metacognitive awareness. We analyzed predicted and actual exam performance for 127 students enrolled in an upper-level psychology course. Prior to completing each exam, students predicted their final score (0-100%) and were rewarded extra credit based on how well their predicted scores matched actual exam performance. We examined calibration bias (i.e., degree of overconfidence or underconfidence) for two exams. Our results revealed that training, feedback, and incentives improved calibration. Specifically, individuals who earned a "C", "D", or "F" on the first exam were overconfident whereas the "A" or "B" students were slightly underconfident. Significant improvements in calibration on the second exam were observed for the C, D, and F students.
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• SELECTIVE ATTENTION IV •

(4096)

Perceived Duration of Auditory Oddballs: Effects of Pitch Distance and Likelihood. ELISA KIM and J. DEVIN MCAULEY, *Michigan State University*—When judging the duration of an unexpected (oddball) stimulus presented within a series of identical (standard) stimuli, individuals tend to perceive the duration of the oddball to be longer than the standard. Three experiments used an auditory oddball paradigm to investigate the nature of the oddball effect, manipulating oddball pitch distance, likelihood, and duration range. Results showed that (1) far-pitch oddballs are perceived to be longer than near-pitch oddballs, but oddball likelihood has minimal effects on perceived duration, (2) perceived oddball duration is related to how quickly participants are able to respond to the oddball, and (3) whether (or not) oddball stimuli are judged to be longer than the standard depends on the range of tested oddball durations. Overall, findings are most consistent with an attention-based explanation of the oddball effect, and suggest that more salient oddballs enable faster initiation of the internal clock process used to estimate event durations.
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(4097)

Auditory Distractor Effects Interact With Visual Search Perceptual Load. DONALD J. TELLINGHUISEN and ALEXANDER J. COHEN, *Calvin College*—Effects of irrelevant auditory distractors on visual search under varied levels of perceptual load have been mixed. Response-incompatible auditory distractors have been shown to yield longer RTs and more errors in high load (target-similar) than low load (target-dissimilar) searches of letter-circle arrays, relative to response-compatible distractors (Tellinghuisen & Nowak, 2003). Macdonald and Lavie (2011), however, found that pure tone auditory distractors were ignored in high load but not low load visual discrimination tasks. We report experiments that address unresolved issues of timing and distractor-target response mapping that may underlie this discrepancy. Utilizing a letter-circle array task, response-incompatible distractors yielded greater distraction effects regardless of whether distractor onset or offset was simultaneous with target search array presentation. Second, utilizing a size discrimination task varying in perceptual load where auditory distractors mapped on to the response required to targets, significant distractor effects occurred for high load tasks, contrary to Macdonald and Lavie.
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(4098)

Using Sequential Structures of Sound to Elucidate the Basis of Distraction by Auditory Novelty. ANATOLE NÖSTL and PATRIK SÖRQVIST, *University of Gävle*—The cross-modal oddball paradigm is typically used to study why infrequently presented sound prolongs reaction time to visual targets (the novelty effect). In the experiment reported here, we used this paradigm with a twist whereby each target was preceded by one of three standard sounds (A, B or C) which formed a repetitive sequential sequence across trials (i.e., A-B-C-B-A-B-C-B- etc.). The standard sound sequence was occasionally interrupted during the experimental session (e.g., A-B-C-A-B-C-B- etc.) to test whether this interruption produced a novelty effect. Interruptions did capture attention and more so when the replaced sound differed substantially—in Hertz—from the replacing sound. Standard sound can cause a novelty effect, not only infrequently presented sound, as long as they violate what we have learned about (and therefore expect of) the sound environment.
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(4099)

A Basis for the SNARC Effect in Language. PETER DIXON and CHRIS WESTBURY, *University of Alberta*—The SNARC effect is a spatial compatibility effect in which lefthand responses are relatively fast to small digits and righthand responses are relatively fast to large digits. We show that this trend reflects the frequency of use in the language: In the Google 1T corpus, the relative frequency of the words "left" and "right" in the context of a preceding or following digit decreases systematically with digit magnitude. We hypothesize that the SNARC effect arises because responses are sometimes mediated by verbal codes for left and right, which in turn depend on word frequency in the stimulus context.
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(4100)

Task-(Un)Specific Effects of Temporal Preparation. HANNES SCHRÖTER, TERESA BIRNGRUBER and ROLF ULRICH, *University of Tübingen,* JEFF O. MILLER, *University of Otago*—Temporal preparation usually results in enhanced performance in a variety of tasks. We investigated to what extent temporal preparation involves increased readiness for task-specific processing requirements as opposed to increased task-independent readiness. In the present experiment, participants performed either a visual or an auditory discrimination task within a variable foreperiod paradigm. In separate blocks of trials, the presentation of tasks was either blocked or randomly varied. In principle, task-specific temporal preparation should have larger effects with blocked than with varied presentation of tasks. We observed the standard foreperiod effect: mean RT decreased with increasing foreperiod duration. Furthermore, mean RT was shorter with blocked than with varied task presentation. In addition, we observed a sequential foreperiod effect: the standard foreperiod effect was larger when foreperiod duration on trial n-1 was long as compared to when it was short. Neither the standard nor the sequential foreperiod effect were significantly influenced by the type of task presentation. Thus, our results favor accounts of the foreperiod effect according to which this effect reflects increases in task-independent readiness.
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(4101)

Change for Change's Sake? Previewed Faces Can't Resist the Physical! ELISABETH BLAGROVE and DERRICK G. WATSON, *University of Warwick*—Previous work with previewed faces has shown that these important social stimuli can only be partially ignored (Blagrove & Watson, 2010). It has also been shown that, despite the wealth of literature supporting a negative valence advantage in visual search, valence-based differences only emerged with very brief preview duration. That said, these valence-based effects have been less clear cut when evaluating the influence of change on previewed faces. For example, where we might expect any change made to a previewed face to abolish the advantage of a preview, this has only been shown inconsistently and mainly in circumstances where it has not been possible to disentangle the effects of physical and affective changes. Two experiments reported here evaluated the effects of physical change to schematic negative and positive face previews. Under these conditions, preview benefit was abolished, with resulting search rates being highly inefficient for both negative and positive target faces.
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(4102)

Attentional Engagement is Not Sufficient to Prevent Spatial Capture. DOMINIQUE LAMY and ALON ZIVONY, *Tel Aviv University*—What conditions, if any, can fully prevent attentional capture (i.e., involuntary allocation of spatial attention to an irrelevant object) has been a matter of debate. It was recently suggested that while tight spatial focusing of attention does not suffice to block attentional capture, attentional engagement in an object can entirely prevent spatial shifts of attention to distractors (Folk, Ester & Troemel, 2009). In this series of experiments, we overturn this conclusion. Subjects searched for a color target in a rapid visual serial presentation (RSVP) stream and a distractor in the central stream followed by a distractor in the periphery appeared before the target. Although the central distractor produced an attentional blink, indicating that attention was engaged in it, whether the peripheral distractor letter was compatible with the target letter strongly modulated target identification performance. This finding suggests that the peripheral distractor captured attention despite the fact that attention was already engaged in the central distractor. We conclude that attentional engagement is not sufficient to prevent attentional capture.
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(4103)

Task Demand Modulates the Effect of Prime-Probe Contextual Similarity on Negative Priming. HSUAN-FU CHAO, *Chung Yuan Christian University*—Negative priming refers to the delayed response to a target that was previously a distractor in a selective attention task. This phenomenon is sometimes modulated by contextual similarity between the prime and probe, but sometimes not. The present study tested the hypothesis that task demand modulates the effect of prime-probe contextual similarity on negative priming. In Experiments 1 and 4, the contextual cues were irrelevant to the task demand, while in Experiments 2 and 3 they were task relevant. The results demonstrated that task-related symbolic cues modulated the negative priming effect but task-irrelevant symbolic cues did not.
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(4104)

Does Spatial Attention Influence Lexical Processing During Reading Aloud? STEPHANIE WAECHTER, DANIEL EHRLICH, JENNIFER A. STOLZ and DEREK BESNER, *University of Waterloo*—There is considerable evidence that spatial attention is a necessary preliminary to lexical-semantic processing in visual word recognition (e.g., McCann, Folk, & Johnston, 1992). However, there is little convincing evidence as to whether spatial attention also influences lexical-semantic processing. To address this issue, we report a spatial cueing experiment in which target word frequency (high versus low) and distractor type (word versus nonword) are manipulated. The results suggest that spatial attention operates in a dynamic fashion in visual word recognition.
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(4105)

The Effects of Semantic Relatedness on Top-Down Attentional Control. ANDRIA SHIMI and GAIA SCERIF, *University of Oxford* (Sponsored by Marios Avraamides)—This study examined whether the ability to selectively attend to memory items interacts with the semantic characteristics of the memoranda and whether this interaction changes across development. Young adults, eleven-year-olds, and seven-year-olds were presented with a memory array of four items and were later asked to report whether a probe item had been part of the initial memory array. Memory array items belonged to the same or different semantic category. In addition, the memory array could either be uncued or followed by a spatial cue that directed participants' attention to a location in the array. Results showed that while participants in the three age groups differed in terms of their basic recall ability in the absence of an attentional cue, all participants' performance was significantly improved by orienting their attention to the memory array voluntarily. Furthermore, children and adults were differentially able to exploit the semantic relatedness of the items to orient attention.
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(4106)

Activating the HPA-Axis to Explore the Role of Stress and Norepinephrine Release on Mind Wandering Behaviour. MELAINA T. VINSKI, KAIAN UNWALLA and SCOTT WATTER, *McMaster University* (Sponsored by Karin Humphreys)—By incorporating the Adaptive Gain Theory of attentional orientation within the mind wandering paradigm, the current work investigates the role of norepinephrine (NE) on mind wandering by activating the Hypothalamic-Pituitary-Adrenal (HPA) Axis stress response. Participants were grouped by baseline level of stress and negative affect, and completed either an experimental or control version of the Trier Social Stress Test (TSST), followed by the Sustained Attention to Response Task (SART) as a measure of mind wandering frequency. Behavioural data suggests that acute stress induces atypical deficits in task performance due to TSST-oriented attentional focus. Pupillary data suggests that the cognitive shifts are associated with variation in norepinephrine levels (NE), released upon HPA-Axis activation. Findings provide evidence for NE as a potential mechanism underlying the initiation of mind wandering behaviours, with the behavioural and psychobiological data supporting a bio-cognitive transactional theory of stress response within the mind wandering paradigm.
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(4107)

The Levels-of-Inattention Hypothesis: Objective Measures Reveal Mindless Reading at Different Levels. DANIEL J. SCHAD and RALF ENGBERT, *University of Potsdam* (Sponsored by Reinhold Kliegl)—During mind wandering, attention is directed away from the external environment and cognitive processing is decoupled from perceptual information. Mind wandering is usually treated as a dichotomy, and often measured using self-reports. We here propose the levels-of-

inattention hypothesis, which postulates graded decoupling at different levels of processing. To measure levels of decoupling during reading we introduce the sustained attention to stimulus task (SAST), which relies on psychophysics of error detection. We found that subjects were less likely to notice errors requiring high-level processing for their detection as opposed to errors requiring only low-level processing. Eye tracking showed that before errors were overlooked effects of high- and low-level linguistic variables on gaze durations were reduced in a graded fashion, indicating episodes of weak and deep decoupling. Individual gaze durations predicted overlooking of lexical errors five seconds before they occurred. Our findings support the levels-of-inattention hypothesis and suggest levels of mindless reading can be measured in the SAST. Tracking eye movements to detect mind wandering online provides a promising tool to study mind wandering.
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(4108)

Persistent Changes in Attentional Bias Following Brief Reward Learning. BRIAN A. ANDERSON and STEVEN YANTIS, *Johns Hopkins University*—We have previously shown that stimuli associated with reward come to capture attention independently of their physical salience and goal-relevance, reflecting value-driven attentional capture (Anderson, Laurent, & Yantis, PNAS, 2011). In several prior studies, we have only investigated recent reward learning. One possibility is that value-driven attentional priority is continuously updated with ongoing learning, such that only recent experience with reward influences attention. Another possibility is that experience with reward creates changes in attentional priority that persist without further exposure or reinforcement. Here we provide evidence for the second possibility. Previously reward-associated stimuli spontaneously capture attention over 6 months after reward learning, and the strength of this attentional bias is proportional to reward-modulated changes in attentional priority evidenced during initial learning. Similarly persistent attentional biases have been shown to occur for drug-associated stimuli, suggesting a possible link between value-driven attentional capture and addiction.
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• DIVIDED ATTENTION •

(4109)

The Number & Quality of Tracked Representations in Multi-Object Tracking. WEIWEI ZHANG, *University of California, Riverside,* ANDREW P. YONELINAS, *University of California, Davis*—Human observers' ability to continuously track multiple spatiotemporal objects is limited by many experimental factors. However the nature of these limits has been the subject of considerable controversy. In the present study, observes tracked six targets among six distractors in random motions for 4.5 seconds, and then reported whether a probed item was one of the tracked items on a 6-point confidence scale. Receiver operating characteristic (ROC) curves were constructed from the confidence data. Two independent parameters were estimated from ROCs, to represent the probability that the probed item is tracked (PT) and the resolution of the tracked items (d prime). We found that manipulations of motion speed (Exp. 1), object spacing (Exp. 2), and external noise (Exp. 3) mainly affected PT. In contrast, the resolution of the tracked items remained largely fixed. Taken together, these results suggest attentional tracking is based on a limited set of fixed-resolution representations.
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(4110)

Capacity Coefficient Variations. JOSEPH W. HOUPT, *Indiana University,* ANDREW HEATHCOTE and AMI EIDELS, *The University of Newcastle,* NATHAN MEDEIROS-WARD, JASON M. WATSON and DAVID L. STRAYER, *University of Utah*—The capacity coefficient has become an increasingly popular measure of efficiency under changes in workload. It has been used in applications ranging from psychophysical detection tasks to complex cognitive tasks, as well as in addressing questions in social and clinical psychology. The basic formulation compares response times to each stimulus property (or task) in isolation to response times with all stimulus properties (or tasks) at the same time. A number of variations on the basic capacity coefficient have been used, both in the experimental design and in the calculations, and many more are possible. Here we outline the theoretical reasons for the different variations and discuss the information researchers need to choose the appropriate variation of the capacity coefficient. We then compare the different analyses applied to two cognitive tasks: an audio-visual detection task and a dual n-back task.
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(4111)

Delayed Perceptual Awareness in Dual-Task Performance. DANIEL BRATZKE and TANJA SEIFRIED, *University of Tübingen* (Sponsored by Hartmut Leuthold)—When participants are asked to separately respond to two stimuli (S1 and S2) and the interval between the onsets of the two stimuli (SOA) is varied, response time to the second stimulus (RT2) typically increases with decreasing SOA. Recent studies have indicated that participants are largely unaware of this dual-task interference. Specifically, introspective estimates of RT2 have been shown to be independent of SOA. According to the delayed perceptual awareness hypothesis, processing S1 in the central bottleneck delays the perceptual awareness of S2 presented at the same time. In the present study, participants watched a revolving clock-hand while they performed a dual task. Following their two speeded responses, in one condition participants were asked to indicate the clock-hand positions when they had perceived the stimulus onsets. In another condition, they were asked to indicate the clock-hand positions when they had selected their responses. The results showed that the perceptual latency for S2 (i.e., the deviation of the reported clock-hand position from the actual position of stimulus onset) increased with decreasing SOA. The present study thus provides evidence for the delayed perceptual awareness hypothesis.
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(4112)

Mind-Wandering and Driving Performance: Effects on Reaction Time and Other Measures. MATTHEW R. YANKO and THOMAS M. SPALEK, *Simon Fraser University*—In the present work we examined how mind-wandering influences driving performance. In a series of experiments using a high-fidelity driving simulator, participants followed a car along an otherwise unoccupied highway. At random times during the drive, the lead vehicle abruptly applied the brakes, requiring a braking response from the participants. In addition, an auditory tone was presented at random intervals, requiring participants to indicate if their mind was on-task, or wandering. We found that drivers increased separation from a lead vehicle when mind-wandering and, with following distance held constant, drivers showed slower RTs to a lead vehicle breaking.
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(4113)

Contextual Modulation of Crosstalk in Dual Tasks: Evidence From Saccades and Manual Responses. ALEKSANDRA PIECZYKOLAN and LYNN HUESTEGGE, *RWTH Aachen University* (Sponsored by Iring Koch)—The simultaneous execution of two actions usually causes performance costs. While most studies and theory concentrated on explaining dual-task costs by referring to interference within a single experimental trial (intra-trial interference), the present study investigates the role of contextual effects, i.e. interference between consecutive trials (inter-trial interference). Participants responded to single auditory stimuli with a saccade, a manual response or both. To study inter-trial interference, we compared dual-task costs of pure blocks (containing stimuli on one side only) with mixed blocks (containing stimuli on both sides), whereas intra-trial interference was manipulated by utilizing compatible and incompatible responses. Reaction times indicated that inter-trial interference influenced dual-task costs only when a certain amount of intra-trial interference was present. Theoretical implications for the concept of crosstalk will be discussed.
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(4114)

Moving Bottleneck? Assessing the Dual-Task Costs Across a Range of Task Pairings. TIM WIFALL and ELIOT HAZELTINE, *University of Iowa*—In a widely used dual-task procedure, stimuli for two tasks are separated by a stimulus onset asynchrony (SOA), and RTs for the second task increase as the SOA decreases. This phenomenon, termed the PRP effect, is typically accounted for by assuming a processing bottleneck at response selection. An open question is whether the durations of the pre-bottleneck and bottleneck stages depend only on the task in question or also on the task with which it is paired. We evaluated the PRP effect across ten experiments in which we systematically manipulated the modality of the input and output pairings for both tasks. The results revealed that the stage durations depend on the combination of the tasks and not just the task itself.
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(4115)

Redundancy Gain in Semantic Categorisation. PETER V. SHEPHERDSON and JEFFREY O. MILLER, *University of Otago* (Sponsored by Jeff Miller)—"Redundancy gain" refers to the common finding that people tend to perform better when presented with redundant targets than with single targets. Most work using redundant targets has involved low-level tasks, but analogous phenomena have sometimes been observed in tasks requiring higher-order processing. We conducted experiments using a semantic categorisation task with redundant stimuli in some trials. Participants saw two briefly presented words and decided whether at least one belonged to a target category. Responses were faster and more accurate when two members of the target category were presented. We compare two possible accounts of these findings: a "race model" (e.g., Raab, 1962) in which RT in redundant trials is determined by the quicker of the two targets being processed; and a coactivation model, according to which activation in the target category's neural representation is greater with redundant than with single-target presentation (e.g., Mohr et al., 1996).
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(4116)

PRP Practice Reduces Backward Compatibility Effects Due to Central Stage Shortening. SANDRA J. THOMSON, LILA K. DANIS and SCOTT WATTER, *McMaster University*—Dual-task interference observed in typical PRP paradigms has been shown to decrease with practice. This reduction in interference has been attributed to increased task automatization, timesharing, or a shortening of the central bottleneck stage of processing in Task1. To explore these alternative explanations, we measured both backward response compatibility effects and dual-task interference over repeated training sessions. Automatization and timesharing accounts predict that Task2-to-Task1 compatibility effects should increase or remain constant with practice, as there is more opportunity for crosstalk from Task2 processing to influence Task1 performance. However, our results indicate that the backward compatibility effect decreased with practice. Moreover, when the difficulty of Task1 response selection was increased, both the backward response compatibility effect and the amount of dual-task interference increased. These findings are consistent with a central stage shortening account of PRP practice effects, and support a response selection stage account of backward compatibility effects in Task1.
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(4117)

Serial Consolidation of Orientation Information Into Visual Short-Term Memory. TAOSHENG LIU and MARK W. BECKER, *Michigan State University*—While much work has focused on the storage limit of visual short-term memory (VSTM), the formation and stabilization of VSTM representations (consolidation) is also capacity limited. Such a limit could be due to either a serial or a limited-capacity parallel process. Previous studies have had difficulty differentiating between these two possibilities. Here we took a novel approach by measuring memory precision in a

sequential-simultaneous paradigm and fitting the data with a quantitative model. Participants viewed two oriented gratings either sequentially or simultaneously and reported one of the grating's orientation via method of adjustment. The data were well fit by a mixture model that assumes performance is limited by a noisy memory representation plus random guessing. Critically, the serial and limited-capacity parallel processes made distinct predictions regarding model parameters. We found strong support for the serial process, implying that one can only consolidate one orientation into VSTM at a time.
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(4118)

Task-Irrelevant Dimension and Response Set-Specific Control Mechanism. SANG-A KIM, SEAH CHANG and YANG SEOK CHO, *Korea University*—It has been found that no congruence sequential effect was obtained between two different congruencies when participants were to perform vertical and horizontal arrow flanker tasks alternately in a trial-by-trial manner to eliminate immediate stimulus-response repetition (Mayr, Awh, & Laurey, 2003). However, this result was possibly due to different irrelevant dimensions between the tasks. In the present study, participants were to perform vertical and horizontal color flanker tasks. Different sets of color were used for each color flanker task. When the tasks were performed with the same response set in Experiment 1, a significant sequential modulation of the congruence effect was obtained. However, when each task was performed with a different response set in Experiment 2, no sequential modulation was obtained. These results suggest that control processes induced by conflict suppress a specific automatic activation link between the task-irrelevant dimension and the response set to resolve conflict.
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• COGNITIVE CONTROL III •

(4119)

The Modulation of Response-repetition Effects under Task-switching. KAI ROBIN GRZYB and RONALD HÜBNER, *University of Konstanz* (Sponsored by Marco Steinhauser)—Response-repetition (RR) effects largely vary between conditions. One source of this variation is presumably the modulation of response conflict. Specifically, we hypothesized that a bias towards response shifts increases the response conflict when a response repeats and slightly reduces the conflict when a response shifts. As a consequence, RR effects should be shifted towards (more) costs. This prediction was confirmed in an experiment, where RR benefits on task-repetition trials were reduced and RR costs on task-switch trials were increased for incongruent compared to neutral stimuli. In addition, a second experiment showed that the increase in RR costs was modulated by previous-trial congruency. Together, our results support the idea that a response shift bias in task-switching is implemented as an inhibition of the last response in order to promote behavioral flexibility.
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(4120)

Eliminating Dual-Task Costs Depends on the Relationship Between Tasks. KIMBERLY M. HALVORSON and ELIOT HAZELTINE, *University of Iowa*—Ideomotor (IM) tasks use stimuli that strongly resemble the sensory consequences of a response to cue that response. Dual-task costs are greatly reduced or even eliminated when both tasks are IM and the appropriate task structure is used (Greenwald, 1973; 2003). According to Greenwald (2003), these tasks avoid costs because participants can access the appropriate response without engaging the performance-limiting bottleneck stage. To test this account, we used stimuli and responses from tasks that had previously shown no dual-task costs when performed together, but we reversed the stimulus-response mappings so that participants had to "do the opposite." Thus, each stimulus resembled the environmental outcome of the alternative response in the pairing. These tasks, which clearly do not conform to the definition of IM compatibility, were performed simultaneously without costs. This suggests that the conceptual relationship between tasks is critical; dual-task costs can be avoided when both tasks share a rule.
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(4121)

The Effects of Media Multitasking on Cognitive Control. REEM ALZAHABI and MARK W. BECKER, *Michigan State University*—Within the past decade there has been a 120% increase in the amount of media multitasking the average youth engages in (Rideout, Foehr, Roberts, 2010), yet little is known about the cognitive impacts of this now ubiquitous behavior. To investigate this issue, we had participants complete the Media Multitasking Index Questionnaire (Ophir, Nass, Wagner, 2009) and then tested their performance on a series of cognitive control tasks. Based on a task-switching paradigm, we found that heavy media multitaskers had decreased switch costs compared to light media multitaskers. Both groups showed comparable dual-task performance on a dual-task that required performing two visual/manual tasks. In a Psychological Refractory Period task, that required performing both an auditory/vocal and a visual/manual task, heavy media multitaskers appeared to complete the response selection stage more rapidly, resulting in less dual-task interference. In sum, these findings suggest that frequent media multitasking may be associated with greater cognitive control.
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(4122)

Voluntary Task Switching Interferes With Concurrent Timing, Involuntary Task Switching Does Not. CHARLES VIAU-QUESNEL and CLAUDETTE FORTIN, *Université Laval*—In the involuntary task switching (ITS) paradigm, cues indicate which task needs to be completed for a given target. Switch costs – an increase in RTs and errors in switch vs repeat trials – are assumed to be the product of cognitive control. In the voluntary task switching (VTS) paradigm, cues are replaced by instructions leaving the task choice to the participants. Cues are removed to reduce bottom-up control and to elicit a contribution of top-down control.

