

Abstracts

of the Psychonomic Society

Volume 18 • November 2013

54TH ANNUAL MEETING

Sheraton Centre Toronto Hotel
Toronto, ON, Canada
Thursday, November 14-
Sunday, November 17, 2013

REGISTRATION

*Grand Ballroom Foyer, Lower Concourse,
Sheraton Centre Toronto Hotel*
Thursday, November 14 11:00 a.m.–8:00 p.m.
Friday, November 15 7:30 a.m.–6:00 p.m.
Saturday, November 16 10:00 a.m.–1:00 p.m.

BUSINESS MEETING

*Grand Ballroom Centre, Lower Concourse,
Sheraton Centre Toronto Hotel*
Saturday, November 16 5:10 p.m.–6:00 p.m.
• Presentation of the Psychonomic Society 2013 Best
Article Awards
• Business of the Psychonomic Society

SYMPOSIA

Friday, November 15 9:50 a.m.–12:00 noon
Symposium I: Future Global Change and Cognition

Friday, November 15 1:30 p.m.–3:40 p.m.
**Symposium II: Experience-Induced Neuroplasticity:
Evidence from Bilingualism**

Saturday, November 16 9:50 a.m.–12:00 noon
**Symposium III: Memory & the Law: Lessons from
Cases**

Saturday, November 16 1:30 p.m.–3:40 p.m.
**Symposium IV: Exploring the Canine Mind: Studies of
Dog Cognition**

KEYNOTE ADDRESS FOLLOWED BY THE WELCOME RECEPTION

*Grand Ballroom East, Lower Concourse, Sheraton Centre
Toronto Hotel*
Thursday, November 14 8:00 p.m.–9:00 p.m.
• **Psychonomic Society Outstanding Early Career
Awards**
• **The Memory Factory**
Elizabeth Loftus, University of California at Irvine
• **Welcome Reception**
*Grand Ballroom Foyer, Lower Concourse, Sheraton
Centre Toronto Hotel*

POSTER SESSIONS

Sheraton Hall, Lower Concourse, Sheraton Centre Toronto Hotel
Session I:
Thursday, November 14 6:00 p.m.–7:30 p.m.
Session II:
Friday, November 15 12:00 noon–1:30 p.m.
Session III:
Friday, November 15 6:00 p.m.–7:30 p.m.
Session IV:
Saturday, November 16 12:00 noon–1:30 p.m.
Session V:
Saturday, November 16 6:00 p.m.–7:30 p.m.

FUTURE MEETINGS

2014 – Long Beach, CA – November 20-23
2015 – Chicago, IL – November 19-22
2016 – Boston, MA – November 17-20
2017 – Vancouver, BC – November 16-19





**PRESENTATION OF THE PSYCHONOMIC SOCIETY
OUTSTANDING EARLY CAREER AWARDS**

PSYCHONOMIC SOCIETY KEYNOTE ADDRESS

Elizabeth Loftus, University of California, Irvine

The Memory Factory

8:00 p.m., November 14, 2013, Grand Ballroom East

WELCOME RECEPTION

The Governing Board welcomes all attendees to the Welcome Reception, hosted by the PS Governing Board, held on November 14 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 191-192 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 2013.



HOTEL

The Sheraton Centre Toronto Hotel offers an ideal location near all of Toronto’s attractions. Take Toronto’s PATH, a 16-mile underground walkway of shops and services, which connects hotel guests to the financial and entertainment districts. Just steps away are the Eaton Centre shopping mall, Nathan Phillips Square, and the Four Seasons Performing Arts Center. Enjoy the largest indoor/outdoor heated Toronto pool. Enjoy the many wonderful restaurants located within walking distance to the Sheraton Centre Hotel.

The Sheraton Centre Toronto Hotel will be the headquarter hotel, and site for all meetings, including meetings of 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 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 18**. Visit the Psychonomic Annual Meeting website to make reservations. The hotel reservation link can be reached via the page:

<http://www.psychonomic.org/annual-meeting.html>

You may also call +1-416-361-1000 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 \$199 CAD 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 Toronto, please visit www.seetorontonow.com

TRAVEL IN TORONTO

The Toronto Pearson International Airport offers a few options for transportation to the downtown corridor.

Airport Express:

Price: \$25-\$30 CAD one-way. \$35-\$40 CAD round trip. Airport Express runs a regular schedule, and stops at the Sheraton Centre Toronto Hotel. Find Airport Express just outside of Terminal 1, Door C, or Post #25-26 area at Terminal 3. Make your reservations online to receive a “Web Discount.” <http://www.torontoairportexpress.com>.

Taxi Service:

Price: \$50-\$65 CAD one-way. Signs at the airport will direct you to the taxi pick-up location.

REGISTRATION

Registration is free for members and will be located on the Lower Concourse Level at the Convention Registration Desk, at the following times:

Thursday, November 14 11:00 p.m.–8:00 p.m.
Friday, November 15.....7:30 a.m.–6:00 p.m.
Saturday, November 1610:00 a.m.–1:00 p.m.

You are encouraged to preregister through the Psychonomic Society website, 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 Toronto and complete a registration form so the Society can obtain an accurate count of attendees.

PROGRAMS

Programs are 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:

- Civic Ballroom (Second Floor)
- Conference Room B&C (Mezzanine Level)
- Grand Ballroom East (Lower Concourse)
- Grand Ballroom Centre (Lower Concourse)
- Grand Ballroom West (Lower Concourse)
- Dominion Ballroom (Second Floor)*

*On Sunday, The Dominion Ballroom will be divided into two separate rooms: Dominion North and Dominion South.

All poster sessions will take place in Sheraton Hall, on the Lower Concourse level.

Exhibits will be located in the Grand Ballroom Foyer, on the Lower Concourse level.

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. 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 14, there will be a general reception with a cash bar between 5:30 p.m. and 7:30 p.m. in Sheraton Hall, 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.

On Thursday, November 14, there will be an additional general reception with cash bar and hors d'oeuvres between 9:00 p.m. and 10:30 p.m. in the Grand Ballroom Foyer, site of the exhibits.

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 1,264 submissions. Of the 1,248 papers that were accepted, 298 are spoken papers and 950 are posters. In addition, there were four Invited Symposia.

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 Sheraton Hall. 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	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.
Friday Noon	10:00 a.m.–1:30 p.m.	12:00 noon–1:30 p.m.
Friday Evening	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.
Saturday Noon	10:00 a.m.–1:30 p.m.	12:00 noon–1:30 p.m.
Saturday Evening	4:00 p.m.–7:30 p.m.	6:00 p.m.–7:30 p.m.

We have extended viewing time so that all interested attendees can see the posters of their choice and reduce the crowded conditions that at times occur during the poster sessions. As usual, the author(s) are required to be present only during the official times shown in the program. Posters should be taken down at the end of the actual session. Please do NOT leave your poster behind at the end of 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., 001–191).

PROGRAM HISTORY

Year – Site	Submissions	Accepted
2012 – Minneapolis	1,066	1,054
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, Jennifer Lanzel, Linda Potchoiba, and Jane Shepard.

OTHER MEETINGS

- **APCAM–Auditory Perception, Cognition, and Action 12th Annual Meeting**
Thursday, November 14, Dominion Ballroom South
Visit apcam.us for more information.

- **CCS–Comparative Cognition Society**
Thursday, November 14, Dominion Ballroom North
For more information visit www.comparativecognition.org

- **OPAM–Workshop in Object Perception, Attention, and Memory**
Thursday, November 14, 7:00 a.m.–5:00 p.m., Grand Ballroom West

The 21st annual OPAM meeting is a one-day workshop dedicated to issues in object perception, attention, memory and other areas of visual cognition. This year’s keynote address will be given by Dr. Stephen Mitroff, Duke University. For more information visit www.opam.net or contact one of this year’s organizers: Michael Mack (mack.michael@gmail.com), Josh Cosman (joshua.d.cosman@vanderbilt.edu), Jeff Moher (jeff_moher@brown.edu), or Michael Hout (michael.hout@asu.edu).

- **SCiP–Society for Computers in Psychology**
Thursday, November 14, Conference Rooms D-G
For more information, visit www.scip.ws.

- **Tactile Research Group**
Thursday, November 14, 8:30 a.m.–6:00 p.m., Conference Room B

Invited speakers include John Kennedy, Yon Visell, Nicholas Giudice, Jean Vroomen, Mounia Ziat and Vincent Levesque. Contact Masashi Nakatani (mn2598@columbia.edu) for more information.

- **WICS- Women in Cognitive Science 13th Annual Meeting**
Thursday, November 14, 4:00 p.m. - 6:00 p.m., Civic Ballroom. For more information visit <http://womenincogsci.org>.
- **SJDM- Society for Judgment and Decision Making Annual Meeting**
Friday, Saturday, Sunday and Monday, November 15-18, Sheraton Centre Toronto Hotel; Second Floor: Civic Foyer, Civic Ballroom, Willow East, Essex Ballroom, Simcoe, Civic Ballroom North, Civic Ballroom South, Grand Ballroom West.