Previous research has shown that ITS does not interfere with concurrent timing. The present study compared ITS and VTS in reaction time and in dual task conditions with concurrent time production. Both ITS and VTS generated switch costs in the reaction time condition. In the dual task condition with timing, the effects of VTS and ITS interacted with session order: when the VTS session was first, switch costs were obtained in both VTS and ITS sessions; when the ITS session was first, no costs were found in either paradigm. Results suggest that VTS involves different cognitive resources than ITS – putatively top-down control – and that those resources are involved in timing. The effect of session order suggests that control mechanisms may be persistent across sessions.
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(4123)

Exploring Boundary Conditions of Conflict Adaptation Effects During Task Shifts. MARK E. FAUST, *University of North Carolina at Charlotte,* KRISTI S. MULTHAUP, *Davidson College,* ANAM K. BARAKZAI, ALAN M. PLUMEAU, MICHAEL E. ROSS and ALEXANDRA M. STUBBLEFIELD, *University of North Carolina at Charlotte*—Resolving conflict from distracting information is a key aspect of cognitive control. Conflict adaptation, a reduction in interference on the current trial following a conflict trial (versus a non-conflict trial) has been proposed to reflect a general control process not limited to the stimulus-response mappings of the current task. This view predicts that conflict adaptation effects should be observed across successive trials even if aspects of the task change. To explore the boundary conditions of conflict adaptation, we used Stroop and flanker interference tasks and varied the critical target response dimension (color versus form) across successive trials in a 2-trial sequence while keeping the distractor items and locations constant. Conflict adaptation effects were observed for some, but not all sequence types involving task shifting. Taken with our previous studies in this series, the results suggest that the cognitive control responsible for conflict adaptation is neither fully general nor simply task-specific.
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(4124)

Strategies for Selective Stopping: Challenging the Race Model. PATRICK G. BISSETT and GORDON D. LOGAN, *Vanderbilt University* (Sponsored by Timothy McNamara)—The selective stopping paradigm addresses motor selectivity in controlled behavior, as subjects have to stop to one signal but ignore another. We distinguished three strategies for selective stopping: (1) Selective stopping may prolong the stop process by adding a discrimination stage, as existing accounts assume. (2) Subjects may stop nonselectively and then respond if the signal is an ignore signal. (3) The requirement to discriminate stop and ignore signals may interact with the go process, invalidating the independent race model (Logan & Cowan, 1984). When stop and ignore signals were equally likely, 8/24 subjects used strategy 2, and 16/24 use strategy 3. When stop signals were frequent, 11/18 subjects used strategy 2; when ignore signals were frequent, 12/18 subjects used strategy 3. These results suggest that the commonly accepted first strategy is seldom implemented, and that selective stopping is either not selective (strategy 2), or interacts with going (strategy 3).
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(4125)

Assessing Capture Following a Switch in Search Strategy: Evidence for a Breakdown of Top-Down Control. JAMIE NAYLOR and MEI-CHING LIEN, *Oregon State University,* ERIC RUTHRUFF, *University of New Mexico*—Lien, Ruthruff, and Johnston (2010) reported that the attentional control system is able to rapidly and fully switch between different search settings (e.g., red to green), with no carryover. The present study examined whether such impressive flexibility is possible even with more complicated switches, namely the singleton search and the feature search. These modes seem particularly incompatible, creating a severe challenge. On each trial, participants were prompted to identify the letter that is uniquely colored (singleton search) or that has a specific color (feature search). The target display was preceded by a non-informative cue display containing an irrelevant color singleton cue. On feature search trials, the irrelevant color singleton cue was able to strongly capture attention (at least for random task sequences), contrary to the typical contingent capture findings. This breakdown indicates a limitation in the sharpness of attentional control, under conditions that might be prevalent in the real world.
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(4126)

Word Recognition in a Shallow Orthography: Cross-Task Comparison of Lexical Effects. SITI SYUHADA FAIZAL, *Washington University in St. Louis,* MELVIN J. YAP and SUSAN J. RICKARD LIOW, *National University of Singapore*—Models of word recognition need to account for the impact of lexical variables across different tasks, and cross-linguistic comparisons provide insights into the language-generality versus language-specificity of cognitive processes. Unlike English, the number of letters, phonemes, and syllables are highly correlated in Malay's shallow alphabetic orthography. Controlling for specific onsets, within-subjects multilevel analyses revealed robust main effects of length, frequency, and Levenshtein distance for lexical decision (LDT) and speeded pronunciation (SP) latencies, and a borderline effect of neighborhood size on LDT but not SP. Interactions of these effects with task revealed that both frequency and Levenshtein distance had significantly more facilitatory impact on LDT than on SP, whereas length had similar inhibitory impact that was larger than other lexical variables across tasks. These results contrast with reports for English and suggest that speeded pronunciation and lexical decision in shallow orthographies involve much more serial decoding and less recourse to lexical access.
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• LETTER AND WORD PROCESSING II •

(4127)

Eye Movements in Reading and Proofreading: Modulating Frequency but Not Predictability Effects. ELIZABETH R. SCHOTTER, KLINTON BICKNELL, ROGER LEVY and KEITH RAYNER, *University of California, San Diego*—Word frequency is the most robust lexical variable known to affect word recognition (e.g., lexical decision, naming latency and eye movements during reading). However, frequency effects are not always observed, for example, during mindless reading (Reichle, Reinenberg & Schooler, 2010) or when searching for a word in text (Rayner & Raney, 1996). Conversely, frequency effects increase when proofreading for misspellings that produce nonwords (e.g., trcak; Kaakinen & Hyönä, 2010). One possible explanation for increased frequency effects during proofreading is that subjects read more cautiously, which enlarges all lexical effects (e.g., predictability). However, in a study similar to Kaakinenn and Hyönä's we found that predictability effects do not increase during proofreading. These data suggest that, when searching for misspellings (nonwords), subjects do not rely more on all sources of information about word identity, but rather that word frequency provides information especially useful for detecting nonwords.
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(4128)

Do Reading and Spelling Share a Lexicon? ANGELA C. JONES, *John Carroll University,* KATHERINE A. RAWSON, *Kent State University*—In the reading and spelling literature, there is debate as to whether reading and spelling share a single lexicon versus two separate, independent lexica. Available evidence tends to support a single lexicon view over one positing independent lexica (e.g., Burt & Tate, 2002), although results are somewhat mixed. However, theories from the literature on skill acquisition and automaticity suggest another possible account: there may be separate lexica with some sharing of information (e.g., Rawson, 2010). To competitively evaluate these three accounts, we conducted two experiments involving differing levels of reading and spelling practice for new words. Across experiments, new words were presented for high practice, low practice, or no practice in reading and/or spelling tasks. Outcome measures included transfer tests tapping reading or spelling. Results support a separate-but-shared account: reading and spelling practice contribute to separate lexica, but information can be shared between them.
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(4129)

A Preliminary Investigation Into the Processing of Lexicalized Blend Words. BARBARA J. JUHASZ, JENNIFER BREWER and MICHAELA TOLMAN, *Wesleyan University,* REBECCA L. JOHNSON, *Skidmore College*—Blending is a word formation process where a new word is created from two base words (e.g. smog, infomercial). The linguistics literature describes research and theories related to the creation of blend words (e.g. Gries, 2004; Lehrer, 1998). However, very little research has examined how blend words are processed relative to other types of words. In the current research, a questionnaire with 54 blend words selected from various sources was created. Participants were asked to rate their familiarity and identify both base words. Sixteen blends were selected in which over 50% of the participants could identify the two base words. These items were matched on average familiarity and length to non-blend words for a lexical decision task. Blend words were recognized significantly slower in the lexical decision task compared to the non-blend words. Implications of the results for theories of morphological processing will be discussed.
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(4130)

Up & Down or Plus & Minus? A Polarity Explanation for Verticality Effects in Word Categorization. REMO JOB, BARBARA TRECCANI and SIMONE SULPIZIO, *University of Trento,* CLAUDIO MULATTI, *University of Padova*—The congruency effect between the typical location of concepts (e.g. "up" for eagle) and the location of the referring word stimulus on the screen has been interpreted as due to the automatic activation and integration of linguistic and perceptual-motor information, and is usually considered evidence for the perceptual simulation model. In three experiments, we show that spatial dislocation of the word along the vertical dimension is neither necessary nor sufficient for congruency effects to arise. This pattern is inconsistent with the perceptual simulation model but it is fully accounted for by the polarity principle that postulates the alignment of bipolar dimensions for the conceptual, perceptual, and response representations.
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(4131)

Locative and Compositional Relation Activation in Integrative Priming. LARA L. JONES and WILLIAM FUSS, *Wayne State University*—Integrative priming refers to the faster word recognition of a target following a prime with which it can be combined into a sensible word pair via the inference of a relation (compositional relation for LOG HOUSE, locative relation for ISLAND HOUSE). Target RTs occur as early as 50 ms after prime onset. Variations in priming magnitudes between some integrative relations may be due to individual differences in the ability to perceptually simulate the prime-target combination at SOAs < 100 ms. For a 50 ms SOA, priming for locative and compositional relations differed between males and females, whereas for a 300 ms SOA, priming was equivalent between the locative and compositional relations for both sexes. Results are the first to demonstrate sex differences in the onset of activation for two common integrative relations and suggest a perceptual simulation process consistent with that found in conceptual combination studies (Wu & Barsalou, 2009).
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(4132)

QWERTY: We Like Easy Words to Type. ERIN M. BUCHANAN, KATHRENE D. VALENTINE and MARILEE L. TEASLEY, *Missouri State University*—Recently, Jasmin and Casasanto (2012) published an article about the influence of

QWERTY standard keyboards on our perception of words. They argued that the way words are typed has caused people to prefer words that have more right handed typed letters. However, we believe that the analysis of word preference is too simple. Beilock and Holt (2007) have shown that expert typists prefer letter combinations that are on opposite hands over single hands, ostensibly because they are easier to type. This research implies that both skill level and "typability" need to be considered when discussing word preference and typing. The current study replicated Jasmin and Casasanto's study by examining preference ratings for real and fake words coded for typing sequence. While controlling for typing speed, fake words appear to show no effect of typability. However, real words show higher preference ratings for perfectly alternating words with no repeated key presses (i.e. city, rock, lamb). Other effects will be discussed.
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(4133)

Do Skilled Readers Use Phonological Syllables in Reading English Words? Evidence From ERP. DANIEL TRINH and DEBRA JARED, *University of Western Ontario*—The current study investigated the role of syllables in reading English words using ERPs. Stimuli were disyllabic words with the syllable boundary between two consonants. Carreiras, Vergara, and Barber's (2005) congruency paradigm was used in which stimuli were presented in two colors that divided the word either before (pi-cnic), at (pic-nic), or after (picn-ic) the syllable boundary. The syllable congruent condition did not produce a unique pattern of results. Instead, words divided before the syllable boundary elicited a greater N250 than words in the other two conditions, and words divided after the syllable boundary elicited a reduced N400 compared to the other two conditions. We interpret the N250 effect to reflect enhanced competition between the phonology of the first segment (pi) and the whole word when the subsequent consonants are less available to constrain the pronunciation of the first vowel. These results suggest that English words are not parsed into syllables during reading.
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(4134)

The Next Word in Spoken Word Recognition: Disentangling Refractory and Priming Effects. DANIEL MIRMAN, ALLISON E. BRITT and QI CHEN, *Moss Rehabilitation Research Institute*—Performance in word recognition tasks can be facilitated (priming effects) or hindered (refractory effects) by repetition. To disentangle the mechanisms that underlie these effects, a spoken word-to-picture matching task was conducted in which the target was either the same as the previous trial, a distractor from the previous trial, or a new item. Eye-tracking was used to examine the time course of activation in younger and older adults. Compared to new items, repeated targets were initially less fixated and were weaker competitors; however, they were also recognized faster. These data suggest two mechanisms: a refractory mechanism that inhibits words after they are processed and a learning mechanism that facilitates subsequent recognition. A comparison of two individuals with aphasia showed that these mechanisms can be impaired separately. Simulations of a simple computational model showed that transient refractory inhibition combined with incremental learning can account for these data and other related findings.
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(4135)

In•cite' or In'•sight: Stress Consistency and Regularity Effects in Disyllabic Russian Word Naming. OLESYA ZHURAVLEVA and STEPHEN J. LUPKER, *University of Western Ontario*—The present study examined spelling-to-stress consistency and stress regularity effects in naming disyllabic Russian words. First, an analysis of the stress patterns of 13,339 words identified seven orthographic components that are predictive of stress assignment in Russian. The impact of regularity and the consistency of these components on stress assignment performance were assessed in a naming task involving 1,061 disyllabic words. The regularity of stress pattern as a function of part of speech and the consistency of four of the orthographic components (word beginning, first syllable, body of the first syllable and body of the basic orthographic structure) were significant predictors of stress assignment. These results suggest that in assigning lexical stress readers are sensitive to a number of orthographic cues to stress that are present in the language. This knowledge might be of utility to modelers of polysyllabic word reading in general and of stress assignment in particular.
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(4136)

Cognitively Controlled Saccade Targeting in Reading: Evidence From a Sentence Shift Experiment. KLINTON BICKNELL, EMILY HIGGINS and KEITH RAYNER, *University of California, San Diego*—It is generally assumed that the target of saccades into a word in reading is not under direct cognitive control, but is determined by oculomotor processes sensitive only to word length and distance from fixation (McConkie et al., 1988). An alternative view is that readers target more distant characters in words when they have parafoveally processed them more. These possibilities are difficult to distinguish because the actual landing site within the word has large effects on subsequent word processing measures. In two studies, we experimentally manipulated landing site by shifting the text 3 characters during the saccade into a target word. Subsequent word processing time (gaze duration) given a particular landing site was lower/higher when the eyes would have landed further forward/backward in the word (controlling for saccade length), supporting the cognitive view in which readers who have already done more word processing parafoveally target the end of the word.
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(4137)

The Processing Advantage and Disadvantage for Homophones in Lexical Decision Tasks. YASUSHI HINO and YUU KUSUNOSE, *Waseda University,* STEPHEN J. LUPKER and DEBRA JARED, *University of Western Ontario*—Studies using the lexical decision task with English stimuli have demonstrated that homophones are responded to more

slowly than nonhomophonic controls. In contrast, several studies using Chinese stimuli have shown that homophones are responded to more rapidly than nonhomophonic controls. In an attempt to better understand the impact of homophony, we investigated homophone effects for Japanese Kanji words in a lexical decision task. The results indicated that, whereas a processing disadvantage emerged for Kanji homophones when they have only a single homophonic mate (as in the English experiments), a processing advantage occurred for Kanji homophones when they have multiple homophonic mates (as in the Chinese experiments). Based on these results, we discuss the nature of the processes that may be responsible for producing the processing advantages and disadvantages for homophones.
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(4138)

The Psychological Reality of Words in Chinese Reading: Evidence From Eye Movements. XINGSHAN LI, JUNJUAN GU and PINGPING LIU, *Chinese Academy of Sciences,* KEITH RAYNER, *University of California, San Diego*—In two experiments, we tested the prediction that reading is more efficient when characters belonging to a word are presented simultaneously than when they are not in Chinese reading using a novel variation of the moving window paradigm (McConkie & Rayner, 1975). In Experiment 1, we found that reading was slowed down when Chinese readers could not see characters belonging to a word simultaneously compared to when they could do so. In Experiment 2, when Chinese readers could choose whether the two characters in the moving window contained a word or two characters that did not constitute a word, they had a clear tendency to choose to look at two characters belonging to a word simultaneously. The results of the current study provide strong evidence that character processing is affected by word knowledge and the processing of other characters belonging to the same word in Chinese reading, and add to a growing body of evidence which has demonstrated that words do have psychological reality for Chinese readers. The results also suggested that the eye movement control strategy of Chinese readers is rather flexible in that it can be adjusted on-line to modify the characteristics of the window.
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(4139)

Parsing English and Chinese Strings of Characters into Words by Speakers Varying in Fluency. LIANG TAO, *Ohio University,* ALICE F. HEALY, *University of Colorado, Boulder*—Five groups of subjects (native Chinese speakers, native English speakers in Chinese language courses at 3 levels, and native speakers of other languages) identified English words from strings of letters and Chinese 2-syllable words from strings of Chinese characters. The passages contained scrambled real words. It was much easier to parse English than Chinese passages, contrary to normal reading practice: Normal English text uses inter-word spaces to indicate word boundaries, whereas normal Chinese text provides equal space between characters. Thus, reading Chinese requires parsing strings of characters into words. Nevertheless, practice at parsing Chinese was not sufficient for the identification of Chinese bi-syllabic words without a meaningful context. The results also indicate that reading experience aids word parsing in Chinese: Native Chinese speakers and native English speakers at the third level did better than the other subjects at parsing Chinese, and parsing was more accurate for common than rare words.
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(4140)

Concurrent Eye-Tracking and Mouse-Tracking in the Visual World Paradigm. JOSHUA LEVY and ADRIAN STAUB, *Univesity of Massachusetts, Amhers*t—Eye-tracking (ET) and mouse-tracking (MT) have each been used as dependent measures of on-line processing and integration of visual and auditory stimuli. We measured eye and mouse movements concurrently in a visual world task to investigate the relationship between these two dependent measures at the level of the individual trial. Subjects were instructed to click on a target picture, and in half of the critical trials the foil picture on the screen was a phonological competitor (e.g., panda/pancakes). A fixation on the foil picture predicted a larger deviation of the mouse towards the foil. In contrast to previous studies that have suggested unimodal distributions of mouse trajectories (e.g., Spivey, Grosjean, & Knoblich, 2005), we found substantial deviation of the mouse toward the foil in the competitor condition only when the eyes did fixate the foil; there was no difference in mouse deviation between the competitor and control conditions when the eyes did not fixate the foil. Taken together, the results suggest that ET and MT are closely linked dependent measures, and that the distribution of mouse trajectories may reflect a mixture of underlying distributions.
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(4141)

Word Superiority and Memorial Inferiority for Handwriting. ANTHONY S. BARNHART and STEPHEN D. GOLDINGER, *Arizona State University*—Barnhart and Goldinger (2010) reported that various "top-down" effects in lexical access (e.g., word frequency effects) were magnified when people read handwritten words, relative to computer print. We suggested that, when letter-level input is degraded, the perceptual system adjusts with greater lexical feedback. This hypothesis creates a puzzle when considering the classic word-superiority (WS) paradigm, wherein letter strings are briefly flashed then masked. One might expect handwritten items to create large WS effects, as word-level influences would dominate weak letter-level activity. Alternatively, one might expect handwritten items to create small WS effects, as the letter-level input may not sufficiently activate words. In three experiments, we observed clear WS effects with handwritten items, of exactly the same magnitude as the effect with printed items. We also observed a powerful phenomenological effect of "form blindness." People often could not report whether letter strings were handwritten or printed, immediately after seeing them.
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(4142)

Spatial Representations During Reading: Processing of Text to the Left of Fixation. VICTORIA A. MCGOWAN, SARAH J. WHITE and KEVIN B. PATERSON, *University of Leicester*—The spaces between words serve as easily identifiable visual cues to a word's boundaries and are thought to play an important role in planning eye-movements during reading. Although much is known about how readers use the spatial layout of upcoming text, little is known as to how readers might continue to process the spatial layout of text that has been previously read (i.e. text to the left of fixation). The present research used a gaze-contingent technique in which upon fixating to the right of an embedded target word, the space preceding the target was filled with a letter, or a letter within the target was substituted for a space. Our findings reveal that changes to word spacing to the left of fixation influence eye-movement behaviour (increased reading times and regression probabilities). The results indicate that our spatial representation of text to the left of fixation is updated as we read.

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• PSYCHOLINGUISTICS III •

(4143)

Spreading Activation or Repetition? The Effects of Newly Learned Associates on Eye Movements During Reading. MATTHEW J. ABBOTT and KEITH RAYNER, *University of California, San Diego* (Sponsored by Charles E. Clifton)—Prior research has shown that during reading, words are processed more easily in some contexts than in others. Lexical priming is explained to be the result of either: (1) spreading activation within the lexicon, where one word primes another closely related word (e.g., bread primes butter), (2) message-level information influencing lexical processing through access of a schema or script, or from a discourse representation. The present study further examined spreading activation during reading by having subjects learn novel paired associates (e.g., banner – maturity) prior to reading sentences containing them. Word pairs in sentences either always matched what subjects studied (Experiment 1), or were mismatched half of the time (Experiment 2). Subjects' eye movements were monitored, and both early and late reading time measures were reduced on both studied target and prime words. Results indicated the presence of priming by spreading activation preceded by strong effects of repetition priming across tasks.

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(4144)

Effects of Transitional Predictability on Eye-Movements in Visual Search and Reading. POLINA M. VANYUKOV, TESSA WARREN and ERIK D. REICHLE, *University of Pittsburgh*—Probabilistic theories of sentence processing argue that statistical regularities in language influence the difficulty of processing words or structures during reading (e.g. Levy, 2008). Whereas effects of word frequency are commonly observed in reading experiments, evidence for transitional predictability effects on eye movements is debated (e.g., Frisson, Rayner, & Pickering, 2005; McDonald & Shillcock, 2003). We report two experiments investigating such effects. In Experiment 1 participants scanned lines of Landolt-C clusters in which the transitional probability of clusters was manipulated. In Experiment 2 participants read paragraphs with repetitions of either a Saxon genitive (e.g., octopus's tentacle), or a PP genitive (e.g., tentacle of the octopus), followed by a test sentence containing a Saxon genitive. Transitional predictability affected fixations on the second cluster in the pairs and on the head of the Saxon genitive in the test sentence. These findings indicate that eye movement programming is sensitive to learned statistical regularities.

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(4145)

Eye Movements Reveal Processing Differences Between Modal Verbs Should and Must. STEPHANIE HUETTE, TEENIE MATLOCK and MICHAEL SPIVEY, *University of California, Merced*—Modal verbs are considered "helper verbs" because they modify degree of certainty with statements like "You [should/must] brush your teeth everyday", but little is known about how they are semantically processed. An audio-visual two-alternative forced-choice task was conducted to examine processing differences between the modal verbs should and must. Unambiguous sentences were either agreed with or disagreed with, and participants' eye movements were monitored as they heard the sentence. Reaction times reveal no differences in processing. However, eye movement analyses revealed proportionally more fixations to a competitor when the word should was used, indicating should triggers thoughts of alternatives more than the word must. These results suggest two mental models are simultaneously activated, entailing both agreement and disagreement with the statement in question when should is used.