OFFICERS OF THE SOCIETY

Past Chair	Jeffrey M. Zacks (2012)
Current Chair	Helene Intraub (2013)
Chair-Elect	Jeremy M. Wolfe (2014)
Secretary/Treasurer	Ruth Maki (2011-2016)
Convention Manager	Andy Conway (2012-2016)

GOVERNING BOARD

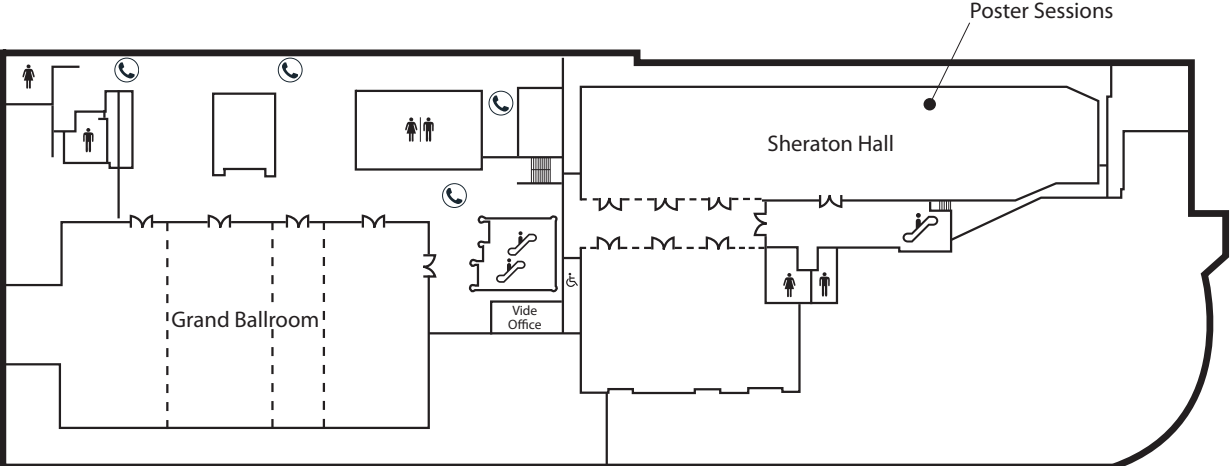
- R. Reed Hunt (2008-2013)
- Jeffrey M. Zacks (2008-2013)
- Michael C. Anderson (2009-2014)
- Helene Intraub (2009-2014)
- Colin M. MacLeod (2010-2015)
- Jeremy M. Wolfe (2010-2015)
- Cathleen Moore (2011-2016)
- Lynne Reder (2011-2016)
- Robert Logie (2012-2017)
- Janet Metcalfe (2012-2017)
- M. Teresa Bajo (2013-2018)
- Aaron Benjamin (2013-2018)

The names of two members elected to the Governing Board for 2014-2019 will be announced at the Business Meeting on Saturday, November 16.

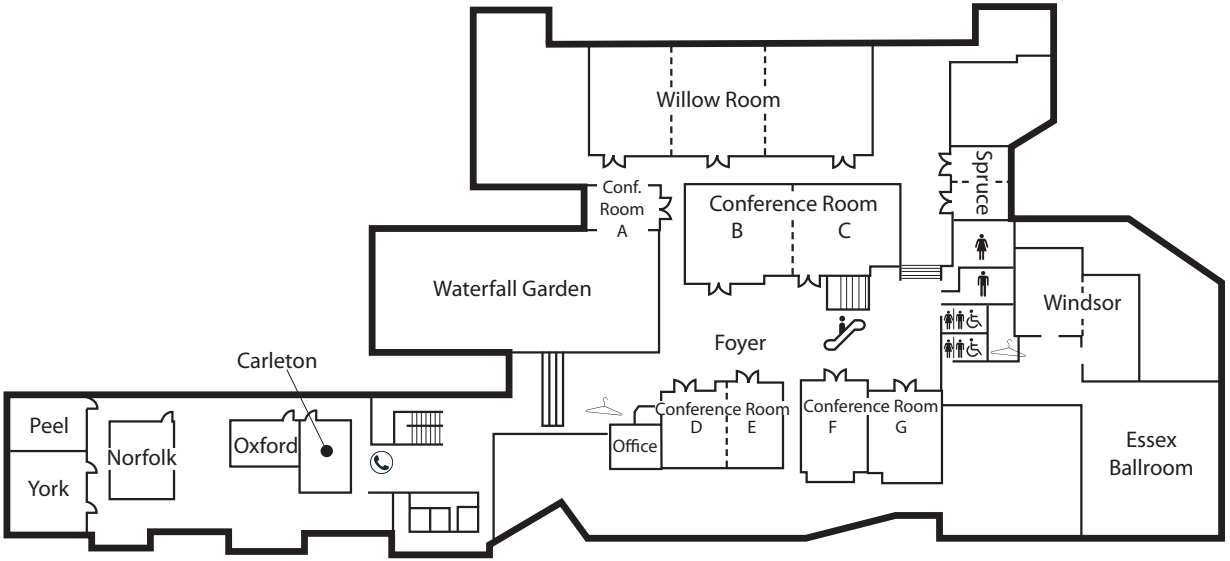
Ruth Maki, *Secretary/Treasurer*
Adjunct Professor, University of Arizona
2785 E. Posse Court
Green Valley, AZ 85614
rmaki@email.arizona.edu

SHERATON CENTRE TORONTO HOTEL, TORONTO, ONTARIO, CANADA

Lower Concourse



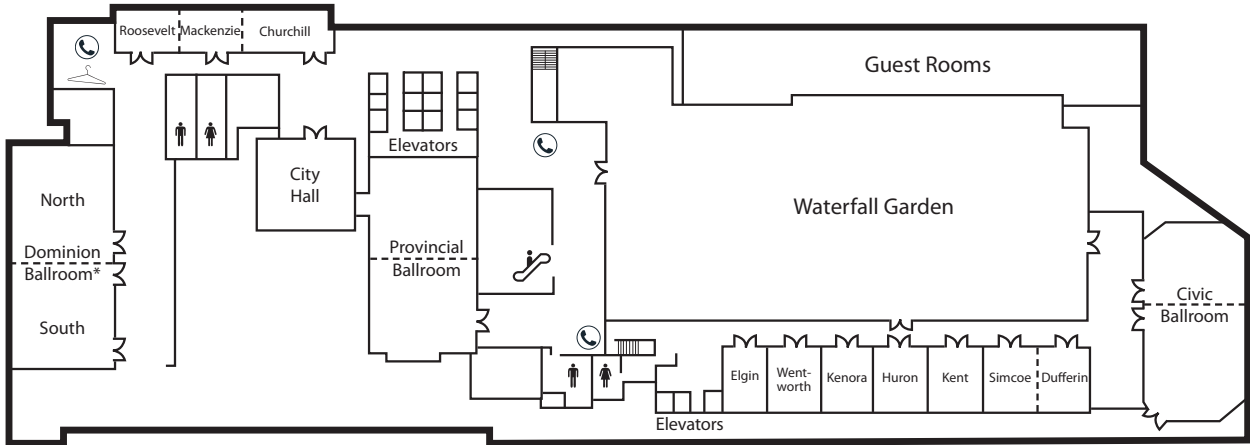
Mezzanine





SHERATON CENTRE TORONTO HOTEL, TORONTO, ONTARIO, CANADA

Second Floor



* On Sunday, the Dominion Ballroom will be divided into separate rooms: North and South.

The Psychonomic Society
Announces the Winners of the

2013 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 Ph.D.) 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 Janet Metcalfe, representing the Governing Board, and David Balota, Laura Novick, and Thomas Zentall, from the membership, comprised the 2013 committee.



Steven Franconeri

Northwestern University

For his contributions to our understanding of the interrelationship between visual spatial attention and the processing of objects and their spatial relations

Nominators:

- Dedre Gentner
- Nora Newcombe



Jeffrey Karpicke

Purdue University

For his advancement of our fundamental understanding of learning and memory while simultaneously solving applied problems in the classroom.

Nominators:

- Jim Nairne
- Henry L. Roediger III



Michael Kaschak

Florida State University

For his research on the role of systems of perception and action planning in language comprehension and the seminal work on the effect of patterns of experience on language production

Nominators:

- Colleen Kelley
- Arthur Glenberg



Bob McMurray

University of Iowa

For his empirical and theoretical contributions to developmental science in the areas of infant speech perception and children's word learning.

Nominators:

- Ed Wasserman
- Stephen Goldinger



The Psychonomic Society
Announces the Winners of the

2013 Associate Member Select-Speaker AWARD

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

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

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

Melissa Baese-Berk

Michigan State University

Area: Speech Perception

Abstract #191 - Distal Speech Rate Influences Lexical Access

Bryan Burnham

The University of Scranton

Area: Attention

Abstract #41 - Contingent Attentional Capture by Items in Selectively Ignored Locations

Asli Kilic

Koç University

Area: Memory

Abstract #70 - A Time Course Analysis of the Strength Based Mirror Effect

Youngbin Kwak

Duke University

Area: Judgment/Decision Making

Abstract #65 - The Rational Adolescent: Evidence from Strategic Behavior in Information Processing Revealed by Eye Tracking

Vanessa Loaiza

Université de Fribourg

Area: Memory

Abstract #11 - The Nature of the Stored Representations in Working Memory Depends on the Maintenance Strategy

George Malcolm

The George Washington University

Area: Visual Processing

Abstract #89 - Object Semantic Properties' Effect on Attentional Allocation in Naturalistic Scenes

Erin Maloney

University of Chicago

Area: Spatial Cognition

Abstract #3 - Math Anxiety Relates to Poor Spatial Processing That Cannot be "Written Away"

Adam Moore

University of Edinburgh

Area: Judgment/Decision Making

Abstract #260 - What's so Special About Moral Judgement? Maybe Not as Much as you Think.