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(4146)

When the Truth Cannot be Ignored: Evidence for Nonstrategic Validation in Language Comprehension. MAJ-BRITT ISBERNER and TOBIAS RICHTER, *University of Kassel, Germany*—In psycholinguistic research, comprehension of linguistic information and knowledge-based validation are often regarded as two separate stages of processing. According to this view, validation is subsequent, optional and strategic. In contrast with this idea, we present evidence for nonstrategic validation during language comprehension by showing that readers cannot ignore the validity of information even if this is detrimental to their task. In an experiment using a Stroop-like paradigm, participants were required to indicate whether a word that rendered a sentence either valid or invalid with regard to world knowledge (e.g., Soft soap is *edible*) had changed color ("yes") or not ("no"). We expected a nonstrategic assessment of validity to interfere with incongruent responses in this task. ANOVAs of the response latencies revealed a significant interaction of

validity and required response that supported this prediction. These results suggest that knowledge-based validation is an inherent and nonstrategic component of information processing.
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(4147)

Looking More When You Know Less: Goal-Dependent Eye Movements During Reference Resolution. EILING YEE, *Basque Center on Cognition, Brain and Language,* DAPHNA HELLER, *University of Toronto,* JULIE C. SEDIVY, *University of Calgary*—Readers typically "look more when they know less"—spending more time looking at difficult or ambiguous regions of text than at easy ones. Yet precisely the opposite pattern often appears in "visual world paradigm" studies, where the more certain listeners are that an entity is being named, the more they gaze at it. Here we report that although there is indeed a positive relationship between gaze and referential certainty when the task is to act on the referent, when this requirement is removed, the positive relationship fails. Moreover, at very high levels of certainty, there are numerically fewer fixations on referents. This may reflect that participants direct their visual attention not only as a consequence of language interpretation, but also due to a drive to consistently extract a "just right" amount of information from the linguistic and visual environment. We relate our findings to similar phenomena observed during reading, picture naming, and in infants' gaze preferences, as well as to related effects in language production. We speculate that the overarching principle in these cases is one of maximizing information extraction in the face of uncertainty.
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(4148)

Picture Naming Clues to Cognitive Deficit in Alzheimer's Disease: Contextual Diversity, Imageability, or Word Frequency. IVA IVANOVA, DAVID SALMON and TAMAR GOLLAN, *University of California, San Diego*—What cognitive mechanism underlies naming impairments in Alzheimer's disease (AD)? We investigated this question by asking which picture name characteristics best predicted naming score differences between patients and matched controls. We administered a 68 item picture naming test (Gollan et al., 2012) to 68 patients with probable AD, and 44 matched controls. For each test item, we calculated the proportion of correct responses for patients and controls, and obtained a difference score by subtracting the patients' score from the controls' score. We used regression analysis to ask which item variables predicted the difference between patients and controls. We found that contextual diversity (Adelman et al., 2006) and imageability, but not word frequency and not number of senses, contributed unique variance to explaining naming impairments in AD. These findings suggest that naming performance in AD is predicted by semantic richness and network size rather than frequency of use per se.
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(4149)

Non-Property Inclusion in Combined Concepts: An Inverse Modification Effect. THOMAS L. SPALDING and CHRISTINA L. GAGNÉ, *University of Alberta*—Recent research has found that the judged likelihood of properties of modified nouns (baby ducks have webbed feet) is reduced relative to unmodified nouns (ducks have webbed feet). Two experiments replicate this standard modification effect and, for the first time, demonstrate an inverse modification effect with properties unlikely to be true of the unmodified noun. Properties that are neither likely nor unlikely to be true are unaffected by modification. The results argue in favor of an inferential process that operates at the level of logical forms or structures, and which operates on the content of the head noun category only to the extent of determining the likelihood of the property for the head. The process appears to be primarily sensitive to knowledge about how sub-categories relate to categories.
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(4150)

Are Structural Regularities Universal? Evidence from Mandarin Chinese Speakers. XU ZHAO and IRIS BERENT, *Northeastern University*—Across languages, certain onsets (i.e., initial consonant sequence, e.g., block) are preferred (e.g., more frequent) to others (e.g., bl>bn>bd>lb, > indicates a preference). Past experimental evidence from English, Spanish and Korean suggests that speakers extend this preference even to clusters that are unattested in their language. All these languages, however, manifest clusters of some kind, so such preferences could reflect not universal principles but linguistic experience. To address this possibility, we examine whether similar preferences are active in Mandarin Chinese—a cluster-poor language. We reasoned that ill-formed structures like lbif will be repaired as better-formed ones (e.g., lebif)—the worse-formed the cluster, the more likely its repair. Results showed that Chinese speakers are sensitive to onset structure, but this sensitivity is masked by the acoustic properties of the materials. These findings are consistent with the hypothesis that speakers of all languages share universal grammatical principles.
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(4151)

Phonetic Convergence in Shadowed Speech: If You Say Potahto, Do I Say Potahto? JENNIFER S. PARDO, KELLY JORDAN, ROLLIENE MALLARI, CAITLIN SCANLON and EVA LEWANDOWSKI, *Montclair State University*—Phonetic convergence occurs in both shadowed and conversational speech, and has been assessed using both acoustic and perceptual measures. A previous study using a perceptual similarity test found that phonetic convergence in shadowed speech was not influenced by lexical characteristics, such as word frequency or neighbor density. However, other researchers have found that words from high-density neighborhoods were produced with greater vowel expansion than words from low-density neighborhoods. The current

study examined the influence of phonological neighborhood on phonetic convergence in vowel spectra. A set of talkers produced monosyllabic target words that varied in frequency and frequency-weighted neighbor density independently. Another set of talkers produced baseline and shadowed tokens of the target words produced by the first set of talkers. Inter-talker distances in vowel formants were derived to assess vowel convergence. Both acoustic and perceptual assessments of phonetic convergence revealed large individual differences, which overshadowed lexical characteristics.
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(4152)

A Common Magnitude Metric in Perception: Interference Between Numbers and Size During Visual Search. OLIVER LINDEMANN, *University of Potsdam,* FLORIAN KRAUSE, *Donders Institute for Brain, Cognition and Behaviour, Nijmegen* —The current study tests the involvement of a common magnitude metric in early visual processing. In a visual search task comprising single-digit numbers, participants had to identify a physically large (or small) target item amongst physically smaller (or larger) distractors. The relative numerical size of the digits was varied, such that the target item was either among the numerically largest or smallest numbers in the search display and the relation between numerical and physical size was either congruent or incongruent. Perceptual differences of the stimuli were controlled in a second experiment in which LCD-style numbers had to be searched. Our results revealed that identifying a physically large target item is significantly faster when the numerical size of the target item is large as well (congruent), compared to when it is small (incongruent). This finding suggests a convergence of physical and numerical size into a common representation of magnitude at an early perceptual processing stage.
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(4155-4156)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION V

Saturday Evening,
Minneapolis Convention Center, Ballroom A
Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• EMBODIED COGNITION II •

(5001)

What's in a Name? Conceptual Factors Influence Spatial Perception During Stimulus Control. DEVIN GILL, JUSTIN DURTSCHI, J. COOPER CUTTING and J. SCOTT JORDAN, *Illinois State University*—Individuals who continually track an object that suddenly vanishes indicate perceived vanishing points displaced beyond the actual vanishing point (i.e., forward displacement: FD) (Hubbard, 1995). FD also decreases with increases in implied friction (i.e., representational friction) (Hubbard, 1995). Jordan, Coey, and Tsippaaoutis (2009) demonstrated that FD increases with implied friction if one controls versus observers stimulus movements. The present experiments examined the extent to which this reversal of the implied friction effect can be modulated by conceptual factors (Reed & Vinson, 1996). Participants either controlled or observered the movements of a trapezoidal stimulus labeled as either a "bullet train" or a "house" in two levels of implied friction (i.e., no surface, and surface below). Results indicate that FD increased significantly across levels of implied friction, both for observers and controllers. However, the conceptual label influenced FD for controllers only (i.e., FD was larger for the "bullet train" condition).
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(5002)

Feature Diagnosticity Affects Semantic Representations of Novel and Common Object Categories. NINA S. HSU, MARGARET L. SCHLICHTING and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Sensorimotor theories of concepts posit that categories may differentially rely on certain sensorimotor regions over others due to each category's properties. While evidence supports some basic predictions based on these theories, less research exists on principles leading to different representations across categories. In two studies, we explored how feature diagnosticity affected neural conceptual representations, by examining how variation in diagnosticity of color information affected recruitment of color-sensitive visual areas during conceptual retrieval. Categories in which color was a necessary feature (similar to lemons and limes) activated color-sensitive visual areas more than categories in which color was an available but not necessary feature, in that shape was sufficient (similar to stop signs and yield signs). This group difference contrasted with comparable explicit color knowledge about object categories. Results suggest that knowledge of both feature importance and use contributes to neural representations, and that diagnostic features may activate automatically during semantic retrieval.
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(5003)

If I Had a Hammer: Does Graspability Affect Object Representation? KEEN SEONG LIEW and JYOTSNA VAID, *Texas A&M University* (Sponsored by Lisa Geraci)—When drawing human facial profiles, vehicles, or animals, handedness-related directionality biases in object facing have been observed (Tosun, Vaid, Liew, Lopez, Kim, 2012; Vaid, 2011; Van Sommers, 1984). Other research suggests a "graspability" effect in ease of object perception for such objects as screwdrivers (de'Sperati & Stucchi, 1997). Previous studies of representational drawing suggest that right vs. left handers orient graspable objects differently, with left handers orienting the handle to the left side of space and right handers to the right (Karev, 1999; Rhodes, 2010). The present study examined this question using a larger set of objects and varying the type of movement associated with the object - movements in extrapersonal space (e.g., hammer) vs. peripersonal space (e.g., toothbrush). The findings are discussed in terms of their implications for the motor imagery hypothesis of object representation.
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(5004)

Embodied Cognition? Evidence From Hand and Foot Responses to Hand- and Foot-Related Action Words. JEFF MILLER and KATE BROOKIE, *University of Otago*—Theories of embodied cognition suggest that the recognition of action-related words activates the pre-motor and motor brain areas involved in carrying out the named actions. Consistent with these theories, recent fMRI studies show increased activation of the particular motor areas associated with specific action-related words. We investigated the time-course of such motor activation within a lexical decision task in which participants made hand responses to words and foot responses to non-words, or vice versa. If motor areas are activated before the end of word recognition, hand responses should be faster to hand- than foot-related action words, and foot responses should be faster to foot- than hand-related action words. In addition, distinct event-related motor potentials associated with hand and foot responses were checked for evidence of motor activations produced during the recognition of hand- and foot-related words.
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(5005)

Embodied Physics Learning. CARLY KONTRA and DANIEL J. LYONS, *The University of Chicago,* SUSAN FISCHER, *DePaul University,* *SIAN BEILOCK, *The University of Chicago*—Recent theories of embodied cognition suggest a new way to look at lab experiences in science classes. Namely, understanding physics concepts like angular momentum involves perceptual and motoric re-experiencing – "embodiment" – of the concept in one's self. If so, then

lab activities giving students direct experience with physics quantities (e.g., feeling force vectors – as opposed to reading about or observing them) might be especially beneficial for re-experiencing and, ultimately, student understanding. We tested these ideas in the laboratory (Study 1) and classroom (Study 2). In both experiments college students completed an angular momentum lab, either observing a demonstration of angular momentum and torque (observation-group) or becoming part of the physical system and feeling the changes in torque themselves (sensorimotor-group). The sensorimotor-group demonstrated significantly better comprehension of factors influencing angular momentum and torque compared to the observation-group, especially when the vector nature of angular momentum needed to be taken into account.
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(5006)

Attentional Disengagement and Behavioral Instability. PAUL SELI, TANYA R. JONKER and DANIEL SMILEK, *University of Waterloo* (Sponsored by Myra Fernandes)—We explore the possibility that attention lapses and mind wandering can manifest behaviorally in terms of instability. We measured behavioral instability using a novel task (the Metronome Response Task; MRT) in which people are asked to respond (via button presses) synchronously with the continuous rhythmic presentation of tones. In the MRT, behavioral instability is indexed by the discrepancy of responses relative to the metronome. In Study 1, we show a positive correlation between behavioral instability in the MRT and attention-lapse frequency as indexed by a GO-NOGO task. In Study 2, we show that participants exhibit increased behavioral instability during episodes of probe-caught mind wandering relative to periods of on-task performance. These results are consistent with the hypothesis that when attention fails, executive resources that normally dampen behavioural variability are disengaged from the focal task, thereby allowing the body to 'wander' in concordance with the mind. On the basis of these results, we conclude that behavioral instability is a theoretically and practically informative marker of attentional disengagement.
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• MUSIC PERCEPTION •

(5007)

Absolute Pitch May Not be So Absolute. STEPHEN C. HEDGER, SHANNON HEALD and HOWARD C. NUSBAUM, *The University of Chicago*—Absolute pitch (AP) is the ability to identify a note without the aide of a reference note. Although past research has suggested that AP is dependent on experience, the mechanism of AP is as yet undetermined. Given the evidence that AP depends on early experience, it seems plausible that AP is a relatively stable phenomenon in adults, as frequencies should map directly onto note categories once early experience has established those mappings. To investigate this, the present study manipulated the short-term perceptual experience of AP participants by systematically changing the tuning of musical passages. The question was whether a shift of 33 cents would affect the representation of notes in listeners with AP. After listening to manipulated passages, AP listeners showed systematic changes in their intonation judgments, perceiving in-tune notes as out-of-tune and previously flat notes as in-tune. Moreover, AP listeners generalized this change to notes that were not heard in the musical passage, but generalization was limited by timbre. The present results raise fundamental questions about the mechanism underlying AP and provide new evidence about the nature of note representation and its plasticity in listeners with AP.
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(5008)

Music and Tonal Language Experience Improve Relative Pitch Performance. MARY K. NGO, KIM-PHUONG L. VU and THOMAS Z. STRYBEL, *California State University, Long Beach*—Pitch is regarded as a fundamental element of music. In some cultures, pitch is necessary for language comprehension, yet few studies have investigated the effect of both tonal language comprehension and musical ability on relative pitch. We explored the relationship between music and tone language experience using a relative pitch task. Participants judged the direction and distance of comparison tones relative to a standard. We measured the percentage of correct responses and computed a Cochran-Weiss-Shanteau (CWS) measure of expertise based on the ratio of discrimination to consistency. Pitch processing was also measured using the Montreal Battery of Evaluation of Amusia (MBEA). Musicians outperformed non-musicians on the relative pitch task and MBEA. Tonal speakers did better than non-tonal speakers on four of six MBEA subscales. Overall, participants' performance improved from Day 1 to 2, and tonal language speakers showed a greater improvement.
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(5009)

Rhythmic Motor Entrainment by a Vocally Stereotypic Species: An Experimental Response to the Vocal Learning and Synchronization Hypothesis. PETER COOK, ANDREW ROUSE, MARGARET WILSON and COLLEEN REICHMUTH, *University of California, Santa Cruz*—Motor entrainment to a rhythmic auditory stimulus, or the ability to "keep a beat," is highly developed in humans and has been demonstrated in a small number of other species as well. According to the vocal learning and synchronization hypothesis, this ability arises as a byproduct of tight associations between auditory and motor circuitry in the brain resulting from evolutionary selection for complex vocal learning and mimicry. Here we show that a vocally stereotypic animal, a California sea lion (Zalophus californianus), can learn to reliably entrain motor behavior to an isochronous auditory rhythm under the three criterial conditions proposed by Patel: entrainment to a complex stimulus; accurate performance with a range of novel stimulus tempos; and a behavioral response that does not reproduce the stimulus.

These findings suggest that the capacity for entrainment does not depend on a capacity for vocal learning, and thus may be more widespread in the animal kingdom than previously hypothesized.
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(5010)

Influence of a Short Delay on the Time Course of Recognition Memory for Melodies. WALTER J. DOWLING, *University of Texas at Dallas*—Previous research (Dowling, Tillmann, & Ayers, Music Perception, 2001) tested recognition of novel musical phrases after filled delays of 5 and 15 s, demonstrating an improvement in discriminating targets from similar lures over that time. Here recognition was tested after 3.25, 6.5, 9.75, and 19.5 s with copies of targets, similar lures in which the melodic contour was shifted along the scale but that otherwise were identical to targets, and different lures in which only the contour was changed. Overall recognition declined with increasing delay, probably because the shortest delay led listeners, especially moderately experienced, to rely on echoic memory. Inexperienced listeners showed a 5 percentage point improvement between 6.5 and 9.75 s, suggesting that they used a combination of strategies. These results illustrate the effect of introducing a shorter delay into the test on listeners' choice of strategies, and hence on the whole pattern of results.
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(5011)

Motor Experience Affects Neural Responses to Perceived Music. BRIAN MATHIAS and CAROLINE PALMER, *McGill University,* FABIEN PERRIN and BARBARA TILLMANN, *Lyon Neuroscience Research Center*—We investigated how auditory and motor experience influence musicians' EEG responses to perceived pitch changes in melodies. Twenty pianists performed (and perceived) or simply perceived novel melodies, and then heard the melodies with or without single pitch changes, which they recognized as altered or original. Altered pitches were always related tonally to the musical context, thus testing expectations based on veridical memories for individual melodies, as opposed to expectations based on tonal relationships. Pianists identified melodies with altered pitches more accurately following performance than perception conditions. Altered pitches in both performed and perceived melodies elicited early negative (N200) and late positive (P300) event-related potential components, which were not elicited by original pitches. The N200 negativities were larger and more anterior for pitch changes presented in previously performed melodies than in perceived-only melodies. Auditory-motor associations formed during performance generated stronger memory-based expectancies than those derived from auditory encoding alone.
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• EVENT COGNITION •

(5012)

Getting the Gist of Events: Rapid Identification of Two-Participant Actions. ALON HAFRI, *University of Pennsylvania,* ANNA PAPAFRAGOU, *University of Delaware,* JOHN C. TRUESWELL, *University of Pennsylvania*—Unlike rapid scene and object identification, little is known about identification of event categories and roles from minimal visual information. We displayed photographs of a wide range of two-participant event scenes (e.g., kicking) for 37 and 73ms followed by a mask, and found that event categories and roles can be identified rapidly, even with various actor pairs and backgrounds. Norming ratings revealed that certain physical features (e.g., outstretched extremities) that correlate with Agent-hood could have contributed to rapid role categorization. Using identical twin actors, we then varied these features in two sets of stimuli, in which Patients had Agent-like features or not. Participants identified roles less accurately when Patients possessed Agent-like features, with this difference being eliminated with 2-second durations. Thus, given minimal visual input, typical Agent-like physical features are used in role assignment but, with sufficient input from multiple fixations, people categorically determine the relationship between event participants.
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(5013)

Perspective Taking in Narrative Film. JAMES A. CLINTON, *Northern Illinois University,* STEPHEN BRINER, *University of Illinois at Chicago,* ANDREW SHERRILL and JOSEPH P. MAGLIANO, *Northern Illinois University*—Filmmakers typically do not explicitly tell you what characters are thinking and feeling. They must rely on cinematic devices (such as point of view shot sequencing, close ups on characters) to emphasize affective and cognitive states of characters. In this study, we utilized two commercially produced films based on the same script, but that were shot and directed in profoundly different ways. In a critical scene of interest, the extent to which cinematic devices were used to provide information about the internal states of one of the characters varied considerably the two films. Participants viewed one of the versions and made judgments regarding how the characters and the viewer felt about each other. Anger was predicted to shift towards empathy for both films. However, this shift was predicted to be greater for one version because cinematic devices emphasize what one character is feeling towards the other character. Differences in affective judgments between films were found. We interpret these differences as being driven by the fact that the viewer is given more information about character internal states through the use of well-documented cinematic techniques
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(5014)

Eye Movements Reveal the Influence of Event Structure on Reading Behavior. BENJAMIN SWETS and CHRISTOPHER A. KURBY, *Grand Valley State University*—Individuals segment information presented in narrative texts into discrete events, with distinct boundaries between those events. Event structure in narrative texts affects how readers build and update their working memory representations of events. But, how might event structure affect reading behavior? The present study examines whether eye-movements during the reading of discourse reveal how readers respond online to event structure. Participants read narrative passages as their eye movements were monitored. Based on norms from prior segmentation data, the extent to which a clause represented an event boundary was coded on a continuous scale, onto which we regressed measures of eye-movement behavior. A number of eye-movement measures revealed that event structure predicted eye-movement behavior. For example, fixation durations were longer for event boundaries and regressions were more likely to land on event boundaries. Eye movements provide a rich set of online data to support the cognitive reality of event segmentation during reading.
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(5015)

Post-Traumatic Stress Disorder Symptom Severity Predicts Event Processing Performance. MICHELLE L. EISENBERG, JESSE Q. SARGENT and JEFFREY M. ZACKS, *Washington University in St. Louis*—The ability to segment ongoing activity into meaningful events is integral for event understanding and memory. Neuroimaging and behavioral studies suggest that Post-Traumatic Stress Disorder (PTSD) could impair some of the mechanisms of event segmentation, and that this may hurt subsequent memory. To test this hypothesis, 145 participants completed event segmentation and memory tasks; tests of working memory, episodic memory, general knowledge, and processing speed; and questionnaires assessing severity of PTSD, dissociation, and perceived social support. PTSD, dissociation, and social support explained unique variance in event segmentation performance, even after controlling for general cognitive function. Furthermore, social support explained unique variance in event memory. Difficulty segmenting events may affect PTSD patients' ability to interpret the activity occurring around them, perhaps contributing to symptoms such as intrusive recollections and increased arousal. If so, then interventions aimed at improving event encoding may help compensate for episodic and autobiographical memory disruptions in PTSD.
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• SOCIAL ASPECTS OF MEMORY •

(5016)

Self-Reference as Level of Processing in a Remember/Know Experiment. GUSTAVO GAUER and JULIANA A. DESOUZA, *Universidade Federal do Rio Grande do Sol*—Self-reference is relevantly correlated to the Levels of Processing (LoPs) in episodic memory. In this study self-related was contrasted with non self-related processing both in human and object representations. Thirty Brazilian undergraduates (average 24 years-old, 18 female) responded to a Remember/Know (R/K) task manipulating LoPs at encoding. In the study phase, 66 words (adjectives and quality-related nouns) were presented in 3 conditions, respectively asking if the word applied: to one´s self (condition Self); to the President of Brazil (Other); or to a train (Object). In the test phase, after a 3 minute filler task, study items were randomly presented among 40 distractors. Subjects responded whether each item was old or new (O/N) and were prompted for a R/K judgment if the item was recognized. The LoP conditions showed main effects on reaction times (RTs) for O/N ($F=3.15$; $p<.05$), but not R/K responses, with lower RTs for Self, followed by the Other and Object conditions. RTs for R/K judgments were better predicted by an actual "remember" response than by LoPs. Results indicate activation of self-related representations facilitating deeper encoding, but not necessarily engaging episodic recollection.
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(5017)

Similarity to the Self Affects Memory for Others. ERIC D. LESHIKAR and ANGELA H. GUTCHESS, *Brandeis University*—Previous evidence suggests that information relevant to the self is better remembered than information that is not. We examined whether the self-reference effect might extend to memory for first impressions of other individuals. We predicted that people with traits similar to the self would be better remembered than those with traits less similar to the self. In this experiment, participants were shown faces paired with a behavioral sentence and the trait adjective implied by the behavior and were instructed to form positive or negative impressions at the time of study. After a recognition memory test, participants rated the traits seen at study for self-relevance allowing us to sort first impression memory into high, medium and low self-relevant trials. Results indicated that high-relevant individuals (people who had traits that were deemed highly self-relevant) were better remembered than were the individuals of medium or low self-relevance. These data suggest that the mechanism supporting self-referencing not only supports memory for information related to the self (e.g., descriptive traits), but it also affects memory for other people.
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(5018)

Mate Processing and Memory for Facts about People. JAMES A. KOLE and ALICE F. HEALY, *University of Colorado, Boulder*—The present study examined whether memory is better for potential mates than for potential friends. In 2 experiments, subjects learned fictitious facts about unfamiliar individuals and were tested immediately afterwards. Subjects were told that these individuals were potential mates (mate processing condition) or potential friends (friend processing condition), or they were given no processing instructions (control condition). In Experiment 1, following learning and testing, subjects in the mate and friend processing conditions selected the individual they would most likely date or

befriend, respectively. In Experiment 2, before learning and testing, subjects were provided with the name of a randomly selected individual and were told that the individual was most compatible with them as a mate or friend. At learning and at test, for the mate and friend processing conditions, memory was better for individuals who were selected as mates or friends than for those who were not, particularly in the mate processing condition and for subjects who were in a relationship. These results are interpreted in terms of survival processing, with attentional narrowing as a possible proximate mechanism.
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(5019)

The Role of Creativity in Unconscious Plagiarism. WILLIAM G. WENZEL and RICHARD J. GERRIG, *Stony Brook University*—We suggest that people's level of creativity affects the extent to which they accept more or less creative products as their own. To test this hypothesis, we carried out a study of unconscious plagiarism. In the first phase of the study, participants carried out a test of creativity (they wrote fortunes for a fortune cookie company). Participants provided their own answers and also viewed "example" fortunes. In the second phase (a week later), participants viewed fortunes and indicated which they believed had been their own and which had been examples or wholly new. We assessed participants' creative ability on the task and established the relative creativity of particular fortunes. Confirming our predictions, we found that more creative participants unconsciously plagiarized more from high creative tokens than did less creative participants; less creative participants unconsciously plagiarized more from low creative tokens. These results support a link between creativity and unconscious plagiarism.
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(5020)

The Impact of Providing Feedback on Response Distributions in Group Learning. LINDSAY S. ANDERSON, ALICE F. HEALY, MATT JONES and LYLE E. BOURNE, JR., *University of Colorado*—The type of feedback available in group learning situations (e.g., classrooms) is potentially richer than with individual learning. In addition to providing the correct answer, instructors can present information about the group's responses, such as a histogram of response frequencies. The impact of such distributional feedback is especially interesting when the most popular response is not correct. In this case, distributional feedback may improve learning, by increasing students' awareness of popular misconceptions, or it may impede learning, by making the incorrect answer more salient. The current study tested these hypotheses by artificially manipulating fictitious group response distributions, presented individually to subjects. Final test performance was unaffected by distributional feedback when the correct answer was most popular, but performance was significantly worse when an incorrect answer was most popular. These results have important implications for real-time electronic quizzing systems ("clickers"), which have become increasingly popular in college and high school classrooms.
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(5021)

Repeating Accented Speech Attenuates the Production Effect. KIT W. CHO and LAURIE B. FELDMAN, *University at Albany, SUNY*—The production effect refers to the finding that words that are spoken aloud are remembered better than those that are read silently (MacLeod et al., 2010). We report two experiments that explored the production effect using English words spoken in the subjects' native accent (American) or a foreign accent (Chinese). In both experiments, participants repeated or listened to a word that was presented in an American or Chinese accent, and memory was assessed using free recall and yes-no recognition memory tests. Experiment 2 used Chinese-accented words that differed in their identifiability rate. In both experiments (1) recall and recognition performance for words that were repeated was higher than for those that were listened to, and (2) in recognition but not recall, words that were listened to in the Chinese accent were more memorable thereby attenuating the benefit of production.
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• EXPLICIT MEMORY III •

(5022)

Properties of Event Clusters Involving Earliest Childhood or Childhood Memories. JOSEPH M. FITZGERALD, MICHELLE WRIGHT and KENDALL M. SOUCIE, *Wayne State University*—Event clusters are one model of the organization and structure of autobiographical memory (Brown & Schopflocher, 1998). As such, the study of event clusters provides a vehicle for the study of memory development. The present study compared the properties of two types of memory cluster: Type 1.) earliest childhood memory along with an event cued by the earliest childhood memory; Type 2.) a memory from 8 to 11 years of age along with an event cued by that 8-11 memory. Some differences were found. For example, the results indicate that the within cluster correlations for emotional intensity and visual experience are significantly lower within the earliest memory cluster than the childhood event cluster. The correlations for several other phenomenological details (e.g., reliving, emotions, rehearsal, coherence, etc.) did not differ between event clusters. Thematic content, subject-perceived and observer-rated linkages, and response time between the two event clusters were also explored. Strong support for the hypothesis of similarity of event clusters was found, but some indications of unique linkages were found.
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(5023)

Autobiographical Memories for World Historic Events. TRAVIS WHITE-SCHWOCH and MATTHEW E. JACOVINA, *Northwestern University,* STEVEN A. CULPEPPER, *University of Illinois at Urbana-Champaign,* DAVID N. RAPP, *Northwestern University*—The historically significant events that we observe throughout our lives present situations in which public semantic knowledge interacts with personal experience. Relatively little is known, though, about

the consistency and confidence of memories for such events over time. We examined memories for three contemporaneous events over a period of 1, 6, and 32 weeks following their occurrence: the Osama bin Laden assassination, Barack Obama's birth certificate release, and UK Prince William's wedding. These events differed on factors including personal relevance, investment, and predictability. The most personally relevant and reported event for the participants, that of the bin Laden assassination, was associated with vivid and consistent memories, with slower rates of decay than was observed for the other events. Participants' self-reported communication of the assassination also predicted their subsequent memory confidence. The obtained patterns of confidence and vividness for the three events reveal features that shape our memories for unfolding history.
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(5024)

Do Subjective Ratings of Autobiographical Memory Predict Objective Measures of Narrative Content? SAMANTHA A. DEFFLER, CHRISTIN M. OGLE and DAVID C. RUBIN, *Duke University*—The qualities of autobiographical memory (ABM) are typically measured using subjective ratings that rely on introspection or objective ratings of memory characteristics (e.g., word counts). Few studies have examined the relation between subjective and objective measures of ABM. To elucidate whether people's subjective views of their memories influence how they narrate these memories, we assessed the extent to which subjective ratings of ABM predict objective qualities of ABM narratives. Approximately 800 memories were rated by participants at recall using the Autobiographical Memory Questionnaire. Memory transcripts were analyzed using the Linguistic Inquiry Word Count. Analyses of interest included whether self-reported ratings of an observer perspective, reliving, and vividness are associated with greater use of perceptual words (e.g., see, hear). Preliminary results indicated that subjective ratings of an observer visual perspective predicted a greater proportion of perceptual words in the narratives. Implications of introspective thought influencing ABM reconstruction will be discussed.
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(5025)

Mapping the Structure of Semantic Memory. ANA SOFIA MORAIS, HENRIK OLSSON and LAEL J. SCHOOLER, *Max Planck Institute for Human Development*—Aggregating snippets from the semantic memories of many individuals may not yield a good map of an individual's semantic memory. The authors analyze the structure of semantic networks that they sampled from individuals through a new snowball sampling paradigm, during approximately six weeks of one-hour daily sessions. The semantic networks of individuals have a small-world structure, with short distances between words and high clustering. The distribution of links follows a power law truncated by an exponential cut-off, meaning that most words are poorly connected and a minority of words has a high, although bounded, number of connections. Existing aggregate networks mirror the individual link distributions, and so they are not scale-free, as has been previously assumed; still there are properties of individual structure that the aggregate networks do not reflect. A simulation of the new sampling process suggests that it can uncover the true structure of an individual's semantic memory.
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(5026)

Beyond Priming: Causes of Sequential Dependence in Semantic Production Tasks. KEVIN A. SMITH, MATTHEW OLARANO, EDWARD VUL and DAVID E. HUBER, *University of California, San Diego*—In many tasks that involve producing a sequence of responses from semantic memory (word association, naming category members, etc.), consecutive responses tend to be more related to one another than responses further separated in time. Here we investigate the causes of this sequential dependence: does it arise from involuntary priming by the preceding response, or is it a feature of the semantic search strategy that people adopt? If dependency arises solely from priming, then a prior response should exert influence on a future response if they are merely adjacent. To test this prediction, we asked subjects to provide a sequence of potential answers to two interleaved Remote Associates Test problems. When subjects returned to a problem, their first response was more related than chance to the prior response from that problem, despite intervening responses to the other problem. In contrast, we saw no such relationship between adjacent responses from different problems. This result shows that the sequential dependence is specific to the current problem, indicating that dependence does not arise from automatic priming by the preceding response, but is instead a feature of the semantic search strategy that people employ.
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(5027)

Terminating Search in Retrieval From Memory. ERICA C. YU, ERIKA K. HUSSEY, MICHAEL R. DOUGHERTY and J. ISAIAH HARBISON, *University of Maryland,* EDDY DAVELAAR, *Birkbeck University of London*—Decisions to terminate or give up search of memory are ubiquitous and part of our everyday decision making but researchers have only recently begun to study the nature of the potential rules for terminating such search. This study explores whether the trade offs we make between the costs and rewards of retrieval from memory are rational and lawful. Experiments used an open-ended free recall paradigm, in which participants decide themselves when to end the retrieval period and manipulations of the environment of costs and rewards. By focusing on measures such as total time spent retrieving, inter-retrieval latencies, and exit latencies (time spent searching for a final item before giving up), we are able to limit the number of plausible rules used to terminate search.
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(5028)

Dissociative Effects of Retrieval Practice and Elaboration on Proactive Interference. MELISSA LEHMAN, MEGAN A. SMITH and JEFFREY D. KARPICKE, *Purdue University*—Retrieval practice enhances memory and helps to insulate

later learned information from proactive interference (Szpunar, McDermott, & Roediger, 2008). According to the elaborative retrieval hypothesis, the retrieval practice benefit occurs because the retrieval of studied information promotes the generation of semantically related information, which aids in later retrieval (Carpenter, 2009). We examined the effects of retrieval and elaboration on proactive interference. Subjects studied multiple word lists and either recalled each list (retrieval practice), did a math task (control), or generated associates for each word (elaboration) after each list. After studying the last list, all subjects recalled the list, and after a 5-minute delay recalled all lists. Retrieval practice after each list enhanced correct recall and reduced prior-list intrusions on the final list (i.e. reduced proactive interference) compared to the control condition. Elaboration, however, reduced correct recall performance and increased prior-list intrusions (i.e. increased proactive interference) compared to control. Analyses of temporal clustering and response times further suggest a dissociation between retrieval and elaboration.
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(5029)

Are High-Value Items More or Less Vulnerable to Retrieval-Induced Forgetting? TOSHIYA MIYATSU, MICHAEL C. FRIEDMAN, ALAN D. CASTEL and ROBERT A. BJORK, *University of California, Los Angeles*—Retrieving information in response to some cue typically produces both retrieval-induced remembering and retrieval-induced forgetting (RIF)—that is, enhanced later recall of retrieved information and impaired recall of competing information—and competing information most strongly associated to a retrieval cue appears most vulnerable to RIF. We examined whether important or high-value competing items would act like strongly associated items or, given participants' strong efforts to remember such items, would be protected from RIF. Participants studied category-exemplar pairs that differed by category in the point value or reward associated with each pair (5, 10, or 20 points). After a retrieval-practice phase that involved retrieving half the members of half the categories, participants attempted to maximize their point totals on a final test of all pairs. Significant main effects of value and RIF were observed and the high-value (20-point) exemplars were, if anything, more vulnerable to RIF than were lower-value exemplars.
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(5030)

Production Improves Memory Even Following Generation or Imagery. NOAH D. FORRIN, TANYA R. JONKER and COLIN M. MACLEOD, *University of Waterloo*—Reading aloud benefits memory relative to silent reading. This "production effect" has been found chiefly using a within-subjects design, one of the results leading MacLeod et al. (2010) to postulate that distinctiveness drives the memory advantage for produced words. Consistent with this distinctiveness account, they found that even words that were deeply encoded—through generation or a pleasantness judgment—received an additional memory boost from production. Experiment 1 of the present research extended this result to imagery: We found an incremental benefit of production for words that were imagined as objects. In Experiment 2, we demonstrated an additive effect for generation and production; more important, the magnitude of the production effect was consistent for generated and read words. In line with the distinctiveness account, we conclude that "aloud" information stands out as equally distinct—and consequently memorable—regardless of whether it accompanies deep or shallow processing.
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(5031)

The Continued Influence of Implied Versus Directly Stated Misinformation. PATRICK R. RICH and MARIA S. ZARAGOZA, *Kent State University*—Previous studies have documented that initial accounts provided in preliminary news stories can continue to influence beliefs even after a correction is given; a phenomenon called the continued influence effect (CIE; e.g., Johnson & Seifert, 1994). Whereas prior research has focused on how the nature and timing of the correction influences CIE, the present study examined whether some kinds of preliminary information are easier to correct than others. One dimension on which preliminary accounts of crimes may vary is the certainty with which they identify someone as the culprit. We hypothesized that it may be more difficult to correct information that merely casts suspicion on an individual (implied suspect condition) than a statement which states that the individual is a suspect (explicit suspect condition). In support of this hypothesis, the current study found that a CIE was observed in the implied suspect condition but not the explicit suspect condition.
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(5032)

Source Monitoring for Color Information: Accuracy is Higher for Intrinsic than Extrinsic Features. KERRY A. CHALMERS and HEIDI E. TURON, *The University of Newcastle*—The effect of intrinsic versus extrinsic source features on source monitoring performance was investigated under intentional versus incidental learning instructions. Eighty-eight undergraduate students completed a visual source monitoring task, a binding task, and three short-term memory tasks (forward and backward digit span and grid span). In the source monitoring task, participants viewed line drawings of common objects drawn in red or green surrounded by a black frame (intrinsic condition) or drawn in black surrounded by a red or green frame (extrinsic condition). At test, forced-choice item recognition judgments were followed by source judgments regarding the color presented with each picture. As predicted, participants were more accurate in the intrinsic than the extrinsic source condition and in the intentional than the incidental learning condition. Source monitoring accuracy was predicted by performance on the binding task, but only in the intrinsic condition. Implications for theories of source monitoring performance are discussed.
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(5033)

Age and Cognitive Abilities: A Non-Monotonic Relationship. BONNY A. BRIGHT, MICHAEL D. BESCH, HELGA NOICE and TONY NOICE, *Elmhurst College*—One hundred and twenty-nine residents from 5 different retirement homes in the Chicago area were given a battery of cognitive/functional tests. Comparing the test scores of young-olds (65-69 yrs.) to old-olds (85-90+ yrs), strong disparities were found on some measures (e.g., delayed recall) but not on others (e.g., problem-solving). Furthermore, functional performance (as measured by the OTDL-R, Diehl et al. , 2005) was remarkably similar across age groups. Results of the Memory Controllability Index (MCI, Lachman et al., 1995) showed great disparities between young-olds and old-olds on likelihood of remaining independent (with the major drop-off at age 75) but not on ability to improve with effort.
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• HUMAN LEARNING AND INSTRUCTION III •

(5034)

Self-Paced Study Beats Fixed-Paced Study. MARIO DE JONGE and HUIB K. TABBERS, *Erasmus University,* YOONHEE JANG, *University of California, San Diego,* DIANE PECHER and RENÉ ZEELENBERG, *Erasmus University*—In a vocabulary learning experiment, native speakers of English studied lists of Dutch-English word pairs under one of four imposed fixed presentation rate conditions (24 x 1 s, 12 x 2 s, 6 x 4 s, or 3 x 8 s) and a self-paced study condition. Total study time per list was equated for all conditions. For fixed presentation rate conditions, we found a non-monotonic relationship between presentation rate and recall performance with intermediate presentation rates resulting in superior recall. In addition, self-paced study resulted in better recall performance than fixed presentation rates, with the exception of the 12 x 2 s condition which did not differ from the self-paced condition. Additional correlation analyses suggested that the benefit of self-paced over fixed-paced study resulted from the allocation of more study time to difficult pairs than to easy pairs.
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(5035)

Computerized Hints Can Optimize Feedback. MATTHEW J. HAYS, *University of Southern California,* JASON R. FINLEY, *University of Illinois at Urbana-Champaign,* ROBERT A. BJORK, *University of California, Los Angeles,* AARON S. BENJAMIN and JOHN A. WALKER, *University of Illinois at Urbana-Champaign*—Learners are often poor stewards of their own instruction, terminating study too soon (Kornell & Bjork, 2008) or laboring in vain (Nelson & Leonesio, 1988). In the present experiment, participants studied 60 cue-target word pairs. They then engaged in four rounds of retrieval practice for all 60 pairs. During retrieval practice, the participants were prompted with the cue word plus one of three types of assistance: (a) standard feedback, which revealed the correct target after each response; (b) diminishing hints, which provided fewer letters of the target stem on each successive round; or (c) adaptive hints, which added target letters until retrieval was successful on each trial. On a cued recall test 10 minutes after retrieval practice, performance was highest for pairs practiced with adaptive hints. Thus, computer-guided adaptive hints ensured that learners encountered desirable difficulties--and overcame them in a productive way.
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(5036)

Thinking Like a Teacher Enhances Memory for Text Information. JOHN F. NESTOJKO, DUNG C. BUI and HENRY L. ROEDIGER, III, *Washington University in St. Louis* (Sponsored by Sana Hale)—Recently, we demonstrated that expecting to teach—without actually teaching—improved learning of text information as compared to expecting a test of that information. To enhance applicability of these findings, our current research examined if two new conditions would produce comparable results. Prior to encoding, participants were given instructions telling them they might teach, they should pretend that they would later teach, or that they should expect a test. Subsequently, all participants read two text passages and were tested on one passage, then returned two days later to be tested on both passages (i.e., one retest and one new test). Results revealed that, similar to our prior findings, the teaching-expectancy proxy conditions (i.e., might-teach and pretend-to-teach) produced benefits on free recall tests and multiple-choice tests. Additionally, these benefits persisted over a 2-day delay if tested initially. However, these conditions did not enhance problem-solving abilities relative to expecting a test.
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(5037)

Does Auditory Inductive Learning Benefit From Blocking or Interleaving Category Exemplars? VERONICA YAN, EMILY R. VETTER and ROBERT A. BJORK, *University of California, Los Angeles*—In contrast to learners' intuitions, inductive learning often benefits more from interleaving exemplars of different categories than from blocking exemplars by category (e.g., Kornell & Bjork, 2008). Existing studies, though, have used visual materials, such as exemplars of bird families or artists' paintings, and there are reasons to think that learning auditory categories might profit from blocking exemplars. Current conceptions attribute the benefits of interleaving, in part, to learners recalling previous exemplars of a category when exposed to new exemplars—and such retrieval may be more difficult with auditory exemplars. We examined inductive learning of auditory categories in two experiments, one using categories (birdsongs) where retrieving prior exemplars would seem difficult, another using categories (female voices) where participants are more practiced at retrieving exemplars. Participants listened to six clips of each of 12 bird species or female voices, either interleaved or blocked, and then identified new exemplars on the final test. Inductive learning benefited from interleaving in both experiments, whereas the participants, post experiment, judged blocking to be more effective for learning.
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(5038)

Know Thy Enemy: Competition is Better Than Cooperation in Recall Performance. SU HYOUN PARK, CHONG IN NAH, EUN HEE JI and MIN-SHIK KIM, *Yonsei University*—Reysen and Adair (2008) found that participants' recall performance was better when the memory items were purportedly given by another participant than by the computer, indicating social processing can improve recall performance. Different social contexts, however, may have different effects on memory. For example, recall performance may depend on whether the nature of social context is cooperative or competitive. In the current research, each participant studied a 30-item word list and performed a turn-based recall test with his/her partner (a confederate) who was believed to be either participant's cooperator or competitor. After a brief distractor task, participants were asked to recall the words that the participants and their partners had recalled in the turn-based recall test. Results showed that participants recalled more of the items recalled by the competitive partner than the cooperative partner. This suggests that the nature of social context also matters in recall performance. Social processing does not always improve memory performance; rather, performance depends on the nature of social context. Further research should be conducted on how dissociable components of social processing interact with memory performance.
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(5039)

Spreading the Words: A Spacing Effect in Vocabulary Learning. NICOLE A.M.C. GOOSSENS, GINO CAMP, PETER P.J.L. VERKOEIJEN, HUIB K. TABBERS and ROLF A. ZWAAN, *Erasmus University Rotterdam*—The spacing effect refers to the frequently observed finding that distributing learning across time leads to better retention than massing it into one single study session. In the present study, we examined whether the spacing effect generalizes to primary school vocabulary learning. For this aim, children from grade 3 were taught the meaning of fifteen new words using a massed procedure and fifteen other new words using a spaced procedure. The fifteen words in the massed condition were divided into three sets of five words, and each set was taught three times in one of three learning sessions. In the spaced condition, learning was distributed across the three sessions: All fifteen words were practiced once in each of the three learning sessions. At the retention tests after one week and after five weeks we observed that the meaning of spaced words was remembered better than the meaning of massed words.
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(5040)

Prior Knowledge Must Be Evaluated to Protect Against Illusory Truth Effects. MEREDITH E. MECHANIK and ELIZABETH J. MARSH, *Duke University* (Sponsored by Alan Brown)—To judge if something is true, people often use heuristics such as familiarity. Surprisingly, people rely on these cues even when they should be able to retrieve the knowledge needed to make a judgment, meaning contradictions like "The Nile is the longest river in South America" are rated as truer if previously seen (an illusory truth effect). In two experiments, we manipulated whether subjects initially rated how true or interesting they found statements in order to examine whether forcing subjects to initially evaluate stored knowledge would dilute repetition effects. The illusory truth effect only occurred when the statements were initially rated for interest, not truth; when subjects initially rated statements for interest, they later rated repeated statements as truer than new statements. In contrast, no illusory truth effect occurred when subjects initially evaluated facts for truth. Evaluating the truth of information may safeguard against illusory truth effects.
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(5041)

Multiple Exposures to Novel Words and the Development of Word Representations During Silent Reading. STEPHEN M. BRUSNIGHAN and JOCELYN R. FOLK, *Kent State University* (Sponsored by William E. Merriman)—Previous studies investigating incidental word learning during reading have demonstrated that readers are skilled at retaining novel word meanings after one incidental reading exposure. In the current study, we investigated whether memory for information about newly acquired words increased with the number of exposures to those novel words during the reading session in a variety of informative sentence contexts. In our study, participants read sentence pairs containing novel and known English words while their eye movements were recorded. For each participant, the target words were presented either once in a single sentence context or presented 3 or 6 times in different informative sentence contexts. Following the reading session, participants took vocabulary tests on the novel target words from the reading session and tests of their linguistic skills. Both the number of exposures to novel words during the reading session and participants' linguistic skill levels impacted reading times and vocabulary outcomes.
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• AUTOMATIC PROCESSING •

(5042)

The Taming of the Stroop: Strategic Control of Automatic Processing. SARAH UZZAMAN and STEVE JOORDENS, *University of Toronto* (Sponsored by John M Kennedy)—Previous work has shown that certain manipulations modulate the magnitude of Stroop interference which suggests that participants can exert some control over the processing of irrelevant dimensions. We describe two experiments that follow up on this work using a proportional manipulation on integrated Stroop stimuli. In Experiment 1 we compared the modulation of Stroop interference as a function of proportion manipulations for both separated and integrated Stroop stimuli, where Stroop interference was reduced in the context with a lower proportion of congruent trials relative to incongruent trials. In Experiment 2 we tested one possible

alternative explanation of the Experiment 1 results, and ruled it out. The reduction in Stroop interference for the integrated items appears to provide strong evidence that participants can indeed modulate the extent to which they process the word dimension of a Stroop stimulus.
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(5043)

The Primacy of Components in Numerical Fractions. THOMAS J. FAULKENBERRY and SARAH A. MONTGOMERY, *Texas A&M University, Commerce*—Recent studies in numerical cognition have yielded equivocal results concerning the representation of fractions. In the present experiment, we used computer mouse tracking to investigate the temporal dynamics of fraction representations in a comparison task. We manipulated the numerical value (larger or smaller than 1/2) and the component size (larger or smaller than 5) of fractions as people mentally compared the fraction to 1/2. We found that participants' hand trajectories tended to deviate toward a response that was consistent with component size, not fraction magnitude. However, there was an overall numerical distance effect, indicating that participants did form representations of numerical value, but only after first attending to the components separately. These data support the numerical dual code theory of Cohen Kadosh and Walsh (2009), where people first process an initial automatic code tied to surface format, but later refine this code to accommodate task demands.
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(5044)

How Well Do Skilled Typists Know the QWERTY Keyboard? KRISTY M. SNYDER, *Vanderbilt University,* YUKI ASHITAKA, *Kobe University,* GORDON D. LOGAN, *Vanderbilt University,* HIROYUKI SHIMADA, *Kobe University*—QWERTY keyboards are ubiquitous. Therefore, we should know them like the back of our hands, but do we? Skilled typists have excellent implicit knowledge of key locations, which enables them to execute 5-6 keystrokes a second. We investigated whether typists also have explicit knowledge of key locations. In a free recall experiment, typists correctly located 14.9, mislocated 5.9 and omitted 5.1 letters. In a cued recall experiment, typists correctly identified letter locations 79% of the time. In a recognition memory experiment, the hit rate was 82% and the false alarm rate was 15% for adjacent locations and 4% for distant locations. The findings indicate that skilled typists have explicit knowledge of about half of the key locations and incomplete or inaccurate knowledge of the remaining key locations. The results support a two-loop theory of skilled performance by demonstrating that skilled typists' explicit knowledge is insufficient to enable their fluency.
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(5045)

You Better Stop! Binding of "Do Not Respond" Tags to Distractors. CARINA S. GIESEN and KLAUS ROTHERMUND, *University of Jena*—Irrelevant stimuli become integrated with simultaneously executed responses into a transient episodic unit; subsequently repeating the distractor automatically triggers retrieval of the associated response. The current research investigates whether this basic process of behavior automatization also applies to situations in which one did not respond to a stimulus. In two experiments, a stop-signal task was combined with a sequential priming paradigm to test whether distractors are associated with a "do not respond" tag. Stopping a simple response during the prime trial delayed responding and facilitated stopping in the probe if the same distractor was presented in prime and probe. These distractor repetition effects were independent of the relation between the to-be-executed responses in the prime and probe, indicating that "do not respond" tags are global ("do not respond at all") rather than being response-related (e.g., "do not press the left key").
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(5046)

Effects of Sex and Gazing Direction on the Face Preference. KENGO TANE and CHIKASHI MICHIMATA, S*ophia University*—Shimojo, Simion, Shimojo, & Scheier (2003) indicated that the active gaze shift increased the preference of the long-gazed faces. The present study examined the influence of gaze direction (direct or indirect gaze) and the sex of the presented faces. The participants performed two-alternative forced choice, and we manipulated stimulus presentation duration to cause the gaze duration bias. The stimuli were male and female faces gazing directly or indirectly. The preferred rate of long-gazed face was the dependent variable. The results showed that the long-gazed faces were more preferred in the male faces, irrespective of the participant's sex. This difference was observed only for the faces that were not gazing at the front.
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• COGNITIVE CONTROL IV •

(5047)

Exploring Task Differences in Backward Inhibition. FRANCES J. FRIEDRICH and JAMES N. NELSON, *University of Utah,* RUSSELL E. COSTA, *Westminster College*—Backward inhibition (BI), or N-2 repetition costs, occurs when performance in Task A is slower if that task was recently abandoned (e.g., task sequence ABA) than if it was not recently performed (e.g., CBA). This pattern is thought to suggest that as a new task is prepared, the previous task is actively inhibited. However, color discrimination tasks appear to operate differently than others: although switch costs for color judgments may be comparable to other tasks, BI effects for color are smaller or non-existent (e.g., Costa & Friedrich, 2012; Mayr & Keele, 2000). In a series of experiments we explored why the color task does not routinely produce BI. For example, increasing or decreasing the overall difficulty of a task may affect the size of the switch cost but does not affect BI in the same way. We discuss the nature of BI in light of these task effects.
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(5048)

Factors Influencing Transfer of Item-Specific Control and Associative Learning. JULIE BUGG and ERICA DAYAN, *Washington University in St. Louis*—The item-specific proportion congruent (ISPC) effect is the finding that Stroop interference is reduced for mostly incongruent as compared to mostly congruent items. Using picture-word Stroop, three experiments examined transfer of the ISPC effect to novel stimuli under conditions that (a) stimulated use of item-specific control (modulation of word reading), or (b) stimulated use of associative learning (prediction of high contingency responses). During training, two exemplars from each category were used. During transfer, three new exemplars from each category were presented. Transfer of item-specific control was largely absent, possibly because participants did not develop a category-level representation, unlike in prior studies with four exemplars (Bugg, Jacoby, & Chanani, 2011). By contrast, evidence for transfer of associative learning was present, although no such evidence was found when the transfer items required a different response than training items. These findings reveal theoretically important factors influencing transfer in ISPC paradigms.
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(5049)

Conflicts as Aversive Signals. GESINE DREISBACH, *University of Regensburg,* RICO FISCHER, *Technische Universität Dresden*—According to one highly influential theory of human action control, the mobilization of cognitive control is triggered by the detection of response conflicts. The idea that the anterior cingulate cortex (ACC) serves as the conflict detector has recently been challenged suggesting that its function lies in the detection of aversive signals in general. Two experiments will be presented, providing first direct evidence that conflicts are actually registered as aversive signals. Congruent and incongruent Stroop color-words served as primes, positive and negative stimuli (Exp. 1a: Pictures; Exp. 1b: Words) as targets in an affective priming paradigm. The predicted interaction Prime congruency X Target valence proved significant in both experiments: negative targets were evaluated faster after incongruent than after congruent Stroop primes and positive targets were evaluated slower after incongruent than after congruent primes. Results have behavioral and theoretical implications for theories of human action control and ACC function.
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(5050)

Can Internet Data be Trusted? Validating Mechanical Turk for Cognitive Research. MATTHEW J. C. CRUMP, *Brooklyn College, CUNY,* TODD M. GURECKIS and JOHN V. MCDONNELL, *New York University*—Amazon Mechanical Turk is an online crowd sourcing service where anonymous online workers complete web-based tasks for small sums of money. There are many workers willing to perform tasks, and an experiment with n=100 can easily be conducted over night. Amazon Turk has become increasingly popular in the decision making literature, thereby partly demonstrating the viability of the service for running psychology experiments. However, the service has not been validated for cognitive research in general which typically requires multi-trial designs and millisecond accuracy for response recording and stimulus presentation. The service was validated by replicating several classic cognitive tasks including: Stroop, Task-switching, Flanker, Simon, Visual cuing, Attentional blink, Subliminal priming, and Category learning tasks. The replications were mostly successful and validated the approach. A wide-variety of behavioral research can be conducted in a rapid, cost-effective manner using Amazon Mechanical Turk.
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(5051)