Ross Otto

New York University

Area: Judgment/Decision Making

Abstract #262 - Acute Stress Effects on Model-Based versus Model-Free Reinforcement Learning

Joonkoo Park

Duke University

Area: Reasoning/ Problem Solving

Abstract #93 - Improving Math with Number Sense Training: An Investigation of its Underlying Mechanism

ANNOUNCING THE PSYCHONOMIC SOCIETY 2013 BEST ARTICLE AWARDS

Sponsored by Springer

Each year, the Publications Committee of The Psychonomic Society asks the Editors of the six Psychonomic journals to select a best article of the year from among all articles published or slated to be published in that year in their journal. Editors use whatever criteria and procedures they deem best to make their selections. The authors selected to receive these awards this year (who also will be identified in a brief announcement at the PS Business Meeting on Saturday, November 16, 2013) are:



Pastukhov

Attention, Perception, & Psychophysics (Editor Jeremy Wolfe)

Alexander Pastukhov, Jana Füllekrug, Jochen Braun

“Sensory memory of structure-from-motion is shape-specific” DOI 10.3758/s13414-013-0471-8

Alexander Pastukhov, Jochen Braun

“Structure-from-motion: Dissociating perception, neural persistence, and sensory memory of illusory depth and illusory rotation” DOI 10.3758/s13414-012-0390-0

Behavior Research Methods (Editor Gregory Francis)

Guy E. Hawkins, Babette Rae, Keith V. Nesbitt, Scott D. Brown

“Gamelike features might not improve data”

DOI 10.3758/s13428-012-0264-3



Hawkins



McMenamin

Cognitive, Affective, & Behavioral Neuroscience (Editor Deanna Barch)

Brenton W. McMenamin, Chad J. Marsolek

“Can theories of visual representation help to explain asymmetries in amygdala function?”

DOI 10.3758/s13415-012-0139-1

Learning & Behavior (Editor Geoffrey Hall)

Joël Fagot, Anaïs Maugard

“Analogical reasoning in baboons (*Papio papio*): Flexible reencoding of the source relation depending on the target relation”

DOI 10.3758/s13420-012-0101-7



Fagot



Wahlheim

Memory & Cognition (Editor James Nairne)

Christopher N. Wahlheim, Larry L. Jacoby

“Remembering change: The critical role of recursive reminders in proactive effects of memory”

DOI 10.3758/s13421-012-0246-9

Psychonomic Bulletin & Review (Editor Cathleen Moore)

Jane Jacob, Bruno G. Breitmeyer, Melissa Treviño

“Tracking the first two seconds: Three stages of visual information processing?”

DOI 10.3758/s13423-013-0482-4



Jacob

Please join the Publications Committee in congratulating these authors!



The American Journal of Psychology

Established in 1887 by G. Stanley Hall

Personal in-house copy editing provided

Editor: Robert W. Proctor

Book Review Editor: Dominic W. Massaro

History of Psychology Editor: Alfred H. Fuchs

For more information, visit <http://www.press.uillinois.edu/journals/ajp.html>

Join the list of Psychonomic Society members who have published in the *American Journal of Psychology*:

Philip A. Allen	Alinda Friedman	Roberta Klatzky	David C. Riccio
Jeanette Altaribba	Kathleen Galotti	Juliana Leding	Henry L. Roediger III
Richard P. Atkinson	R. Allen Gardner	Fabio P. Leite	David Rosenbaum
Alan D. Baddeley	Dedre Gentner	Alejandro Lleras	Caryn M. Rotello
Soledad Ballesteros	Arthur M. Glenberg	Elizabeth F. Loftus	Sandro Rubichi
Lawrence W. Barsalou	Lisa Geraci	Gordon Logan	Jesse Sargent
Sian L. Beilock	Bradley S. Gibson	Donald G. MacKay	Stephen R. Schmidt
Daniel M. Bernstein	Janet M. Gibson	Colin M. MacLeod	Jonathan W. Schooler
Irving Biederman	Arnold L. Glass	Ruth H. Maki	John G. Seamon
Richard A. Block	Stephen D. Goldinger	George Mandler	Alan Searleman
Donald S. Blough	Peter M. Gollwitzer	Arthur B. Markman	Robert Sekuler
Lyle E. Bourne	Paula Goolkasian	Harvey Marmurek	John W. Senders
Gordon H. Bower	Wayne D. Gray	Randi Martin	Richard M. Shiffrin
Myron L. Braunstein	Seth Greenberg	Dominic W. Massaro	Steven M. Smith
Alan S. Brown	Robert L. Greene	Michael E.J. Masson	Eric Soetens
David Bryant	Anthony Greenwald	Michael K. McBeath	Norman E. Spear
Jerome R. Busemeyer	Steven J. Haase	James L. McClelland	Mary Kay Stevenson
Patrick Cabe	Ralph N. Haber	Mark McDaniel	Jennifer A. Stolz
Richard A. Carlson	Andrea L. Halpern	James L. McGaugh	Thomas Z. Strybel
Thomas H. Carr	Peter A. Hancock	Cathy L. McEvoy	Aimée Surprenant
John M. Carroll	Lynn Hasher	Gail McKoon	Martha Teghtsoonian
Marylou Cheal	Alice F. Healy	Michele L. Meade	Robert Teghtsoonian
Russell M. Church	Morton A. Heller	Douglas Mewhort	Michael P. Toglia
Charles Clifton	Avishai Henik	Ralph R. Miller	Jean E. Fox Tree
Hans Colonius	Douglas J. Herrmann	Cathleen M. Moore	Barbara Tversky
Max Coltheart	Christopher Hertzog	J. Toby Mordkoff	Ryan D. Tweney
Stanley Coren	Rachel S. Herz	Jochen Müsseler	Joseph Tzelgov
Nelson Cowan	Douglas L. Hintzman	James S. Nairne	Ovid J. L. Tzeng
James E. Cutting	James E. Hoffman	David Navon	William R. Uttal
Dale Dagenbach	Donald Homa	Ian Neath	Mieke Verfaellie
Joseph H. Danks	Timothy L. Hubbard	James H. Neely	Kim-Phuong L. Vu
Gary S. Dell	Michael S. Humphreys	Douglas L. Nelson	Eric-Jan Wagenmakers
Natacha Deroost	R. Reed Hunt	Raymond S. Nickerson	Jeffrey B. Wagman
Vincent Di Lollo	Helene Intraub	Gregg C. Oden	Benjamin Wallace
Stephen Dopkins	David E. Irwin	Geoffrey O'Shea	David Waller
John Dunlosky	Chizuko Izawa	James W. Pellegrino	Thomas Wallsten
Paula Durlach	Herbert M. Jenkins	Thomas V. Petros	Lawrence M. Ward
David G. Elmes	Arthur T. Jersild	Zehra F. Peynircioğlu	Joel S. Warm
Randall W. Engle	Phillip Johnson-Laird	Maura Pilotti	Richard M. Warren
William Epstein	Mary Riess Jones	Clare Porac	Michel Wertheimer
Ronald P. Fisher	John Jonides	Mitchell Rabinowitz	J. W. Whitlow, Jr.
Gary Fisk	Jerwen Jou	Gabriel A. Radvansky	Motonori Yamaguchi
Donald J. Foss	James F. Juola	Sam S. Rakover	Michael E. Young
Robert Fox	Todd A. Kahan	Roger Ratcliff	Rose T. Zacks
James L. Fozard	Ronald T. Kellogg	J. Don Read	Maria S. Zaragoza
Joel S. Freund	Sachiko Kinoshita	Adam Reeves	Michael D. Zeller
Jennifer J. Freyd	Marcel Kinsbourne	Jason F. Reimer	Thomas R. Zentall



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The 13th Annual Meeting of Women in Cognitive Science

Thursday, November 14, 2013

Sheraton Centre Hotel, Toronto, Civic Ballroom

WICS Meeting: 4-6 pm

WICS Social Hour: 6-7 pm

Intellectual phony or successful academic? Overcoming the impostor syndrome

Keynote speaker:

Valerie Young

Author of: *The secret thoughts of successful women: Why capable people suffer from the impostor syndrome and how to thrive in spite of it.*

Panelists:

Penny Pexman
University of Calgary

Patricia Reuter-Lorenz
University of Michigan

Sharon Thompson-Schill
University of Pennsylvania

Janet van Hell (moderator)
Pennsylvania State University

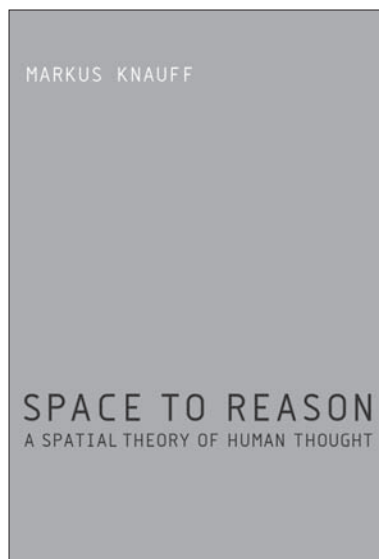
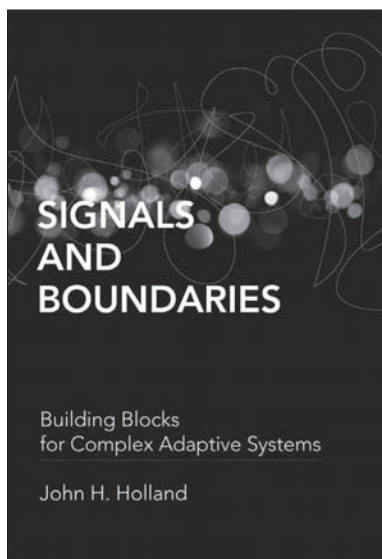
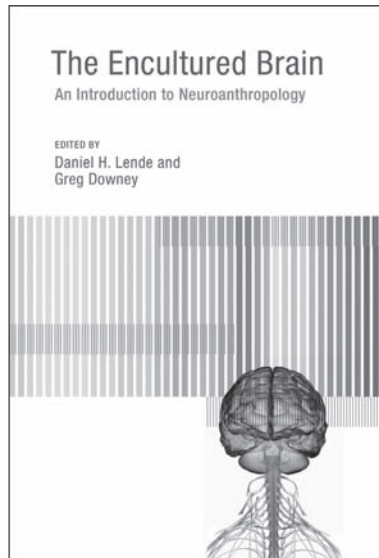
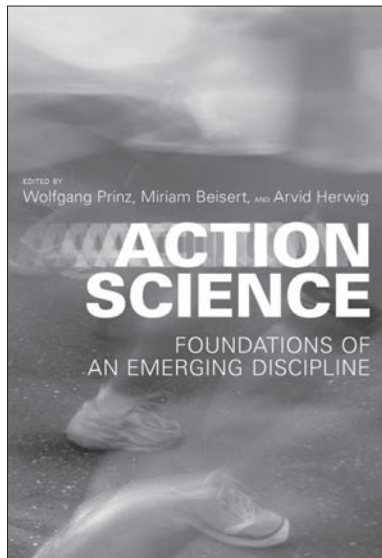
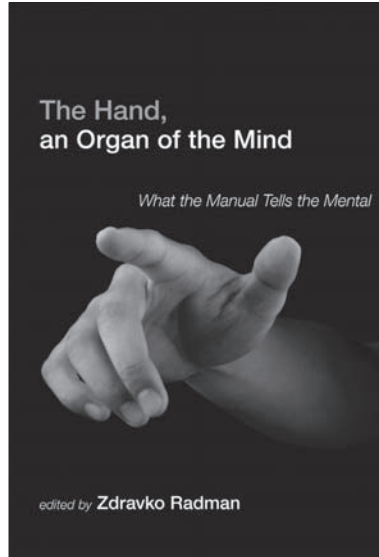
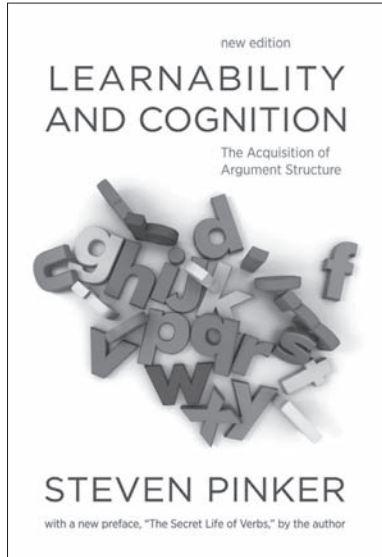
Acknowledgments:

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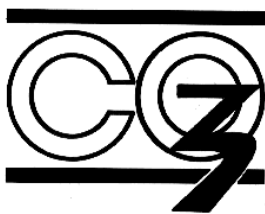
Fall Meeting of the Comparative Cognition Society

November 14 – Sheraton Centre Hotel

All are Welcome – Registration is Free (Please Register to Receive Updates)

Paper Sessions

- 8:05 - Sequence Learning, Timing, and Perception
- 9:20 - Social and Prosocial Behavior
- 10:20 – Communication, Categorization, and Reasoning
- 1:00 - Memory and Metacognition
- 2:10 - Choice Behavior
- 3:20 - Spatial Cognition
- 4:20 - Keynote Address – Nora Newcombe (Temple University)
Studying Development Comparatively



21st Annual *International Conference on Comparative Cognition*
Melbourne, FL March 26 - 29, 2014

Call for Papers will be Posted on the CCS Website in September

**COMPARATIVE
COGNITION & BEHAVIOR
REVIEWS**

The online journal of the Comparative Cognition Society

Check out these resources on the CCS website

- ComparativePsych News Feed: Reports from the media related to animal behavior and comparative cognition may be viewed on the website or emailed directly to you as they are posted
- CCS YouTube Channel: videos from laboratories, documentary footage, etc gathered by category. Post videos from your lab and let us know to be included
- Job Postings and Student Opportunities in comparative cognition (check them out and/or fill out the web form to post yours)

Support the Activities of the Comparative Cognition Society
Please Consider Joining the Society – See the CCS Website for Details