Does Response Inhibition or Binding Cause Response Repetition Effects? CHRIS HYDOCK, JOHN PHILBECK and MYEONG-HO SOHN, *The George Washington University*—Humans must constantly select reactions to the various stimuli they perceive, a demand that is facilitated with cognitive control. Normally, there are performance benefits when repeating response to a stimulus, but sometimes there are performance costs, referred to here as response repetition effects (RR effects). Two explanations have been offered. According to the binding account, stimuli and responses become associated. Completely repeating a previous association facilitates processing, but only partially repeating a previous association interferes with processing. According to the inhibition account, responses are inhibited after they are execution to prevent accidental re-execution. This inhibition in combination with stimulus priming produces RR effects. Understanding RR effects in relation to these accounts is a necessary step towards a complete grasp of cognitive control. We used two task-switching experiments to distinguish the accounts. In Experiment 1, participants responded to the magnitude of two dimensions of a stimulus. In Experiment 2, participants categorized letter and number stimuli that were presented in one of two locations. Results are considered in relation to two accounts of RR effects.
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(5052)

Conflict Resolution Processes are Mediated by Stimulus Presentation Rate and Language Experience. SUSAN TEUBNER-RHODES, DONALD J. BOLGER and JARED M. NOVICK, *University of Maryland*—Cognitive control—the ability to regulate mental activity—is crucial for resolving among conflicting evidential sources. Generally, conflict detection initiates sustained cognitive control engagement, which enhances resolution on subsequent conflict trials (i.e., conflict adaptation). Using the Stroop task, we examined how adaptation is influenced by task demands and individual differences in cognitive control, by manipulating stimulus-presentation rate and language experience. By presenting stimuli at jittered inter-stimulus intervals (1500, 3500, 5500ms), we increased conflict-monitoring demands. We also tested the effect of bilingual (versus monolingual) language experience—believed to enhance cognitive-control abilities—on Stroop performance. Jittering stimulus-presentation rate eliminated conflict-adaptation effects, suggesting

that behavioral adjustments are mediated by variable monitoring demands. Interestingly, in the first half of the task, monolinguals exhibited significant Stroop-interference and -facilitation accuracy effects, whereas bilinguals exhibited neither. Thus, modulating conflict-monitoring demands (via jittered presentation rate) impairs conflict adaptation, whereas increasing cognitive-control abilities (via bilingual experience) improves resolution processes.
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(5053)

Effects of Cognitive Control Training on Decision Making and Creative Thinking. EVANGELIA G. CHRYSIKOU, ELIZABETH A. JOHNSON and KAYCI L. VICKERS, *University of Kansas*—Cognitive control influences cognition by functioning as a filtering mechanism that maintains task-relevant information while gating task-irrelevant information. Research has shown that cognitive control is amenable to change: training regimens have increased participants' performance in tasks that require working memory or resolution of conflict among competing representations. In contrast, research also indicates that reduced cognitive control can promote certain types of learning and creative problem solving. Nevertheless, the generalizability of these findings to other kinds of cognitive tasks has not yet been investigated. We hypothesized that training that increases cognitive control would improve decision-making, though have negative consequences for creative thinking, whereas training that decreases cognitive control would have the reverse effects. Participants were randomly assigned to one of six conditions depending on the training task and the type of dependent measure that they received following the training. The results show dissociable effects of training as a function of the tasks and support a view of cognitive control as a flexible mechanism adapted to a subset of a person's everyday challenges.
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(5054)

The Effects of Implicit Sequence Knowledge on Distractor Interference. RACHEL M. WYNN, MATT HITCHINS and MYEONG-HO SOHN, *The George Washington University*—We used a sequence version of the Simon task in which a spatial response is executed to a non-spatial feature (i.e., color) of a stimulus that is presented in a spatial location. Using four colors and four locations, we manipulated the consistency of a color, therefore a target sequence, or a location, therefore a distractor sequence. The hypothesis is that the both types of implicit knowledge will automatically activate the spatial code associated with them. When the spatial code associated with the target is activated, the distractor interference should decrease. In contrast, when the distractor-related spatial code is activated, the distractor interference should increase. We tested these predictions in a series of implicit sequence learning experiments. The results show that while participants were generally unaware of the consistent sequence, the implicit sequence knowledge differently benefited the performance depending on the knowledge was about the target or the distractor.
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(5055)

The Source of Response Repetition Cost: Evidence From a Subliminal Priming Study. MATT HITCHINS, RACHEL M. WYNN and MYEONG-HO SOHN, *The George Washington University*—Response repetition benefits performance when the stimulus or task is repeated. However, when the task or stimulus changes, repeating the same response often results in a response repetition cost (RRC). To investigate the source of RRC, we adopted a subliminal priming version of the task-switching paradigm, in which the prime task is either the same as or different from the probe task. In the subliminal condition and the dummy condition, the prime stimulus was presented for 15-24 ms and participants issued a response based on their best guesses. In the dummy condition, the prime stimulus was not associated with a valid response. In the supraliminal condition, the prime stimulus was presented above the perceptual threshold. The results showed that the RRC does not depend on the perception of the stimulus, suggesting that the RRC can occur solely due to the processes related to the execution of a motor response.
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• SPEECH PERCEPTION II •

(5056)

Rapid Decay in Speech Perception. L. ROBERT SLEVC and RYAN A. SIMMONS, *University of Maryland, College Park,* RANDI C. MARTIN, *Rice University*—Does speech perception require sustained activation of phonology to accurately activate lexical and semantic representations? NL is a patient with pure word deafness (PWD), a severe deficit in speech perception co-occurring with preserved speech production and reading. PWD is typically assumed to reflect problems in early stages of speech perception; however, NL often makes semantic comprehension errors (e.g., repeating "salt" as "pepper"). According to Monte Carlo simulations and Latent Semantic Analysis (Landauer et al., 1998), his semantically related errors occurred considerably more often than expected by chance, suggesting that NL suffers from rapid decay of phonological representations that can nonetheless pass some activation to lexical/semantic levels. Supporting this hypothesis, NL's speech perception was improved (and errors were more semantically related) for words that were auditorily semantically primed. These data suggest that sustained phonological activation is required for accurate lexical access and that PWD can result from rapid decay of phonology.
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(5057)

Category Retuning Affects Early Stages of Speech Processing. HOLGER MITTERER, *Max Planck Institute for Psycholinguistics,* EVA REINISCH, *Carnegie Mellon University*—Listeners use lexical knowledge to retune phoneme categories that speakers produce in an idiosyncratic way. We asked at what stage during speech perception the retuned categories affect the interpretation of a speaker's phonemes. During exposure listeners performed a lexical

decision task in which either /s/ or /f/ was replaced by an ambiguous sound (between-participant manipulation). At test listeners categorized sounds along [s]-[f] continua in minimal word pairs (e.g. "nice"-"knife") while their eye movements were tracked. Listeners who heard the ambiguous sound replace /s/ gave more /s/-responses than the other group. To test the processing stage of this effect the onset of the effect of exposure was pitted against the onset of the effect of the fricative continuum. Both effects emerged simultaneously as early as the acoustic signal of the fricatives could be processed. Retuned phoneme categories thus affect early stages of speech processing.
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(5058)

Children's Restoration of Temporally Reversed Speech. ROCHELLE S. NEWMAN, *University of Maryland*—Understanding spoken language involves both bottom-up perceptual and top-down cognitive information. Saberi & Perrott (1999) modified fluent sentences by temporally reversed segments of a set duration (preserving the global but not more specific speech patterns). High adult comprehension with sufficiently short segments suggested the use of "higher-order corrective measures" to restore the distorted signal. Children are affected by signal distortions to a greater extent than are adults, but can make use of top-down constraints by age 5 (Newman, 2004; Nittrouer & Boothroyd, 1990) but not earlier (Newman, 2006). Studies have been limited to distortions caused by noise; we examined children's comprehension of sentences with temporal reversals. Adults (n=28) showed nearly perfect performance for 50ms reversals, and a decline in accuracy as segment length increased. Children (5–5½ years, n=20; 4-4 ½ years, n=20) showed a steeper decline in performance, but demonstrated some comprehension with segment sizes up to 75 ms.
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(5059)

When Will You Learn? Interactions of Real-Time Lexical Processing and Word Learning. KEITH S. APFELBAUM and BOB MCMURRAY, *University of Iowa*—Studies of learning rarely examine real-time factors. This may be crucial when stimuli are temporal or require processing, as it is unclear when associations should be formed. Early in a word, multiple candidates are consistent with the input (when dee… has been heard, both deep and dear are briefly activated). When mapping such words to referents, if learning is immediate, learners may map both word-forms to a referent. We trained adults on novel words with cohort or rhyme competitors. In one condition, words and pictures were synchronous—participants may map both competitors to the referent; in a second, referents followed the word, allowing competition to resolve before learning. After training, lexical competition was evaluated in the visual-world-paradigm. Synchronous pairings led to increased cohort fixations, but not rhyme. Thus, during periods of temporal ambiguity, associations can be formed to multiple partially active candidates—associative learning does not wait for processing to finish.
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(5060)

Rate-Dependent Speech Processing Can be Domain Specific. CHRISTINE M. SZOSTAK and MARK A. PITT, *The Ohio State University,* LAURA C. DILLEY, *Michigan State University*—The perception of function words produced in casual speech can be made to disappear by slowing the rate at which surrounding words are spoken (Dilley & Pitt, 2010). The current study explored the domain generality of this speech-rate effect, asking whether it is induced by temporal properties found only in speech or whether it can also be produced with nonlinguistic sounds. Stimuli were short word sequences (e.g., minor or child) appended to precursors that were speech, low-pass filtered speech, or tones, presented at two rates of speech. Listeners transcribed all words they heard. Only precursors heard as intelligible speech generated a speech-rate effect (i.e., caused the function word to disappear, yielding minor child), suggesting that some aspects of rate-dependent speech processing are domain-specific.
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(5061)

Preferred Labels for Objects Influence but Do Not Stifle Lexical Competition in the Visual-World Paradigm. ELIKA BERGELSON and DELPHINE DAHAN, *University of Pennsylvania*—Past research on spoken-word recognition has established listeners' tendency to fixate on objects with names that share phonological similarity with a target's name. Such fixations, to e.g. a pillar upon hearing 'pillow', may be driven by the visual similarity between the pictured pillar and the mental representation of a pillar, itself prompted by the first sounds 'pill'. Alternatively or in addition, they may be driven by the similarity between the pictured object's putative name (the name participants have spontaneously associated with the picture on the display, e.g., "pillar") and the first sounds of 'pillow'. Capitalizing on the fact that many objects have more than one name (e.g., pillar or column), the present study demonstrates the contribution of both processes simultaneously. This finding highlights people's capacity for flexibility during language comprehension: Expectations influence but do not limit people's speech processing.
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(5062)

Using Mouse-tracking to Examine the Time Course of Long-term Repetition-Priming. MAURA L. KRESTAR, SARA INCERA and CONOR T. MCLENNAN, *Cleveland State Univesity*—Previous studies using mouse-tracking to examine temporal processes (e.g., face perception) demonstrate that hand movements reveal the real-time evolution of responses during psychological tasks. The purpose of the present study was to examine the time course of long-term repetition-priming in an auditory lexical decision task. Based on previous work, we predicted facilitation for words that were repeated (priming) relative to new (unprimed) words. In particular, using mouse-tracking toward "word" and "nonword" responses on the screen, we predicted priming would emerge via 1) shorter reaction times, 2) fewer changes in direction, and, compared to the ideal trajectory, 3) smaller deviation and 4) area under the curve. We further predicted that differences

in spatial attraction, velocity, and angle between the primed and unprimed conditions would change throughout the trial. Our results should provide greater understanding of the long-term repetition-priming effect, including the real-time processing dynamics throughout the course of priming.
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(5063)

Listening Situation Modulates Lexical and Acoustic Context Effects in Phonetic Categorization. EVA REINISCH and LORI L. HOLT, *Carnegie Mellon University*—Phonetic categorization is influenced by multiple sources of contextual information, but little is known about how they interact. We examined the relative influence of lexical versus acoustic contexts on phonetic categorization of [s]-[S] continua embedded in word-nonword pairs preceded by sequences of nonspeech tones varying in mean frequency. Both lexical and nonspeech acoustic context influenced [s]-[S] categorization, with categorization shifted toward word responses in a Ganong-like lexical effect and contrastively with nonspeech acoustic context. Additionally, when the informational load of the lexical context was low (four word-nonword continua) acoustic context exerted a greater influence than when the informational load of the lexical context was high (forty continua). Multiple sources of context interact to influence phonetic categorization. The relative influence of different information sources is modulated by the listening environment.
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• MOTOR CONTROL •

(5064)

A Conceptual Response-Distance Effect for the Stroop Task. JING CHEN and ROBERT W. PROCTOR, *Purdue University*—The Stroop effect is larger when the response keys/hands are close together than when they are far apart (the response-distance effect). We previously used a two-stick manipulation to dissociate the effect of hands from keys, allowing the hands to be far apart when the keys were close, and vice versa. The Stroop effect was larger in the close-key/far-hand condition than in the far-key/close-hand condition, indicating that distance between the keys (not the hands) is crucial. The current study further examined the response-distance effect by keeping the physical key-distance constant while manipulating the conceptual distance, using two keys identified as "5" and "6" (conceptually close) or "1" and "9" (conceptually far). The Stroop effect was found to be larger in the conceptually close condition. This result suggests that the conceptual labels are coded as action goals, and the response distance effect is mainly modulated by the distance/discriminability between the action goals.
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(5065)

Investigating Shared Task Representations in the Social Simon Paradigm: Effects of Friendship and Empathy. RUTH M. FORD and BRAD ABERDEIN, *Griffith University* (Sponsored by Professor Lia Kvavilashvili)—Previous research has shown that people are faster to execute actions if such actions are spatially congruent with the stimulus signalling them, a phenomenon known as the Simon Effect. For example, when confronted with a series of images of hands and asked to make a left-hand button press when the index finger wears a green ring versus a right-hand button press when it wears a red ring, participants show shorter response latencies when the finger points in the appropriate direction. Notably, the influence of spatial compatibility remains robust when the left- versus right-hand actions are carried out by different people sitting next to one another (the Social Simon Effect), suggesting that the task representation is socially shared. In the present study, participants (n = 44) worked with either a friend or a stranger to perform a Social Simon procedure, and additionally completed tests of cognitive and affective empathy. Results showed that the influence of spatial compatibility was greater when participants performed the task with a friend than with a stranger, and that its magnitude was correlated positively with empathy only in the former case. These findings reveal an important contribution of social processes to joint action.
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(5066)

Spatial Compatibility Effects for Unimanual and Bimanual Wheel-Rotation Responses. NICOLE M. MURCHISON and ROBERT W. PROCTOR, *Purdue University*—Compatibility effects for right/left stimuli mapped to wheel-rotation responses were measured for unimanual and bimanual operation. Experiments 1 and 2 were similar in that participants responded in different trial blocks with the hands at the top or side of the wheel, with the wheel operated unimanually in Experiment 1 and bimanually in Experiment 2. In Experiment 3, only the side hand position was used, and unimanual/bimanual operation was varied within-subjects. Experiment 4 was comparable to Experiment 3, except that the wheel was held at the bottom. For all hand positions, the mapping of clockwise-to-right and counterclockwise-to-left yielded better performance than the alternative mapping, with little difference in effect size for the bimanual and unimanual response modes or the left and right hands. To conclude, the critical relation is between the wheel-rotation action and the stimulus position, regardless of whether the wheel is operated by one or two effectors.
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(5067)

Touching Targets With the Dominant or Non-Dominant Hand. JONATHAN VAUGHAN, ELIN L. LANTZ, SARAH E. ANDREWS, EMMA T. GEDULDIG and JOHN B. WILDMAN, *Hamilton College*—Moving rapidly with the left hand (the non-dominant hand, for right-handers) is less accurate than with the right hand (Woodworth, 1899). In a 3-dimensional work environment, using a tool to touch small, widely separated objects (i.e., difficult targets, as quantified by Fitts' law) takes longer with the left hand than with the right hand (Vaughan, Barany, & Rios, 2012). By contrast, the hands differ less in the time required to touch

easier targets. The hand difference in movement time (left-hand cost) is localized in the period after peak velocity, the "current control" phase of movement. Left-hand cost may reflect the relative specialization of the left hemisphere (which controls the dominant hand) for the modulation of movement dynamics, and of the right hemisphere for the control of static posture (Sainburg, 2002). We explore the implications of these results for the understanding of movement kinematics in 1- and 3-dimensional movement tasks.
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(5068)

Vision Modulates the Structure of Movement-Amplitude Time Series. ANDREW B. SLIFKIN and JEFFREY R. EDER, *Cleveland State University*—When humans repeatedly produce an action, the amount of variability is distributed across a range of time scales or frequencies. A finding of particular interest is that fluctuations in system output are highest at the lowest frequencies with fluctuation magnitude (power) declining as frequency increases. Such time-series structure is termed pink noise. Pink noise seems to be limited to action executed in the absence of external, task-related feedback; when action is executed in the presence of feedback, power is evenly distributed across all frequencies—i.e., white-noise is revealed. Here, we sought to determine if the structure of movement-amplitude (MA) time series would change when amplitude requirements increased (6.35, 12.70, 25.40, 50.80, and 101.60 mm) under conditions of visual feedback. Given that increases in amplitude requirements are known to induce increased reliance on visual feedback, we predicted an amplitude-requirement-induced shift in MA structure from pink to white noise. Those results were revealed.
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• LETTER AND WORD PROCESSING III •

(5069)

Reading Automaticity Using a Stroop Task. WILLIAM STURGILL, *Rockhurst University*—Three experiments (E1-3) explored the automaticity of reading hypothesis using Stroop tasks. Stimuli were four 2-syllable, 6-letter color words in which adjacent letters at positions 2-3 or 4-5 were independently transposed (TL) or not (canonical). In E1, TL-23 slowed shade identification, in congruent and incongruent conditions more than TL-45 (incongruent only) did. In E2, a replaced letter (RL-45) condition and form matched control strings (2 syllable, 6 letter, and same initial 2 letters as color words) were added. All four TL conditions produced Stroop effects. Together, E1&E2 suggest a bias to focus on letter positions 1-2 to identify shade, in both stimulus types. In E3, the location of the adjacent (23 or 45), differently shaded and incongruent target letters was cued. The TL manipulation, especially when canonical, in the uncued syllable affected RT to identify shade in the cued syllable. The corpus of results lends support to the automaticity hypothesis.
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(5070)

Rapid Contextual Influences During Reading: Evidence From Eye Movements. HEATHER SHERIDAN and EYAL M. REINGOLD, *University of Toronto Mississauga*—We used distributional analyses of eye fixation durations to examine the time course of contextual influences during reading. Specifically, we manipulated the contextual predictability (high predictability vs. low predictability) of 40 target words, and the contextually instantiated meaning (dominant vs. subordinate) of 60 lexically ambiguous words (e.g., bank). Ex-Gaussian fitting revealed that both of these contextual manipulations produced a significant shift in first-fixation distributions, such that the low predictability distribution was shifted to the right of the high predictability distribution, and the subordinate distribution was shifted to the right of the dominant distribution, with no significant contextual differences in the degree of skew. In addition, a survival analysis technique showed that contextual influences on fixation duration can emerge as early as 139 ms from the start of fixation. We discuss the implications of these fast-acting contextual influences for models of lexical ambiguity resolution and for models of eye movement control during reading.
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(5071)

Is the Masked Priming Same-Different Task a Pure Measure of Prelexical Processing? ANDREW N. KELLY, WALTER J.B. VAN HEUVEN, NICOLA J. PITCHFORD and TIMOTHY LEDGEWAY, *University of Nottingham* (Sponsored by Jonathan Grainger)—To study prelexical processes involved in visual word recognition a task is needed that operates only at the level of abstract letter identities. The masked priming same-different task has been purported to do this, as the same pattern of priming is shown for words and nonwords. However, studies using this task have consistently found a processing advantage for words over nonwords, indicating a lexicality effect. Experiment 1a-d used conventional visually presented reference stimuli to test previous accounts of the lexicality effect. Results ruled out the use of different strategies, or strength of representations, for words and nonwords. No interaction was observed between prime type and word type, but a consistent word advantage was found. Experiment 2a-b used novel auditorally presented reference stimuli to restrict nonword matching to the sublexical level. This abolished scrambled priming for nonwords, but not words. Overall this suggests the processing advantage for words over nonwords results from activation of whole-word, lexical representations. These results have important implications for models of orthographic processing and studies that have used this task to investigate prelexical processes.
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(5072)

A New Perceptual Bias: The Letter and Word Magnification Effect. BORIS NEW and KARINE DORÉ-MAZARS, *University Paris Descartes; VAC,* CÉCILE ISSARD, *University Paris Descartes,* JULIEN BARRA, *University Paris Descartes; LMC* (Sponsored by Marc Brysbaert)—The "word superiority

effect" refers to the phenomenon that people have better recognition of letters presented within words as compared to isolated letters and to letters presented within nonword (Reicher 1969). These perceptual biases have been explained through the interactive activation model (McClelland and Rumelhart, 1981). Here we investigated whether overactivation of features could lead to another perceptual bias wherein letters are perceived as taller than pseudoletters, or words taller than pseudowords. Two experiments (letter and word) were run in order to test this hypothesis, using a size comparison task in which participants had to decide whether two stimuli, one a letter (or word) and the other a pseudo- or mirror letter (or word), are of identical or different height. Our results show that participants perceive letters and words as taller than pseudo or- mirror ones while they were physically identical in height.
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(5073)

ERP Correlates of Letter Position Assignment as a Function of Word-Frequency and Task Demands. MARTA VERGARA-MARTÍNEZ and MANUEL PEREA, *Universitat de València,* PABLO GOMEZ, *DePaul University,* TAMARA Y. SWAAB, *University of California, Davis*—We investigated the impact of lexical frequency on letter position assignment by examining the temporal dynamics of lexical activation induced by pseudowords extracted from words of different frequency. For each (low-frequency/high-frequency) word (mother/diurnal), we created two pseudowords: A transposed-letter pseudoword (mohter/diunral) and a replacement-letter pseudoword (mosher/diurbal). ERPs were recorded while participants read words and pseudowords in two experiments with different tasks: Semantic categorization (Experiment 1) and lexical decision (Experiment 2). In both experiments, the ERPs to TL-pseudowords and words of high frequency were comparable early in the N400 epoch, while they both differed from the replacement-letter pseudowords. Thus, TL-pseudowords derived from high-frequency words activate their corresponding base-word representations to a considerable degree. In contrast, for low-frequency stimuli, similar ERPs were obtained for both replacement- and transposed-letter pseudowords. These findings impose constrains on computational/neural models of visual-word recognition.
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(5074)

Bi-Mora Frequency Versus Linguistic Constraint: 'Whack-A-Male' Effects on the Processing of Japanese Nonwords With Repeated Vowels. KATSUO TAMAOKA, *Nagoya University*—With the five Japanese vowels (i.e., /a/, /e/, /i/, /o/, and /u/), the random chance was calculated at 4.00%. CVCVCV-nouns with the same vowels repeated in the corpus of 13 years of the Asahi Newspaper counted 9.15%, which is significantly higher than the random chance. On the contrary, the Obligatory Contour Principle (OCP) refers to a linguistic constraint on similar or same phonological features from being repeated. Bi-mora frequency (facilitation) and OCP linguistic constraint (inhibition) provide an opposite prediction in phonological processing of CVCVCV-structured strings. The result of naming latencies showed that nonwords with repeated vowels were named more slowly than nonwords with non-repeated. Error rates were higher in naming nonwords with the same vowel repeated than those with non-repeated. Therefore, the OCP linguistic constraint must influence phonological processing of CVCVCV nonwords with the same vowel repeated while bi-mora frequency did not have much influence. The explanation proposed is the 'whack-a-mole' phenomenon.
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(5075)

ERP Masked Pseudohomophone and Transposed-Letter Priming Effects in Children and Adults. MARIANNA D. EDDY, *Massachusetts Institute of Technology,* JONATHAN GRAINGER, *Aix-Marseille University & CNRS,* PHILLIP J. HOLCOMB, *Tufts University,* JOHN GABRIELI, *Massachusetts Institute of Technology*—For beginning readers, phonological recoding enables the unfamiliar printed word to be connected with its familiar spoken form and associated meaning. As reading experience grows, phonological recoding is gradually replaced by a more direct and more efficient mapping of orthography onto semantics. Here we used masked priming and event-related potentials (ERPs) to investigate phonological and orthographic processing in a group of adults and a group of 8-10 year old children. Phonological processing was examined by comparing effects of pseudohomophone (PH) primes (brane-BRAIN) with their orthographic controls (brant-BRAIN), and orthographic processing was examined by comparing effects of transposed letter (TL) primes (barin-BRAIN) with their controls (bosin-BRAIN). Both adults and children showed PH and TL priming on the N250 ERP component. Children showed larger TL priming effects and earlier PH priming effects, and their priming effect sizes were related to measures of reading ability. These findings suggest that while 8-10 year-old children have already developed efficient orthographic processing, they continue to rely on phonological information more so than adult readers.
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(5076)

Linguistic Context Effects on Attentional Control of Naming Pathways. JENNIFER H. COANE, *Colby College,* CLAUDIA SANCHEZ GUTIERREZ, *Universidad de Salamanca*—Lexical and sublexical information contribute to word naming speed and accuracy. Orthographically deep languages like English require more reliance on lexical pathways than shallow languages like Spanish. In the route priming paradigm, low frequency exception (LFE) targets (e.g., pint) that require lexical access are embedded in sublexical-dependent nonword (e.g., flirp) or LFE contexts. Typically, errors to LFE targets increase in the nonword context, suggesting that readers control reliance on lexical and sublexical pathways. We examined whether the broader linguistic context in which readers are immersed modulates the effect. Native English speakers in the US and in Spain were tested in counterbalanced blocks of nonword and LFE contexts. Target accuracy was lower in the nonword context.

Furthermore, participants in Spain were slower at naming targets in nonword contexts, but only when this context was first, suggesting that immersion in a shallow language context temporarily increases reliance on sublexical pathways.
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(5077)

Phonological Preview Benefits: Parafoveal Information Processing in Skilled and Less-Skilled Deaf Readers. NATHALIE N. BELANGER, RACHEL I. MAYBERRY and KEITH RAYNER, *University of California, San Diego* (Sponsored by Rebecca Johnson)—Many deaf individuals do not develop the high-level reading skills that will allow them to fully take part into society. To attempt to explain this wide spread difficulty in the deaf population, much research has honed in on the use of phonological codes during reading. The hypothesis that the use of phonological codes is associated with good reading skills in deaf readers, though not well supported, still lingers in the literature. We investigated skilled and less-skilled adult deaf readers' processing of orthographic and phonological codes in parafoveal vision during reading and monitored their eye movements. Orthographic preview benefits were found in early and late measures for skilled hearing, skilled deaf, and less-skilled deaf readers, but only skilled hearing readers relied on phonological codes in parafoveal vision. Crucially, skilled and less-skilled deaf readers showed the exact same pattern of preview benefits during reading. These results support the notion that reading difficulties in deaf adults is not linked to the failure to activate phonological codes during reading.
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(5078)

Free Association Norms for Quantifying Orthographic and Phonological Similarity. JENNIFER H. COANE, ANNA B. CARON and ADAM C. LAVIOLET, *Colby College,* STEPHANIE-ANN M. LAROSE-SIENKIEWICZ, *Boston College,* JOSEF M. BRODER, *Colby College* (Sponsored by Martha E. Arterberry)—Visual word recognition involves orthographic, phonological, and semantic processing. A critical tool for understanding how orthography and phonology contribute to lexical access is the form priming paradigm, in which a similar (sharing spelling or sound patterns) or dissimilar item precedes the target. Changes in target accessibility are assumed to reflect structures and processes involved in lexical access. Whereas semantic priming paradigms can use free association measures to quantify the relatedness of word pairs, to date, extensive free association measures for formally similar items have been unavailable to researchers. Similarity is often defined by relying on the number and/or position of shared graphemes or phonemes and several models of orthographic coding have been proposed (e.g., SERIOL, SOLAR). We present data from over 50 participants who generated formally similar responses to almost 2000 monosyllabic cues. The free association data will be compared to existing computational models of orthographic similarity.
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(5080)

Masked Priming: Does Letter Confusability Influence Position Coding? IVANA KIHAS, *Macquarie University,* SERJE ROBIDOUX, *ARC Centre of Excellence in Cognition and its Disorders* (Sponsored by Derek Besner)—In recent years, researchers have become keenly interested in the processes that are involved in coding the positions of letters within a letter-string. This interest stems from evidence that access to lexical entries is flexible with respect to the order of the letters in a letter string. For example, jugde as a prime facilitates responses to JUDGE relative to primes like junpe. Similarly, primes like grdn facilitate responses to GARDEN (see Grainger, 2008, for a review). Such findings have led to the development of several models of position coding (e.g., Open Bigrams, Grainger & Van Heuven, 2003; SERIOL, Whitney, 2001, 2007; SOLAR, Davis, 2010). However, none of these models consider the influence of early visual processes. Two experiments examine the role of letter-confusability in masked priming and transposed-letter priming.
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(5081)

Tracking the Consequences of Morpho-Orthographic Decomposition Using ERPs. JOANNA MORRIS, *Hampshire College,* JONATHAN GRAINGER, *Université d'Aix-Marseille,* PHILLIP HOLCOMB, *Tufts University*—Dual-route models of complex word recognition propose that there are two distinct sources of morphological influences on visual word recognition – sublexical morpho-orthographic segmentation and supralexical morpho-semantic processing. To test this hypothesis, we used the temporal sensitivity of event related potential recordings to directly examine the effects produced by the short masked presentation of complex non-words (formed by the combination a legal stem and legal affix, e.g. huntity, cornity, scanity) on the recognition of semantically transparent complex words (e.g. hunter), semantically opaque pseudocomplex words (e.g. corner), and simplex words (e.g. scandal). We found a large early frontal N250 effect that was mostly evident for transparent complex words. These results suggest that although morpho-orthographic decomposition may operate in complex and pseudocomplex stimuli alike, the results of that decomposition only affect the subsequent processing of transparent complex words.
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(5082)

It's a Letter Search Task…It's a Reading Task…No It's SuperMLE: A New Model of the Missing-Letter Effect. ANNIE ROY-CHARLAND, *Laurentian University,* JEAN SAINT-AUBIN, *Universite de Moncton,* MICHAEL A. LAWRENCE and RAYMOND M. KLEIN, *Dalhousie University*—Numerous models have been developed in order to account for results obtained in a simple task where participants read a continuous text while searching for a target letter. A robust observation is encountered: the letter is more frequently omitted when embedded in frequent function words than in less frequent content words. This presentation proposes a review of all models of this Missing-Letter Effect including the Attentional Disengagement (AD) model, the

sole remaining model able to account for all empirical data accumulated over the decades. We conducted the most extensive test of a model to date by having participants read a long text containing a 100 occurrences of a function word and a 100 occurrences of content words either in a rapid serial visual presentation procedure or while eye-movements were monitored. Although the results are challenging for the current version of the AD model, modifications are proposed that can accommodate them.
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(5083)

Can Individual Differences in Grapheme-Phoneme Correspondences Account for Variability in Nonword Pronunciation? JAMES S. ADELMAN, *University of Warwick*—Models of reading propose competing accounts of influences on reading a word or nonword of other known words. Patterns of nonword pronunciation give evidence regarding such processes, such as: A given nonword does not always yield the same pronunciation (Andrews & Scarratt, 1998). Zevin and Seidenberg (2006) modeled such inconsistency by retraining the same backpropagation model multiple times to instantiate different individuals. Pritchard, Coltheart, Palethorpe, and Castles (2012) compared new nonword pronunciation data with the grapheme-phoneme-correspondence-based nonword reading of the dual-route-cascaded (DRC) model and the delta-rule-learning-based nonword reading of the connectionist-dual-process models. The DRC's pronunciations were more often used by people, and rarely was a DRC pronunciation for a nonword used by no participant. For a strictly rule-based process to account for variability in pronunciations of a nonword, individual differences in rules can be invoked. I examine whether this explanation is feasible with a re-analysis of Pritchard et al.'s data.
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(5084)

Phonology Contributes to Error Signal in Spelling Decisions: Evidence From ERNs. LINDSAY N. HARRIS, *University of Pittsburgh,* GABRIELLA GABBARD, *Indiana University,* CHARLES A. PERFETTI, *University of Pittsburgh*—Past research has shown that the magnitude of error-related negativities (ERNs) following spelling decisions is related to spelling ability, suggesting that orthographic representations contribute to the signal evaluated during error monitoring (Harris, Perfetti, and Rickles, under review). Here, we investigate whether phonology can also contribute to the error signal in spelling decisions. Foils that either preserved (gazell) or altered (gazille) the phonology of their targets (e.g., gazelle) were presented as stimuli in a spelling decision task, and event-related potentials were recorded from participants' scalps. The ERN effect was greatest for phonology-altering foils, suggesting that the error signal incorporates both orthographic and phonological information, and that phonology-preserving misspellings lead to a weaker signal. These results offer insight into the functioning of the brain's error-monitoring system and reaffirm the potential value of ERNs in linguistic assessment.
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(5085)

Semantic Preview Benefit May be Observed in English: The Importance of Initial Letter Capitalization. ELIZABETH R. SCHOTTER and KEITH RAYNER, *University of California, San Diego*—Recently, the field of reading has seen the development of a debate over whether semantic information is obtained from word n+1. Most evidence has been negative in alphabetic languages like English (Rayner, et al., 1986), Finnish (Hyönä & Häikiö, 2005) and Spanish (Altarriba, et al., 2001); but, studies in German have found positive support (Hohenstein, et al., 2011). The present study investigates whether this discrepancy may be due to differences in visual properties of the orthography: capitalization of the first letter of nouns. In German, all nouns are capitalized whereas in the alphabetic languages that do not show semantic preview benefit, initial letters of nouns rarely are. In the present study, we used target nouns that can sometimes be capitalized (e.g., She loves china cups. vs. She loves China the country). We provide evidence that, in English, semantic preview benefit is only observed when the target word is capitalized.
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(5086)

Alternative Methods for Measuring the Frequency of TXTMSG Abbreviations. MARY L. STILL, *Missouri Western State University,* ALISON L. MORRIS, *Iowa State University*—Recently there has been increased interest in text-message abbreviation processing. Evidence suggests that abbreviations have lexical status, but this revelation raises new concerns. If abbreviations are similar to words, their processing should be affected by variables such as frequency. We used three measures to approximate frequency – Google search counts, familiarity ratings, and knowledge of abbreviation meanings – and investigated their ability to predict perceptual identification of emotion-laden (positive, negative, neutral) abbreviations (e.g., LOL) and pseudo-abbreviations (e.g., LOH). With no consideration of frequency, higher identification rates were found for abbreviations than pseudo-abbreviations and for negative abbreviations than positive abbreviations. When frequency was considered, there was no effect of emotion for abbreviations. Interestingly, only Google counts were predictive of perceptual identification performance and the other approximate measures (familiarity ratings and knowledge of abbreviation meanings) were not significantly correlated with Google counts. These results highlight the importance of developing and utilizing accurate frequency measures in abbreviation recognition research.
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(5087)

The Interaction of Frequency, Predictability and Launch Site During Natural Paragraph Reading. VERONICA WHITFORD and DEBRA TITONE, *McGill University*—Recent debate concerns whether word frequency and predictability interact during the earliest stages of reading, and whether the distance of a prior fixation (launch site) modulates this interaction (Hand, Miellet, O'Donnell, & Sereno, 2010; Slattery, Staub, & Rayner, 2012). A frequency X predictability interaction is theoretically important because it implies

that context can affect the earliest stages of lexical access. We investigate this issue using eye movement measures of extended paragraph reading. Forty English monolinguals read four 200-word paragraphs for which subtitle word frequency, predictability and length were assessed for all first-mention content words (e.g., Whitford & Titone, 2012). LME models for gaze duration revealed significantly larger predictability effects for low- vs. high-frequency words across the board, but especially for far launch sites. The frequency X predictability interaction was also significant for total reading time but was unaffected by launch site. These data provide clear evidence of a frequency X predictability interaction that is modulated but not eliminated by launch site proximity, suggesting that frequency and predictability both modulate the earliest stages of lexical access.
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• CONCEPTS AND CATEGORIES II •

(5088)

Expertise Effects in Category Beliefs and Stigma in Mental Health. LINDZI L. SHANKS, *Texas Tech University,* JESSECAE K. MARSH, *Lehigh University*—The beliefs people hold about categories can drive how people interact with category members. For example, we found beliefs related to communicability of a mental disorder category can create stigmatic beliefs towards those category members. These beliefs about disorder transmission are presumably wrong and should be alleviated with education or experience with mental disorders. Mental health expertise does create changes in beliefs about the underlying nature of mental health categories (Ahn, Flanagan, Marsh, & Sanislow, 2006). Despite this, individuals with mental disorders report experiencing stigma from mental health providers (Sartorius, 2007). To test the effects of expertise on stigma in mental health, we measured laypeople and professional mental health clinicians' stigma of and underlying beliefs about mental disorder categories. We found experts expressed significantly lower amounts of stigma than laypeople. However, experts stigmatized some disorders and those disorders were also reported as communicable. We discuss possible explanations for these findings.
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(5089)

The Influence of Prior Experiences With Patients on Medical Diagnosis. BENJAMIN M. ROTTMAN, MICAH T. PROCHASKA, RODERICK C. DEAÑO and DAVID O. MELTZER, *The University of Chicago*—Diagnosis is a critical medical skill and has often been studied by psychologists as an instance of real-world, high-stakes categorization. One fundamental question for medical diagnosis is the extent to which physicians' personal experiences with prior patients influence their diagnosis of future patients. Given that many diseases lack clear diagnostic guidelines and that medical training is skill-oriented and experience-based, it is likely that diagnosis is influenced by idiosyncratic experiences, resulting in sub-optimal and variable patterns of treatment. However, there is little work examining the influence of physician's real-world (as opposed to lab-based) experiences on diagnosis. Here we examine the influence of medical residents' real-world experiences, captured by medical records, on their diagnosis of future cases. Specifically, we examine whether the number of patients a physician has seen with a particular disease influences the likelihood that the physician will diagnose a patient with that disease when presented with ambiguous case vignettes.
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(5090)

Effects of Post-Training Pressure on Classification in a Complex Diagnostic Environment. AUDREY P. HILL and COREY J. BOHIL, *University of Central Florida, W.* TODD MADDOX, *University of Texas*—Pressure to perform has been shown to decrease accuracy during learning of an explicit categorization rule, while it can actually increase categorization accuracy when learning a strategy emphasizing holistic integration of stimulus dimensions (Markman, Maddox & Worthy, 2006). We extend this work in two ways. First, instead of a unified two-dimensional stimulus on each trial, participants learned to classify spatially separated stimulus features. Second, we manipulated pressure both during training and during a later transfer phase (since high pressure conditions commonly occur after training is completed). Most of the previously reported patterns are replicated with our segregated stimulus dimensions, but differences emerged in a low-pressure explicit-rule learning condition. Some participants achieved high accuracy in this condition, but many did not, perhaps owing to the physical separation of stimulus components. Also, we find changes in performance between training and transfer; changes which were more pronounced in conditions requiring information integration.
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(5091)

Models of Human Category Learning: Do They Generalize? NOLAN CONAWAY and KENNETH KURTZ, *Binghamton University, SUNY*—Behavioral studies and formal modeling have revealed much about the timecourse of human category learning, but less is known about generalization. It is important for theoretical accounts of category learning to also explain how category knowledge is applied beyond the training set. We employed a minimal case to begin a systematic investigation of generalization. Participants were trained to learn a two-way artificial classification based on small sets of examples that varied along two dimensions. Each class was centered toward a corner of the space (along a diagonal). The dimensions were psychologically separable and differed in perceptual salience. After a learning phase, participants were asked to classify novel examples sampled from the generalization space. We fit ALCOVE and DIVA to the learning data and determined model predictions for generalization. Learners tended to show rule-like performance based on one (the more salient) dimension. Both models were able to account for human generalization performance using attentional mechanisms; though potentially important differences between the models were observed.
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(5092)

Learning How to Generalize. JOSEPH AUSTERWEIL and *THOMAS GRIFFITHS, *University of California, Berkeley*—Generalizing a property from a set of objects to a new object is a fundamental problem faced by people in many domains, and a classic topic of investigation in psychology. Although it is known that how people generalize varies in complex ways depending on the context or domain, it is an open question how people learn the appropriate way to generalize. To understand this capability, we present a mathematical framework that learns how to generalize by learning "overhypotheses" that constrain how properties are distributed over a set of stimuli. The framework predicts that people should learn an overhypothesis for a domain from the structure of concepts learned in that domain. We test this prediction through two experiments, one in a perceptual domain (rectangles) and one in a conceptual domain (animals). The results show that people learn to generalize in the predicted fashion in both domains.

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(5093)

Another Failed Attempt to Make Probabilistic Relational Categories Learnable. WOOKYOUNG JUNG and JOHN E. HUMMEL, *University of Illinois at Urbana-Champaign*—Sandhofer and Smith (2001) showed how different training regimens affect children's learn about color and size words. They showed that a production task, which focuses attention on a single object, facilitates learning color words, whereas a comprehension task, which focuses attention on multiple objects simultaneously, facilitates learning size words. We examined whether these training regimens could aid learning of relational categories with either deterministic or probabilistic structures. In the deterministic condition, the production task yielded superior learning. However, in the probabilistic condition, neither production nor comprehension facilitated learning: Although learning deterministic relational categories can be improved by selection of an appropriate task (i.e., production), probabilistic relational categories persist in being difficult to learn regardless of task. These findings add to a growing literature suggesting that relational categories are learned by a process of intersection discovery, which fails catastrophically with probabilistic structures (Jung & Hummel, 2009; 2011).

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(5094)

Acquiring Higher-Order Relations through Schema Elaboration. DANIEL CORRAL and MATT JONES, *University of Colorado, Boulder*—Higher-order relations are important for various cognitive tasks, such as analogical transfer. Two experiments tested people's ability to learn new perceptual categories defined purely by higher-order relations. Each stimulus consisted of 4 objects, with categories defined by multiple binary relations between pairs of objects (e.g., larger, darker). Categories within each experiment were composed of the same number and types of relations, but differed in the manner that the relations were linked (i.e., by operating on shared objects). Various learning models were compared to the behavioral data, based on the standard theory of schema refinement. The results highlight several shortcomings of schema refinement as a model of relational learning: 1) it can make unreasonable demands on working memory, 2) schemas are unable to grow in complexity, and 3) it incorrectly predicts learning is insensitive to higher-order structure. We propose schema elaboration as an additional mechanism that provides a more complete account.

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(5095)

Derivational Structure of Representations: Effects on Accuracy and Rate of Processing Graphical Information About Objects in Motion. REALITY S. CANTY, JAMES W. PELLEGRINO and SUSAN R. GOLDMAN, *University of Illinois at Chicago*—Two experiments tested hypotheses about the role of perceptual and inferential processes in interpreting graphical information about objects in motion. Undergraduates were tested using a sentence-picture verification task in which graph type (position-time, velocity-time), curve morphology (linear, non-linear), and type of motion judgment (stationary vs moving; accelerating vs decelerating) were manipulated. The relative role of perceptual-based and retrieval-based processes in matching a statement and a graph should depend on whether relevant motion information can be extracted directly from the graph versus derived by inference. As predicted, accuracy was greater when judgment-relevant information was direct versus derived, and systematic errors occurred from slope-related perceptual biases (e.g., Up Means Faster). RTs suggest that the derivational structure of representations (e.g., Palmer, 1978) influences process and strategic variability and is an emergent property of multiple interacting representations (internal and external). Several representation-related constraints and mechanisms are proposed to account for task performance.

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(5096)

Causal Explanations and Judgments of Desired Social Distance and Intervention Need. ERIENNE R. WEINE and NANCY S. KIM, *Northeastern University*—Causal explanations are multi-functional and influence predictions, justifications, and diagnostic decisions (Keil, 2006). For example, expert clinicians are less willing to endorse a diagnosis of depression when plausible, causal life-event explanations for symptoms are available than when they are not (Kim et al., 2012). In two experiments, we examined broader functional impacts of explanation. First, we found an analogous effect of explanation on social judgments, such that plausible, causal life-event explanations for psychologically disordered behaviors decreased lay people's desired social distance (stigma; Link et al., 1999) from a person exhibiting these behaviors, relative to their desired social distance without causal explanations. Second, we found that plausible, causal life-event explanations decreased lay judgments of the need for intervention to address disordered behaviors, yet increased lay judgments of the person's overall

need for intervention, relative to judgments made without explanations. Implications for understanding the range of functions of causal explanation are discussed.
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(5097)

Task Complexity Encourages Shifting From Rules to Exemplars in Categorization and Judgment. JANINA A. HOFFMANN, BETTINA VON HELVERSEN and JÖRG RIESKAMP, *University of Basel* (Sponsored by Aneas Wilke)—Encountering a stranger, we may quickly classify him as a friend or foe. However later a more fine-grained judgment about his friendliness may be required. Research in judgment and categorization suggests that people usually rely on one of two strategies that can be broadly classified as rule abstraction or exemplar memory. In the current project we investigate, if people rely on the same strategy in both tasks and how strategy selection is influenced by task complexity. In an experiment participants solved a categorization and a multiple-cue judgment task with the same task complexity. Task complexity varied from simple, one-dimensional to complex, nonlinear rules determining judgment and category membership. While one-dimensional tasks fostered rule abstraction in categorization and judgment, linear cue-integration tasks slightly increased shifting to exemplar memory. This shift was even more pronounced in a nonlinear judgment task demanding non-additive cue integration. Our results suggest that people rely on similar cognitive processes to categorize and judge objects. Shifting between these processes helps people to deal with task complexity.
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(5098)

Solid Object Similarity in Speakers of English, Japanese, Hmong and Mandarin. MARIA SERA and RUXUE SHAO, *University of Minnesota*—Classifier languages such as Japanese, Hmong and Mandarin divide nouns for solid objects into different groups. This co-variation between classifiers and nouns may affect the similarity among solid objects. In this study, adult speakers of English, Japanese, Hmong and Mandarin (N=64) rated the similarity between 39 drawings that depicted people, nonhuman mammals, birds, fish, trees, flowers, tools, fruit, vehicles, simple artifacts, and celestial bodies. The results were analyzed with multi-dimensional scaling techniques. A dimension that emerged for all for groups involved a continuum between living and non-living things. However, we found differences between the groups in how objects were categorized along this dimension. For example, Mandarin speakers judged people to be more similar to each other and more different from other animals than English speakers. These findings suggest both similarities and differences between the language groups in their categorization of solid objects
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(5099)

Divergence Modeling: an Information Theoretic Method for Analyzing Perceptual Representations via Stimulus Similarity. ANTHONY D. CATE, *Virginia Tech,* TIMOTHY J. HERRON and DAVID L. WOODS, *Veterans Affairs Martinez, CA* (Sponsored by Rachel Diana)—This method uses observed interstimulus similarities to model sets of stimuli as probability density functions in continuous feature parameter spaces. It can be useful to model stimulus representations as probability density functions (pdfs) instead of as zero-dimensional points in a feature space (c.f. General Recognition Theory, Ashby & Townsend, 1986). This approach has the advantage of being able to account from asymmetric similarity relations, e.g. the similarity of A to B differs from that of B to A, which occurs frequently with similarity judgments. The present method assumes that interstimulus similarities are monotonically related to the asymmetric Kullback-Leibler divergence (KL) between two multivariate normal pdfs, and uses the pairwise similarities to calculate a pdf for each stimulus. The mean of each pdf is fixed at feature coordinates specified by the experimenter, and the covariance matrices can be optimized to produce the KLs that fit the observed similarities. The properties of the resulting pdfs can be used to examine stimulus tuning along and between each of the specified feature dimensions. The method can be used to model changes in stimulus tuning, on the level of each or of all stimuli.
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(5100)

Thematic Music Activates Complex Concepts Affecting Story Generation Performance. CYNTHIA SIFONIS and STACY MEMERING, *Oakland University*—Listening to thematic music (e.g., war) affects performance in a story generation task by causing Ps to include concepts associated with the music into their stories (e.g., weapons, blood). The types of story Ps are asked to write also affects the likelihood of including conceptual elements of the music into the stories (e.g., war concepts are more likely to be incorporated when writing a story about an alien planet than a foreign land). However, the concepts associated with the thematic music are included at low rates into the stories suggesting the stories should be examined for more complex concepts such as schemas. We examined whether listening to thematic music brings to mind more complex schematic structures that are differentially manifested in a generation task depending on the type of story Ps are asked to write (e.g., schemas associated with wars on alien planets). Ps listened to one of two 90-sec excerpts of thematic music (Baby/War themed) before or after a story generation task. Results suggest that elements incorporated into stories after listening to themed music are schematic rather than simple associations and the specific manifestation of those elements in the story depends upon both the music and story themes.
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(5101)

Representational Shifts in Memory for Hue. LAURA J. KELLY and EVAN HEIT, *University of California, Merced*—Representational shifts, or movement of the encoded representation from the originally perceived stimulus towards a category prototype, have been proposed and contested in recent years (Lupyan, 2008; Richler, Gauthier, & Palmeri, 2011; Blanco & Gureckis, 2011). The present work investigates

this issue in the domain of color. In this domain, fine control can be exercised over the stimuli, allowing measurement of what is remembered by having memory lures of fine-grained hue differences. Participants were shown a color for 300 ms, then answered a question about the color. There were two conditions: preference ("Do you like this color?" and category "Is this color red or green?"). Next, after 500 ms (Exp. 1) or 5000 ms (Exp. 2), participants made an old-new recognition judgment on the same or a slightly different color. The results showed representational shifts, with the peaks of recognition not centered at the originally presented hue, but instead shifted in the direction opposite from the color prototype.
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(5102)

Semantic Priming and Satiation of Category Membership. MICHAEL E. ROBERTS, JACK BURGESON and CHELSEA OHLER, *DePauw University,* JUSTIN KANTNER, *University of California, Santa Barbara*—Semantic primes speed judgments of category membership, but does an overabundance of primes nullify (or reverse) priming effects via semantic satiation? In two experiments, participants were shown a category label followed by 0 to 30 related primes from the category. Participants judged whether a subsequent target word belonged to the category. For primes presented at a rate of 133ms, the results show a U-shaped response time function based on the number of primes. Response times decreased for up to 10 primes before reaching a plateau between 10 and 20 primes and subsequently increasing between 20 and 30 primes. For primes presented at a rate of 1000ms, a similar U-shaped relationship was found in Experiment 1 but not Experiment 2. The cumulative associative strength between the primes and categories did not show a consistent relationship with response times. A possible explanation using generalization gradients is also discussed.
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(5103)

Individual Differences in Category Learning: Rule- Versus Exemplar-Based Strategies. JERI L. LITTLE, MARK A. MCDANIEL and MICHAEL J. CAHILL, *Washington University in St. Louis*—In categorization tasks, materials and instructions can bias learners toward either memorizing examples (i.e., exemplar strategy) or abstracting an underlying rule (i.e., rule-based strategy). However, little research has explored how—-in a single task—-individuals' strategies might differ. In the present study, participants categorized instances that followed a relational categorization rule. Next, they categorized similar objects that differed from trained objects in one attribute, with half of these transfer items having category membership preserved and half not (i.e., good- and bad-transfer items, respectively). Afterwards, participants self-reported their learning strategy. Self-reported "memorizers" categorized items based on similarity, whereas self-reported "rule-abstractors" categorized items based on the rule, resulting in similar categorizations across the two groups of participants for good-transfer items, but opposing categorizations for bad-transfer items. The relationship between categorization and other measures (i.e., OSPAN, Ravens) was also explored. This work suggests that individuals may have a predisposition for categorization strategy choice.
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(5104)

A Binomial Labeling Task for Category Construction. JOHN P. CLAPPER, *California State University, San Bernardino*—Peoples' ability to discover or construct meaningful categories without external supervision is a fundamental problem in the study of human learning. These experiments employed a novel category construction task in which participants saw stimulus displays containing 16 objects in a 4 x 4 grid, and assigned binomial labels such as A1, B1, A2, etc., to each. In general, people were adept at recognizing categories based on structural correspondence or alignability (shared dimensions of variation), even if the objects differed on all surface features. They also recognized categories in which all instances were identical in a qualitative (discrete-valued) sense, even if the instances displayed substantial metric variation. Participants showed little sensitivity to correlational structure; sets of discretely varying objects were usually partitioned along a single feature dimension. Taken together, these results suggest that the label-generation task may provide a useful window into the structural principles that underlie psychologically natural categories.
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(5105)

Incidental Category Learning During Rote Memorization of Training Examples. NICHOLAS A. HIGGINS and COREY J. BOHIL, *University of Central Florida,* JOSEPH R. KEEBLER, *Wichita State University*—The goal of the present research is to understand the relationship between object similarity and incidentally inferred category structure. Participants performed various tasks to become familiar with individual stimuli (either color photos or line-drawings of main battle tanks), including free-sorting of images, pairwise similarity ratings, and identification training (which is analogous to the rote memorization used to train military personnel to uniquely identify military vehicles for friend or foe judgments). Participants tended to sort vehicles along one of three main dimension classes: 1) type of wheels and wheel-coverings, 2) size and shape of vehicle bodies, or 3) characteristics of guns and other vehicle-mounted equipment. Multidimensional scaling results confirmed these underlying psychological dimensions in many cases. These findings corroborate anecdotal reports that rote memorization training enables individual identification of items but also produces unintended and potentially unhelpful inferences about overarching category structure that may interfere with identification accuracy.
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(5106)

Simultaneously Interleaving Versus Simultaneously Blocking of High and Low Similarity Categories. PAULO F. CARVALHO and ROBERT L. GOLDSTONE, *Indiana*

University—Previous research has shown that successive presentation can be optimized by alternating presentations of the categories (interleaving) or grouping presentations by category (blocking). Furthermore, the advantage of interleaving versus blocking is modulated by the structure of the category. Interleaving improves learning of similar categories while blocking improves learning of low similarity categories. The present work aims to answer two main questions: what sequencing of categories is advantageous when two categories are presented simultaneously instead of successively, and, is the advantage influenced by the category structure? To this end, we presented participants with simultaneous presentations associated with frequent or rare alternation between the categories. We find that for highly similar categories, simultaneous interleaving of the categories resulted in better learning than blocking. However, for less similar categories, no differences between interleaving and blocking were found. These results are consistent with the proposal that different presentation orders lead to differential attentional weighting of unique versus distinctive features, resulting from the comparison of sequentially presented objects.
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• PSYCHOLINGUISTICS III •

(5107)

If the Left-Hemisphere is Reading and the Right-Hemisphere is Feeling, What Happens if You are Reading About Feelings? CONNIE SHEARS, SARAH BARR, CHRISTINE BROWN and SHAUN FLAX, *Chapman University*—Language processing is largely attributed to the left- hemisphere, but has significant right-hemisphere involvement for particular aspects of language such as humor or inferences (Beeman & Chiarello, 1998). Processing of emotions is largely attributed to the right-hemisphere (Borod, 1992), yet there is evidence of left-hemisphere involvement for particular valences (Smith & Bulman-Fleming). With this knowledge, we question how language processing is affected when reading involves emotions and requires inferences. We examined hemisphere differences for the formation of causal inferences based on texts that were positive, neutral or negative, to test whether the right-hemisphere, (favored for emotions and inferences) would form more causal inferences than the left-hemisphere (favored for reading). Utilizing a divided-visual-field paradigm, responses to target words were measured. An interaction between valence and formation of inferences depended upon hemisphere. Findings suggest the left-hemisphere may be as important to inference formation as the right-hemisphere when positive emotions are being processed.
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(5108)

Hemispheric Processing of Inferences in Bilinguals: The Role of Inference Predictability in Multiple Language Activation. FRANCES DANIEL, *Indiana University Northwest,* W. MATTHEW COLLINS, *Nova Southeastern University,* SANDRA VIRTUE, *DePaul University,* IRINA COSSIO and LISSETTE RIVAS, *Nova Southeastern University,* ELISE OZIER and DEVIN BOYLAN, *Indiana University Northwest*—Language selectivity for bilinguals is influenced by predictability; in highly predictable situations, bilinguals tend to activate one language during lexical access whereas in less predictable situations, both languages are activated (Swartz & Kroll, 2006) and this activation is localized in the right hemisphere (Motyka-Joss & Virtue, 2010). Because language becomes more selective as meaningful processing increases (e.g., from phonemes to semantic processing) (Marian et al., 2003), it is reasonable to assume that these effects would increase with additional meaningful processing (e.g., generating inferences). Spanish-English bilinguals read passages in English which promoted a predictable or less predictable inference and then performed a lexical decision task, with either an inference-related, neutral, or non-word. Inference-related words and some of the neutral words were viewed in Spanish (language switch). Response times indicated inhibition, regardless of predictability and hemisphere, suggesting the second language was not active. Inhibition effects were larger when testing the left hemisphere.
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(5109)

Effects of Reading Skill on Metaphor Processing: Evidence From Eye Movements. HANNAH E. FALEER, GARRETT LLEWELYN and JANE ASHBY, *Central Michigan University*—Previous research yields inconsistent data about the nature of metaphor processing. This experiment investigated whether individual differences in reading might contribute to that inconsistency by monitoring eye movements as better and worse college readers silently read metaphors (knowledge is a river) and similes (knowledge is like a river). According to Nelson-Denny scores, the better readers were reading at an end of college level (G.E.=16.1) whereas the worse readers were at a high school level (G.E.=12.5). We measured reading time on the vehicle (river), which was the earliest point for metaphor detection. Better readers spent longer reading metaphor vehicles than the same words in similes, and this pattern held for familiar and unfamiliar expressions. Worse readers processed similes and familiar metaphors in comparable time whereas unfamiliar metaphors took significantly longer to process. These data offer preliminary evidence for reading skill differences in online metaphor processing.
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(5110)

Coherence or Truth, Which is More Important to the Strength of an Argument? YASUHIRO OZURU, GIULIA KAUFMAN and DAVID BOWIE, *University of Alaska, Anchorage*—This study examined the way in which college students evaluate arguments comprised of a claim and a support linked by "because." We asked college students to select either "agree," "disagree," "understand," or "do not understand" for arguments whose truth of the claim, its support, and their coherence were independently manipulated. The results indicated that people tend to agree with a statement only when both the claim and the support are true, and their

relationship is coherent. The frequency of the response "do not understand" is solely determined by the coherence between the claim and support. Finally, the frequency of disagreement was found to increase for two different reasons: a) any falsity in a coherent argument (claim or support) and b) incoherence in true argument (claim and support).
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(5111)

Tailoring Linguistic Expectations in Third-Party Conversation. SI ON YOON and SARAH BROWN-SCHMIDT, *University of Illinois*—In conversation, interlocutors develop partner-specific "entrained" object names, and listeners expect familiar speakers to use entrained names. However, speakers might need to adjust names if they would be confusing (e.g., with a new listener) : Partners played a game, entraining names for game-pieces. At test, scenes contained 3 old and 1 novel game-pieces. The experimenter referred to the entrained object using the fluent entrained expression or a novel disfluent description; a new naïve listener was present, or not. Entrained terms were readily interpreted, regardless of new listeners, suggesting new listeners did not disrupt processing of entrained names. However, interpretation of disfluent instructions was significantly faster when a new listener was present. This result suggests that even in when the listener and speaker have an entrained term, listeners can cancel expectations for entrained terms, given sufficiently motivating contextual changes, such as a new listener who would be confused by entrained terms.
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(5112)

Alignment is a Function of Conversational and Relational Dynamics. MONICA A. RIORDAN, *Chatham University,* ROGER J. KREUZ and ANDREW OLNEY, *University of Memphis*—In two experiments, the predictions of two prominent theories of alignment (priming and grounding) are tested in human to human text-only computer-mediated interactions. Grounding theory suggests that nonverbal content is of critical importance in alignment, and text-only computer-mediated interactions remove such content. Prior experiments in such environments have supported priming, but examined human-computer interactions rather than human-human. In Experiment 1, two strangers conversed via Instant Messenger, and in Experiment 2, two friends conversed. In both experiments, conversations were either neutral in nature or involved disagreement in which each interlocutor was told to persuade the other to a different viewpoint on a topic. Conversations were examined for various forms of alignment: paralinguistic (response time and length), linguistic (part of speech), affective (emotion words), and semantic. All types were assessed on a turn-by-turn basis. Results show distinct patterns of alignment dependent upon relational (friend or stranger) and conversational (neutral or disagreement) dynamics, and that these patterns change with additional conversing. Grounding theory is supported, and extended to text-only environments.
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(5113)

Electrophysiological Effects of Association Strength in Words and Sentences. JOSEPH Z. STAFURA and CHARLES A. PERFETTI, *University of Pittsburgh*—This study examined the effects of antecedent-anaphor association strength on online word and text processing. We measured event-related potentials (ERPs) during semantic relatedness judgments and a sentence comprehension task. In the relatedness judgments, word pairs were strongly associated (SA), weakly associated (WA), or unrelated. In the sentence comprehension task, participants read two-sentence passages: in the SA and WA conditions, critical words in the second sentence were associates of antecedents in the first sentence. A baseline condition contained critical words but lacked associates. Across tasks, association conditions were distinguished by left-anterior ERP negativities (WA < SA) maximal 350 msec post-stimulus. A subsequent posterior component (i.e., N400) distinguished between association conditions in the relatedness judgment task (WA < SA), but not in the sentence comprehension task (WA = SA). The results reveal anterior processes responsive to lexical association that are not modulated by context, and subsequent posterior processes sensitive to context.
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(5114)

Ironic Criticism Simultaneously Enhances and Dilutes the Level of Condemnation. ALBERT N. KATZ and JAMES BOYLAN, *Western University*—In the context of texts which depicted either a minimally confrontational conversation (Study 1) or a more confrontational argument (Study 2) with a close friend, we demonstrate that the use of ironic criticism was rated as both being more humorous, polite, positive and yet also as more sarcastic and mocking than direct criticism. Two novel findings emerged: ironic expression (but not direct expression) influenced perception of failed expectations targeted by criticism and we found greater concordance between ratings of speaker intention and social impression for ratings of ironic expression than for directly expressed criticism. This concordance suggests that, contrary to some speculations, our participants expected that ironic expression of criticism should be interpreted more accurately than direct expression. Our data do not support two theoretical explanations for the function of ironic criticism.
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• BILINGUALISM II •

(5115)

Individual Differences in Executive Functions Predict Second Language Learning Success. JARED A. LINCK, SCOTT R. JACKSON, NOAH H. SILBERT, MEDHA TARE, ANITA R. BOWLES, SUSAN G. CAMPBELL and MICHAEL F. BUNTING, *University of Maryland Center for Advanced Study of Language*—Executive functions (EFs) have been implicated in successful second language (L2) learning and bilingual language processing. However, their skill-specific contributions to L2 learning are unclear. To examine this,

we tested adult native English speakers at an intensive L2 school (N = 1,312). At enrollment, students completed a comprehensive test of personality, motivation, L2 experience, and cognitive abilities (including three EFs), and were tracked until graduation, up to 70 months later. Preliminary analyses of proficiency levels at graduation indicate that working memory was a robust predictor for reading, listening, and speaking, whereas inhibitory control predicted listening and speaking. This was true across 12 languages and controlling for other cognitive abilities (e.g., inductive reasoning, reading comprehension), non-cognitive traits (e.g., personality, motivation), and prior L2 experience, supporting a central role for executive functions in theories of adult L2 learning.
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(5116)

Working Memory and Second Language Learning, Comprehension, and Production: A Meta-Analysis. JARED A. LINCK, *University of Maryland Center for Advanced Study of Language,* PETER OSTHUS and JOEL T. KOETH, *University of Maryland,* MICHAEL BUNTING, *University of Maryland Center for Advanced Study of Language*—According to many, working memory (WM) is an important factor in second language (L2) learning and processing (for a review, see Juffs & Harrington, 2011), but some would say WM's importance is overstated (e.g., Juffs, 2004). Despite many studies over the past two decades, the literature lacks a quantitative synthesis of extant results. We report a meta-analysis of data from 40+ samples involving over 1,700 participants providing 300+ effect sizes. Preliminary analyses suggest that WM is positively associated with L2 processing/proficiency outcomes (estimated ρ = .24, SE = .03). Planned analyses will examine covariates that might modulate the WM-criterion relationship (e.g., participant characteristics, WM measure features, criterion measure factors), and will assess publication bias on the estimated population effect size through established methods (e.g., funnel plots). The preliminary results confirm WM's centrality to theories of L2 processing and L2 learning, and covariate analyses will identify any constraints on WM effects.
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(5117)

Learning Second Language Words With Broader or Narrower Meanings Than First Language Equivalents. SUSAN GUNDERSEN and K. E. EBERHARD, *University of Notre Dame*—Research in perceptual category learning shows that attending to a previously irrelevant dimension is more difficult than ignoring a previously relevant one (e.g., Gladstone, 1998). Similarly, research in second language (L2) learning has shown greater difficulty learning L2 words that have narrower, as opposed to broader, meanings than the first language (L1) equivalent (Gathercole & Moawad, 2010). An artificial language learning experiment was conducted to examine the effects of learning L2 words that have narrower meanings (i.e., two L2 words correspond to a single L1 word), or broader meanings (i.e., one L2 word corresponds to two L1 words) than the L1 equivalents. Difficulty was measured by the number of errors made when learning the L1 words versus the L2 words. Participants had difficulty attending to previously irrelevant dimensions, as demonstrated by a greater number of errors learning L2 words with narrower meanings than learning L1 words with narrower meanings.
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(5118)

Far Transfer From Adaptive Cognitive Training to L2 Vocabulary Learning. ALISON M. PHILLIPS, CHELSEA M. EDDINGTON, JEFFREY S. PHILLIPS and NATASHA TOKOWICZ, *University of Pittsburgh*—Previous research has shown that adaptive cognitive training can improve working memory capacity (i.e., Morrison & Chein, 2011), and that individual differences in working memory capacity can mediate individual differences in second language (L2) learning (i.e., Martin & Ellis, 2012). Here, we examine whether improvements in working memory capacity, through adaptive cognitive training, transfer to L2 learning. Over 4 weeks, participants completed either adaptive or non-adaptive cognitive training across 15 sessions, and then completed L2 Arabic vocabulary training across 4 sessions. Participants who performed adaptive cognitive training, but not participants who performed non-adaptive cognitive training, gains in working memory capacity from pre-training to post-training, as measured by an operation span task, positively correlated with performance on an L2 Arabic vocabulary free recall test administered within one week of training. These results demonstrate that adaptive cognitive training is associated with improvements in both working memory capacity and in L2 Arabic vocabulary learning.
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(5119)

Individual Differences Modulate Effects of Translation-Ambiguity During Learning. TAMAR DEGANI, *University of Haifa,* ALISON M. PHILLIPS and NATASHA TOKOWICZ, *University of Pittsburgh*—Translation-ambiguous words, which map in a one-to-many fashion across languages, are more difficult to learn than translation-unambiguous words (Degani & Tokowicz, 2010). Here, we extend these findings, showing that this difficulty is modulated by presentation order and by individual differences in executive function. Specifically, teaching two Dutch translations for a single English word consecutively, in the same training session, resulted in better performance than teaching each of these two translations in separate training sessions, as reflected in learners' accuracy in both a free recall and a translation production task administered one week after training. Moreover, for translations taught separately, there was a substantial advantage in learning for the translation learned first, and these effects were stronger for individuals with larger Stroop interference scores. These findings highlight the importance of jointly considering item translation-status, learner's abilities, and presentation order when developing effective programs for foreign language vocabulary learning.
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(5120)

Pervasive Benefits of Preparation in Language Switching. ANGELA FINK and MATTHEW GOLDRICK, *Northwestern University*—A critical skill of bilingualism is the ability to control the language of production (e.g., saying 'one' vs. 'uno' for the digit 1). Recent research has focused on local control mechanisms that facilitate trial-to-trial switching of the response language. To what extent is control also required on trials without switching? Low-proficiency bilinguals named digits in their first (L1) or second (L2) language depending on the digit color (e.g., producing 'one' when the digit is yellow, 'uno' when it is blue). Color cues were presented either simultaneous or prior to digits, allowing participants varying amounts of time to prepare a response by engaging language control mechanisms. For both L1 and L2, preparation facilitated not only switch trials but also trials where the language of response did not change. The pervasive benefits of preparation suggests language control mechanisms are engaged on all trials for both L1 and L2.
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(5121)

There Are No Mental Firewalls: FMRI Evidence for Global Inhibition of the Native Language in Bilingual Speech. ELEONORA ROSSI, *The Pennsylvania State University,* SHARLENE NEWMAN, *Indiana University,* MICHELE DIAZ, *Duke University,* JUDITH F. KROLL, *The Pennsylvania State University*—Bilinguals co-activate both languages even when they intend to speak one language alone. To resolve cross-language competition, the dominant language is hypothesized to be inhibited. We investigated the time course and scope of bilingual inhibitory control using fMRI. English-Spanish bilinguals and English monolinguals named pictures in eight blocks. In the first, they named pictures from three categories in English. In a second, they named pictures from three different categories, in Spanish if bilingual, or in English, if monolingual. In six subsequent blocks, they named pictures in English that were previously seen, new pictures from the presented categories, and entirely new pictures. Results showed that only for bilinguals was there activation in the brain areas involved in general cognitive control (ACC, pre-supplementary area, and basal ganglia) following naming in Spanish. That activation extended to new items and across blocks, suggesting inhibition that is global in scope and time course.
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(5122)

Behavioral and ERP Evidence of Sentential Codeswitching in Highly Proficient Spanish-English Bilinguals. KAITLYN A. LITCOFSKY and JANET G. VAN HELL, *The Pennsylvania State University* (Sponsored by James M. McQueen)—Bilinguals have the unique ability to switch between their two languages in conversation. While this codeswitching appears fluent, psycholinguistic and neurocognitive research has shown that switching between languages incurs a processing cost in both production and comprehension. However, the majority of studies examined language switching between isolated items, and little is known about codeswitching in sentence context. We investigated sentential codeswitching in highly proficient Spanish-English bilinguals. Stimuli were 160 sentences that began in Spanish or English and could contain a codeswitch into the other language or not. All sentences were semantically and grammatically correct. Codeswitching was examined behaviorally, using self-paced reading, and with event-related potentials (ERPs). Preliminary results from the behavioral task show that reading times to codeswitched words are slower than to non-switched words, and that this switch cost is symmetric across language switching directions. Results will be discussed in terms of research and models of bilingual language processing.
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(5123)

Bilingual Number Codes and Working Memory: Interactions Between Verbal and Visuospatial Working Memory Components. CRISTINA GIL, MANUEL CARREIRAS and ELENA SALILLAS, *Basque Center on Cognition Brain and Language*—The links between language and numerical representation are still under debate. Here we show that the numeric linguistic code used by bilinguals modulates the retrieval of number long term representations in space (mental number line –mnl-), so that there is an advantage of the language used for learning math (LLmath). Bilinguals were asked to memorize the location of four number words presented visually and successively. Number word layout could be congruent with this mnl (smaller numbers to the left and larger numbers to the right) or incongruent. ERPs time locked to the fourth word differed depending on the language of the stimulus: N1 modulation by congruency was larger and appeared earlier for stimuli presented in the LLmath. Results suggest that number and language interact during the manipulation of numbers in memory. Importantly, LLmath shows to be the preferred code to manipulate mental spatial representations of number.
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(5124)

Working Memory Capacity: Is There a Bilingual Advantage? ILEANA RATIU and TAMIKO AZUMA, *Arizona State University*—The results of previous studies suggest that bilinguals have certain executive function advantages over monolinguals. However, few studies have examined specific working memory (WM) differences between monolinguals and bilinguals. Studies using simple span tasks as measures of WM capacity have produced conflicting results. In the current study, 52 bilingual and 53 monolingual speakers were administered simple and complex WM span tasks, including a backward digit span task, a standard operation span task (Turner & Engle, 1989), an operation span task with a suppression component, and a nonverbal symmetry span task (Kane et al., 2004). The results revealed that performance differences between the monolingual and bilingual groups were not consistent across tasks. Further, the differences seem to depend upon the specific WM demands required by each task. The results of this study are discussed within a framework of inhibitory control.
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(5125)

The Effects of Phonological and Visual Similarity of English Words on Short-Term Memory in Unbalanced Chinese-English Bilinguals. MONICA Y.C. LI, *National Central University, Taiwan,* ESTHER Y.-C. LIN, *National Yang-Ming University, Taiwan,* OVID J.L. TZENG, *National Yang-Ming University, Taiwan; Academia Sinica,* DAISY L. HUNG and DENISE H. WU, *National Central University, Taiwan*—Previous findings from readers of alphabetic languages demonstrate that verbal information in short-term memory (STM) is mainly retained by phonological but not visual representation. In contrast, our previous findings from Chinese readers demonstrate the contribution from both phonological and orthographic representation. To investigate whether bilinguals' STM is delineated by characteristics of the native language or by the to-be-remembered materials, the effects of phonological and visual similarity of English words in native English speakers and in Chinese-English bilinguals were examined. The results showed that English speakers' STM was only hindered by phonological but not visual similarity of English materials, while the STM of Chinese-English bilinguals was affected by both phonological and visual similarity. Furthermore, bilinguals' proficiency in English modulated the effect of visual similarity. The present findings suggest that the representation underlying bilingual verbal STM is jointly determined by features of the first language and proficiency of the second language.
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(5126)

Sensitivity to VOT-Vowel Length Covariation in Spanish and English Monolinguals. ANNIE J. OLMSTEAD and NAVIN VISWANATHAN, *State University of New York-New Paltz*, PILAR AIVAR, *Universidad Autónoma,* SARATH MANUEL and SUSAN M. MASON, *State University of New York-New Paltz*—In both Spanish and English, unvoiced stop consonants (p,t,k) differ from their voiced counterparts (b,d,g) in voice onset time (VOT) (Lisker & Abramson, 1963). In English, but not in Spanish, the VOT differences are also accompanied by a systematic lengthening of vowels following voiced consonants (e.g., Allen and Miller, 1999). In the current study, we examine the sensitivity of English monolinguals and Spanish monolinguals to the English VOT-vowel length relationship. We explore this using a pa-ba categorical perception task in which consonant tokens are followed by vowels of varying length. Results from this task show that, as expected, Spanish monolinguals are less sensitive to the VOT-vowel length relationship than English monolinguals. A second task required participants to imitate the tokens used in the perception task. We expect that speakers' productions will vary as a function of their perceptual sensitivity. The implications for perceptual learning studies will be discussed.
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(5127)

The Processing of Past-Tense Inflection in First and Second Languages: A Masked Priming Study. SAY YOUNG KIM and MIN WANG, *University of Maryland, College Park*—Using masked priming lexical decision paradigm (prime duration = 47ms), we examined the processing of Korean past-tense inflection in adult Korean L1 readers (Experiment 1) and English past-tense inflection in English L1 readers and Korean learners of English as L2. For both L1 groups, when the prime was the past-tense form, the response time on the corresponding stem as the target was significantly faster than when the prime was the orthographic control or the unrelated word. Korean learners of English showed a similar pattern of results; however, the morphological priming effect was not statistically significant. A significant effect of stem frequency on morphological priming was found in Korean and English L1 groups and Korean learners of English as L2, suggesting that lexical access to a morphologically complex word is affected by the aggregated frequency of the stem and its inflected variants for both L1and L2 readers. However, in comparison to L1 readers, L2 learners may be less sensitive to the morphological structure.
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(5128)

Sarcasm: Do you Hear it Now? SARA A. PETERS, KAT WILSON and AMIT ALMOR, *University of South Carolina*—Native English speakers have been found to identify sarcasm in spoken language using both prosody and context, yet it is unclear if non-native speakers use the same information or rely on other strategies. Using a spoken-language comprehension task with contexts and prosody that independently suggested sarcastic or sincere interpretations, we found that: (1) Native English speakers identify the presence of sarcasm better than non-native speakers (β=-0.21, s.e.=.05, $p<.001$); (2) When context and prosody disagree, non-native speakers rely exclusively on context and ignore prosody, but native speakers consider both, although they give more weight to context (interaction β=-0.52, s.e.=.05, $p<.001$). These data support an input processing view of language acquisition by second language learners (e.g., VanPatten, 2008), according to which, learners focus on lower-level input, like lexical information before higher-level cues like prosody.
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• REASONING AND PROBLEM SOLVING II •

(5129)

The Impact of Alluring Information on Scientific Reasoning. REBECCA E. RHODES, *University of Michigan,* FERNANDO RODRIGUEZ, *WestEd,* PRITI SHAH, *University of Michigan*—In today's Information Age, individuals are bombarded with data and asked to make informed decisions such as, "Should I drink more red wine?" or "How frequently should I have a mammogram?" Science and math educators agree that teaching scientific literacy and data interpretation skills are valuable, yet frequently unachieved goals of education. One common error is that individuals are highly influenced by alluring information such as anecdotes or irrelevant neuroscience information (e.g., Arkes & Gaissmaier, 2012; Fagerlin et al., 2005; Weisberg et al., 2008). In the current studies, we examine the degree to which such alluring information impacts individuals' ability to identify

methodological flaws or illogical conclusions in media reports of scientific studies. We also examine how these factors affect decisions based on the information presented. Preliminary results suggest that, depending on the content of the alluring information, it can either detract or enhance critical thinking. Results also suggest that alluring information affects not only critical evaluations of information, but also individuals' decisions to use or share that information with others.
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(5130)

Dissociations in Conflict Detection During Reasoning: Implications for the Science of Religious Belief. GORDON PENNYCOOK, JAMES A. CHEYNE, DEREK J. KOEHLER and JONATHAN A. FUGELSANG, *University of Waterloo*—Recent research has indicated a negative relation between the propensity for analytic reasoning (i.e., cognitive style) and religious belief. Mechanism(s) underlying this relation remain unidentified, however. Here we identify a novel mechanism that underlies cognitive style; conflict detection. We predict that more analytic people are less religious, in part, because they are more efficient at detecting reasoning conflicts, rendering them more sensitive to conflicts between their immaterial religious beliefs and their beliefs about the material world. To examine this hypothesis, we employed problems in which stereotypical information conflicts with base-rate probabilities. Religious believers were less likely to detect conflict than non-believers. Self-reported analytic cognitive style also positively predicted conflict detection. The present findings go beyond the mere association of analytic thinking and religiosity to provide insight into one mechanism that potentially underlies it. More generally, the present work successfully integrates individual difference factors and task-specific manipulations to investigate analytic reasoning.
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(5131)

Belief in Free Will, Life Satisfaction, and the Role of Cognitive Effort. CHRISTOPHER H. RAMEY, *University of Kansas* (Sponsored by Evangelia G. Chrysikou)—Belief in free will (FW; the ability to choose to act one way or another, despite internal and external pressures) differs markedly between laypeople and scientists. Why hold on to the notion of FW? One possibility is that it promotes prosocial behavior. Indeed, research suggests that encouraging disbelief in FW results in cheating and decreased helping. Belief in FW may also act as a control mechanism of more automatic, selfish behaviors; this requires cognitive effort. Participants completed various problems and personality measures to investigate these hypotheses. Results indicate satisfaction with one's past, present, and anticipated future life predicts belief in FW. In contrast, life satisfaction is unrelated to one's belief in the role of fate in one's life, life's randomness, or science's ability to explain things. Belief in FW is also associated with recent positive affect, whereas belief in the determinism of science's account of life is associated with negative affect. As to the 'effort' of exercising FW, participants who solve more problems that required counter-intuitive and, therefore, non-automatic, responses (thus demonstrating more cognitive reflection) are less likely to believe in the role of fate in one's life.
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(5132)

A Defensive Reasoning Bias in Response to Rules Concerning Illness. JOHN P. TAYLOR, *Southern Oregon University*—Performance on reasoning tasks like the Wason selection task (Wason, 1968) have demonstrated that people are generally prone to confirmation bias unless the rules evoke a social contract that may or may not be broken (Gigerenzer & Hug, 1992). Social Contract Theory (Cosmides, 1989) posits that enhanced performance on rules invoking a social contract is due to an evolved mechanism that protects us from being cheated. A similar mechanism may exist as a result of other evolutionary pressures, such as contagion or physical threats. The present study was designed using a two-alternative forced-choice version of the Wason selection task to determine how people reason about rules invoking the threat of illness. The results demonstrate that the order of symptom and cause has some effect on accuracy, but more importantly that reasoners demonstrate a defensive shift towards negating all aspects of the rule.
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(5133)

The Draw-A-Scientist Test: Measures Base Rates beyond Bias. LISA R. GRIMM, EMILY BRAHAM and LYNDA PAGAN, *The College of New Jersey*—Researchers use the Draw-A-Scientist Test (DAST: Chambers, 1983) as evidence for the existence of scientist gender stereotypes. There is much research using this test that documents the development of stereotypic content about scientists (e.g., lab coat and glasses), and the general tendency to draw a male scientist. Our study sought to replicate the stereotypic content present in drawings of scientists while also demonstrating that drawing a male scientist is not necessarily evidence of a gender bias. First, we asked college students to draw 1, 2, or 5 scientists, social scientists, college students, or people. We find that college students are sensitive to gender base rates. Second, we demonstrate that participants rated drawings of female scientists as less feminine and more masculine than drawings of females from the other conditions. Our results indicate that the DAST captures participants' sensitivity to gender base rates in different populations in addition to stereotypic content.
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(5134)

Forced Choice Reasoning Eliminates Belief Bias. DRIES TRIPPAS, SIMON J. HANDLEY and MICHAEL F. VERDE, *University of Plymouth*—Belief bias is the tendency for prior beliefs to influence deductive reasoning. Selective processing theory posits that the believability of a conclusion impacts both the response stage and the reasoning stage (Evans et al., 2001). In contrast, recent arguments based on SDT analysis suggest that the effect is a pure response bias (Dube et al.,

2010). A two-alternative forced choice (2AFC) method was used to eliminate response bias and thereby isolate the impact of believability on the reasoning stage. In Experiment 1, two arguments were shown side by side, with participants deciding which of the two was valid. There was no effect of believability on accuracy. In Experiment 2, arguments were shown one at a time, forcing participants to reason about each one separately. Believability had a significant impact on accuracy. Believability does seem to affect the reasoning stage. However, standard 2AFC presentation encourages the reasoner to focus on the superficial structure of an argument, eliminating the effect of prior beliefs.
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(5135)

Multidimensional Probabilistic Reasoning With Novel and Socially Based Stimuli: The Disappearing Conjunction Fallacy. DANIEL H. BARCH, RICHARD A. CHECHILE, JENNIFER SCHULTZ, BRIANNA A. SMITH, SAMUEL A. SOMMERS and RAYMOND S. NICKERSON, *Tufts University*—A series of experiments examined multidimensional probabilistic reasoning. Individuals made probability judgments for selecting marbles of a given color, pattern, or both from a can. These judgments were remarkably accurate and free from the conjunction-type errors made on analogous word-problem tasks. Introducing a delay between presentation of the marbles and the judgment affected accuracy but not the frequency of conjunction errors. Presenting the diagrams in segments had no effect on accuracy or conjunction errors. Individuals presented with a word-problem task involving social stereotypes – race and sex of violent criminals – made conjunction errors that reflected dominant stereotypes. Performing the visually based task before the word-problem led to significantly fewer conjunction errors on the word-problem task, suggesting that diagram-based tasks (a task at which individuals are accurate and normatively consistent) can prime normatively rational reasoning on word problems that have multiple features and invoke the use of stereotypes.
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(5136)

Generating and Explaining Mappings Between Representations Improves Learning of Mathematics Concepts. KEVIN D. DIETZ and SUSAN R. GOLDMAN, *University of Illinois at Chicago*—Multiple representations of information enhance learning when learners map common elements across the representations (Ainsworth, 2006). However, novices often fail to create mappings (Ainsworth, Bibby, & Wood, 2002). Providing novices with mappings that they self-explain has shown some benefit for conceptual, but not procedural, learning of probability principles (Berthold & Renkl, 2009). The present study tested whether having learners generate their own mappings further improved novices' conceptual learning. Seventy-five low-knowledge participants studied worked-examples of probability word problems and self-explained under one of three conditions: when no mappings were provided, when researcher-produced mappings were provided, or when the participant generated the mappings. Results indicated that the combination of learner-generated mappings and self-explanation produced higher conceptual understanding compared to the other conditions. Additionally, evidence suggested that self-explanations associated with conceptual understanding mediated the relationship between the acquisition of conceptual knowledge and the mappings learners made between representations.
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• JUDGMENT AND DECISION MAKING III •

(5137)

Are People Moral Absolutists or Relativists? DEREK M. POWELL and KEITH J. HOLYOAK, *University of California, Los Angeles* (Sponsored by Patricia Cheng)—Is morality absolute, or relative? In Kohlberg's theory, the endpoint of moral development was the "post-conventional stage." Here, moral rules become differentiated from societal conventions, and held as absolute and invariant. Some ethicists concur, but others hold that morality varies with culture. Do untrained adult respondents make moral judgments consistent with moral relativism or absolutism? Across several scenarios, we found that people's moral judgments were influenced by the historical and cultural context in which the moral act occurred. In some cases, acts happening in far-removed contexts were judged less harshly than the same acts occurring in a modern, western context. In other cases, acts were judged more harshly when they occurred in some other context, and more permissively when they happened in a modern context. The latter finding eliminates potential construal-level explanations of our findings, and suggests that people tend to make judgments based on moral relativism.
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(5138)

Priming an Implicit Religious Network Using Religious Symbols. SARAH E. CAVRAK and HEATHER M. KLEIDER, *Georgia State University*—Symbols are culturally important. They serve as categories and conceptualize interrelationships (Ortner, 1973). Symbols represent information previously learned or experienced, and serve to encourage thoughts and behaviors consistent with this experience to maintain social cohesion (Guthrie, 1996). Religion is defined by its use of symbology, which activates long-term goals, in order to motivate people along a religious path (Geertz, 1973). The current project explored whether religious symbols would prime a network of implicit religious information, via spreading activation theory, and if this activation was influenced by personal religiosity. Participants were primed (implicitly, explicitly) with symbols (religious, nonreligious), and then completed a lexical decision task (Meyer & Schvaneveldt, 1971) where words (religious, nonreligious) and nonwords were presented. Results suggest that religious symbols activate a network of known and personally espoused information for religious participants, such that reaction time is shorter for religious (vs nonreligious) word identifications.
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(5139)

The Face is the Thing. MCKENSIE L. MARTIN, *University of Alabama*—We used factor analysis to examine relationships among a number of chimeric and paper-and pencil tasks that have previously shown evidence of right hemispheric processing asymmetries. The 7 tasks involved the perception of faces, emotions in faces, numerosity, and line midpoints. Analysis of the asymmetries revealed that the 5 tasks using face stimuli resulted in a single factor, regardless of whether the faces were emotional or non-emotional, thus failing to support the hypothesis that emotion perception would constitute a separate perceptual process from non-emotional face perception. A second, bipolar factor revealed separate processes underlying enumeration and line bisection. We also examined whether task asymmetries correlate with performance on the DANVA emotion recognition test. Although previous research has shown moderate correlation, it was essentially null in our study. Together the results indicate that while perceiving facial emotion results in right hemisphere processing, "the face is the thing", not the emotion.
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(5140)

ERP Correlates of Recognition Memory in Heuristic Decision Making. SHANE R. SCHWIKERT and TIM CURRAN, *University of Colorado*—Simple heuristics have been shown to facilitate the interplay between memory and judgment processes by exploiting fundamental cognitive abilities. The recognition and fluency heuristic are prime examples of shortcuts that make the most of an automatic by-product of retrieval from memory in order to make decisions when sparse information is available. We used a modified version of a standard recognition/fluency heuristic paradigm, where participants judge which of two cities or countries has a larger population, and recorded event-related potentials (ERPs) to examine the psychological mechanisms underlying both heuristics. Cities or countries that were more fluently retrieved, as measured in a separate recognition test, showed ERPs markedly different from those that were less fluently retrieved. Specifically, when the difference between retrieval fluencies was large, ERPs associated with familiarity- and recollection-based recognition were larger for the more fluently retrieved region. These findings suggest that retrieval fluency may be influencing decisions.
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(5141)

Nostalgia and Mere Exposure Effect: Impact of Stimuli Repetition and Spacing. KEN MATSUDA, *Yamaguchi University,* ERIKO SUGIMORI, *Yale University,* TAKASHI KUSUMI, *Kyoto University*—This study investigated how nostalgia, after a certain interval, influenced mere exposure effect in spaced (heterogenous) presentation and massed (homogenous) presentation. We controlled exposure sequence (spaced and massed), exposure frequency (3, 6, and 9 times), and intervals between learning and judgment (1 week and 5 min). Fifty-five participants were exposed to each stimulus, and after 1 week and 5 min, they were asked to rate preference, familiarity, novelty, and nostalgia on a 5-point scale as well as recognize old and new items. The result showed that mere exposure effect occurred in spaced presentation, and this was consistent with the results of previous studies. After an interval of 1 week, in judgments about nostalgia, preference, and familiarity, the scores for the stimuli in the massed exposure condition increased, but the scores in the spaced exposure condition did not change. It was thought that nostalgia occurred after an interval and that nostalgia increased the preference for a stimulus and its familiarity.
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(5142)

The Semantics of the Legal Definition of Obscenity. JUSTIN MICLAT, JUSTIN ESTEP and CURT BURGESS, *University of California, Riverside*—Though the shift from a national to a community standard of the definition of obscenity occurred nearly four decades ago, the boundaries of obscenity are a semantic gray area at the legal as well as the academic level. There are three components to obscenity: prurient interest, offensiveness, and social value. An analysis of the semantic independence and the internal meaning structure of the definitional components was conducted. A decision model of determining if a text is obscene is proposed.
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(5143)

Priming Conviction With Exposure to Unjust Verdicts. KARENNA F. MALAVANTI and CHARLES A. WEAVER, III, *Baylor University*—We investigated juror's ability to disregard prior information when rendering verdict in new cases. Specifically, we studied whether reading about an unjust verdict alters their decision-making in other cases. Mock jurors read one of four newspaper-type articles about a case involving child abuse, neglect, and/or murder. Two articles decribed a case in which the verdict was guilty while the other two were not guilty. Additionally, cases described situations where the verdict was perceived either as just or unjust. Afterward, they reviewed the evidence and rendered a verdict on an unrelated armed robbery case in which the actual verdict was not guilty. As expected, reading an article resulting in conviction increased the likelihood of a guilty verdict in the unrelated case. However, jurors who read an article with a perceived unjust acquittal were more likely to reach a guilty verdict for that case and were more likely to convict on the unrelated case as well. Thus, conviction biases were primed with a (relatively complex) perceived violation of justice.
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(5144)

Discounting Monetary Rewards That are Both Probabilistic and Delayed. ARIANA VANDERVELDT, LEONARD GREEN and JOEL MYERSON, *Washington University in St. Louis*—The value of an outcome is affected by both the delay until its receipt (delay discounting) and the likelihood of its receipt (probability discounting). Although much is understood about delay and probability discounting when examined separately, little research has examined more complex situations in which outcomes are both delayed and probabilistic. In this experiment, participants made choices

between smaller rewards that were immediate and certain and larger rewards that were delayed and probabilistic. When delay and probability discounting were analyzed separately, a hyperboloid function provided excellent fits of probability discounting data at each delay and comparatively poorer fits for delay discounting data at each probability. A hyperboloid model that combined delay and probability discounting multiplicatively provided an excellent fit to the combined data. These results suggest that the hyperboloid model of discounting provides a good description of choice in this more complicated situation, and also that probability may be more heavily weighted than delay in determining people's choices when outcomes are both delayed and probabilistic.
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(5145)

This Mug is More Valuable Because It's Yours: Economic Decisions for the Self and Others. MICHAEL GREENSTEIN, *Stony Brook University,* XIAOMENG XU, *Alpert Medical School, Brown University and the Weight Control & Diabetes Research Center of Miriam Hospital* (Sponsored by Nancy Franklin)—Traditional economic theory suggests that people should provide objective values for goods such that two identical items should be given the same value. However, a number of cognitive biases, such as the endowment effect, have been shown to affect how people perform these sorts of economic tasks. The current work examines whether the disparity between the values of objects owned by oneself and another occurs for close others as well. Participants performed three valuation tasks for a number of common objects (e.g. a mug). They performed the task for hypothetical objects of theirs that they were selling, objects of a close other that they were selling, or objects of a stranger they were buying. Generally, participants provided higher values for items that they or the close other owned than the items owned by a stranger. The results represent further evidence of cognitive and social biases affecting economic judgments.
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(5146)

Exploration-Exploitation Across Tasks Reveals Little Evidence for a Common Factor. BETTINA VON HELVERSEN and RUI MATA, *University of Basel,* GREG SAMANEZ-LARKIN, *Vanderbildt University,* ANDREAS WILKE, *Clarkson University*—The need for exploration is ubiquitous. For most of us, not a day goes by in which we do not search for parking spots, online news, or names from memory. Is there a general exploration tendency that can be captured across situations? We investigated individuals' consistency in exploration-exploitation behavior across three computerized tasks: a foraging task involving sequential search for fish in several ponds, a sequential choice task involving choosing a candidate from a pool of applicants, and a multi-armed bandit task. Structural equation modeling revealed that there was no general factor underlying exploration in all tasks, even though exploration was highly consistent within each task. Risk taking as measured by self-report measures was related to exploration in the foraging and sequential choice tasks. The results suggest that while there is no general tendency for exploration, risk preferences may influence exploration across tasks.
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(5147)

Does Need for Cognition Influence Perceived Credibility of Older Witnesses? ANNA E. PITTMAN, MICHAEL P. TOGLIA and CHRISTOPHER T. LEONE, *University of North Florida,* KATRIN MUELLER-JOHNSON, *University of Cambridge*—We examined whether middle-aged witnesses are perceived as more credible than older eyewitnesses, and whether credibility is moderated by need for cognition (NC). Participants read a trial transcript about a child pedestrian-car accident wherein a defendant was charged with manslaughter. The sole eyewitness, either a 49 or 79 year-old male, testified that the child hit his head on a rock upon stepping off the curb before being struck by the defendant's vehicle. Transcripts included direct and cross-examination with half accompanied by the eyewitness' photo. Participants rated witness credibility on nine dimensions including competence, honesty, and suggestibility, then rendered a verdict. Participants completed a NC scale and questionnaire measuring attitudes towards punishment. Across photo conditions, only the age-perceived competence relationship was moderated by NC. Verdicts were significantly related to NC and influenced by attitudes towards punishment. Results are discussed in terms of their implications within the criminal justice system.
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(5148)

Type of Learning Task Impacts Performance and Strategy Selection in Decision Making. THORSTEN PACHUR, *University of Basel,* HENRIK OLSSON, *Max Planck Institute for Human Development (*Sponsored by Thomas T. Hills)—We show that decision performance and the selection between cue-based and exemplar-based inference mechanisms can depend critically on how knowledge about the statistical structure of the environment is acquired. Two types of learning tasks are distinguished: learning by comparison, by which the decision maker learns which of two objects has a higher criterion value, and direct criterion learning, by which the decision maker learns an object's criterion value directly. We trained participants either with learning by comparison or with direct criterion learning and subsequently tested them with paired-comparison, classification, and estimation tasks. Although providing less information, learning by comparison led to better generalization (at test), both when generalizing to new objects and when the task format at test differed from the task format during training. Moreover, learning by comparison enabled participants to provide rather accurate continuous estimates. Computational modeling suggests that the advantage of learning by comparison is due to differences in strategy selection: whereas direct criterion learning fosters the reliance on exemplar processing, learning by comparison fosters cu-based mechanisms.
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(5149)

Trends in Maximization Tendencies. COURTNEY STEIN, MICHAEL SAPOCHETTI and R. TODD COY, *Colby-Sawyer College,* GEORGE L. WOLFORD, *Dartmouth College*—Schwartz et al. (2002) developed a measure to test individual differences in decision making styles, categorizing people as either maximizers (those who agonize over every decision in an attempt to make the 'best' decision) or satisficers (those who are happy with the first item that meets all of their criteria, the 'good enough' decision). These decision making styles have been linked to a number of different outcomes including higher levels of depression and lower levels life satisfaction (Schwartz et al., 2002; Iyengar, Wells, & Schwartz, 2006). The data presented here represent the first long-term study of trends in maximization tendencies across two large (N = 1546) samples (a highly selective four-year college and a less selective four-year college) over 7 years. The results indicate a surprisingly high level of consistency with the original findings, but also show a trend towards higher levels of maximization in this college-aged sample.
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(5150)

Modeling How People's Preferences Change Over Trial and Time With Sequential Sampling Models. NICOLAS A.J. BERKOWITSCH, JÖRG RIESKAMP and BENJAMIN SCHEIBEHENNE, *University of Basel* (Sponsored by Rui Mata)—Many models of decision making assume that people's preferences stay constant over trials, particularly in the absence of learning. However, research on moral decision making indicates violations of this stationary assumption. Khan and Dhar (2006) showed that previous good deeds can license a subsequent bad deed, suggesting that previous choices influence subsequent choices. To explain these effects, we propose a sequential sampling model allowing for stationarity violations. Instead of having stable preferences across trials, we suggest that past decisions changes people's initial preferences when facing a new choice situation. In particular, the model assumes that (a) previous choices that were made with little as compared to high confidence are more likely to result in preference reversals and (b) very recent compared to more remote choices have a stronger impact on subsequent choices. To test the model we conducted an experiment with repeated choices in a moral decision making situation.
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(5151)

New Metrics and Measurement for Information Search in Decision Making. JOSEPH G. JOHNSON and XIAOLEI ZHOU, *Miami University*—Contemporary decision models have shifted away from focusing solely on choice outcomes, additionally making claims about the processes assumed to underlie these observable responses. Although experimental paradigms such as mouse- and eye-tracking have been developed to collect high resolution process data to verify these models, the metrics deployed in analyzing these rich data have not advanced at the same pace. We present work that goes beyond the typical use of summary statistics such as number of acquisitions, acquisition time, or search "pattern" to better understand dynamic patterns of information search. We augment such analyses by considering two distinct, new approaches. First, we analyze the entire (first order) transition matrix, which provides a more sophisticated and complete treatment of search dynamics and allows for the assessment of properties such as stationarity. Second, to compare acquisition streams across conditions, we make novel use of string edit distance techniques. The utility of these techniques is illustrated through application to a vast data set from probabilistic inference tasks under varying conditions. Contributions of these methods to strategy identification and classification are also discussed.
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(5152)

Violations of Consequentialism in Dynamic Decision Making. JARED M. HOTALING and JEROME R. BUSEMEYER, *Indiana University*—Human are often faced with complex choices involving interrelated events, where achieving one's goals requires planning a sequence of actions. Despite the importance of considering entire sequences when planning, rational choice theories state that individuals should be consequential, in that choices should be unaffected by past events and focused only on the potential future outcomes. We present data collected in a dynamic decision making paradigm showing that individuals' risky choices are influenced by past events. In the experiment multistage choices were represented as branching decision trees. At decision nodes, participants chose which path to take through the tree. At chance nodes, a marble was randomly drawn to determine the path. We found that choices made after a bad chance event, i.e. one that that sent the participant down the branch with lower utility, were riskier than those following a good event. Thus, individuals took on additional risk in an effort to recover from a disappointing event. This violation of consequentialism suggests that current prospects are judged relative to counterfactuals. Decision Field Theory-Dynamic, a cognitive model of sequential decision making, is used to account for this finding.
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(5154)

Does Looking Time Predict Choice-Supportive Bias? EVE A. ISHAM, RACHAEL G. GWINN and JOY J. GENG, *University of California, Davis* (Sponsored by Steven J. Luck)—A series of visual binary-choice studies illustrates that the preferred option could be predicted by longer fixation duration leading up to the moment of an explicit decision. Given this, we asked whether the accumulating fixation time also reflects the degree of preference. Specifically, we tested whether a choice-supportive bias (CSB), traditionally known to be dependent of choice, could also be predicted by fixation duration. In three experiments, participants chose and rated binary options on the basis of aesthetic preference. CSB was indexed by the difference in ratings during the decision task and during a baseline task. We found that while fixation duration predicts choice, it does not predict ratings nor CSB.

Moreover, CSB was observed even when explicit choice was omitted. Based on these findings, we propose that ratings and CSB may rely on a separate set of underlying mechanisms from those of the explicit decision-making process.
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(5155-5156)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

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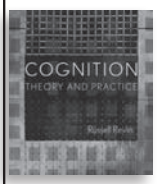

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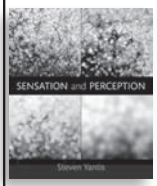

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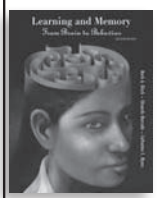

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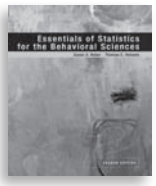

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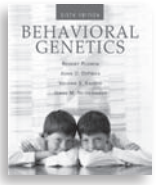

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