THURSDAY EVENING, NOVEMBER 14, 2013

Hospitality	5:30 p.m.–7:30 p.m., Sheraton Hall
Poster Session I	4:00 p.m.–7:30 p.m. (Author present between6:00 p.m.–7:30 p.m.), Sheraton Hall
Vision I (1001–1008)	Working Memory I (1093–1111)
Perception I (1009–1018)	Metamemory/Metacognition I (1112–1126)
Action and Perception I (1019–1036)	Human Learning and Instruction I (1127–1147)
Embodied Cognition I (1037–1049)	Attentional Processes (1148–1157)
Spatial Cognition I (1050–1064)	Letter and Word Processing I (1158–1164)
Cognitive Skill Acquisition (1065–1072)	Psycholinguistics I (1165–1180)
Explicit Memory I (1073–1092)	Judgment and Reasoning (1181–1191)
Psychonomic Society Outstanding Early Career Awards	8:00 p.m., Grand East
Associate Member Select-Speaker Awards	8:00 p.m., Grand East
Keynote Address	8:00 p.m., Grand East
Welcome Reception.....	Grand Ballroom Foyer

FRIDAY MORNING, NOVEMBER 15, 2013

Spatial Cognition (1–5)	8:00 a.m.–9:40 a.m., Dominion Ballroom
Statistics and Methodology (6–9)	8:00 a.m.–9:20 a.m., Grand East
Working Memory I (10–14).....	8:00 a.m.–9:40 a.m., Grand West
Bilingual Language Control (15–20)	8:00 a.m.–10:00 a.m., Civic Ballroom
Auditory Processes (21–25)	8:00 a.m.–9:40 a.m., Conference B & C
Human Learning and Instruction I (26–30).....	8:00 a.m.–9:40 a.m., Grand Centre
SYMPOSIUM I: Future Global Change and Cognition.....	9:50 a.m.–12:00 noon, Grand East
Selective Attention I (40–44)	10:20 a.m.–12:00 noon, Civic Ballroom
Embodied Cognition (45–50).....	10:00 a.m.–12:00 noon, Grand West
Language Processing (51–56)	10:00 a.m.–12:00 noon, Dominion Ballroom
Cognitive Aging (57–62)	10:00 a.m.–12:00 noon, Conference B & C
Judgment and Decision Making I (63–68).....	10:00 a.m.–12:00 noon, Grand Centre
Poster Session II	10:00 a.m.–1:30 p.m. (Author present between12:00 noon–1:30 P.M.), Sheraton Hall
Perception II (2001–2019)	Testing Effects I (2093–2101)
Spatial Cognition II (2020–2033)	Selective Attention I (2102–2122)
Associative Learning I (2034–2047)	Cognitive Control I (2123–2137)
Eyewitness Memory and Identification (2048–2054)	Speech Perception I (2138–2150)
Recognition Memory I (2055–2062)	Psycholinguistics II (2151–2169)
Implicit Learning and Memory (2063–2076)	Bilingualism I (2170–2180)
Working Memory II (2077–2092)	Reasoning and Problem Solving I (2181–2191)

FRIDAY AFTERNOON, NOVEMBER 15, 2013

Recognition Memory (69–74)	1:30 p.m.–3:30 p.m., Grand West
Visual Search (75–79)	1:30 p.m.–3:10 p.m., Grand East
Cognitive Control I (80–85)	1:30 p.m.–3:30 p.m., Dominion Ballroom
Visual Processing (86–90).....	1:30 p.m.–3:10 p.m., Conference B & C
Reasoning/Problem Solving (91–95).....	1:30 p.m.–3:10 p.m., Civic Ballroom
SYMPOSIUM II: Experience—Induced Neuroplasticity: Evidence from Bilingualism	1:30 p.m.–3:40 p.m., Grand Centre
Word Recognition (103–108)	3:30 p.m.–5:30 p.m., Civic Ballroom
Language Production (109–113).....	3:50 p.m.–5:30 p.m., Grand West
False Memory and Eyewitness Identification (114–119)	3:30 p.m.–5:30 p.m., Grand East
Concepts and Categories I (120–124).....	3:50 p.m.–5:30 p.m., Dominion Ballroom
Organization and Configurality in 2D and 3D Perception (125–130).....	3:30 p.m.–5:30 p.m., Conference B & C
Action (131–134).....	4:10 p.m.–5:30 p.m., Grand Centre



FRIDAY EVENING, NOVEMBER 15, 2013

Hospitality	5:30 p.m.–7:30 p.m., Sheraton Hall
POSTER SESSION III	4:00 p.m.–7:30 p.m. (Author present between6:00 p.m.–7:30 p.m.), Sheraton Hall
Vision II (3001–3011)	Visual Search (3100–3108)
Action and Perception II (3012–3024)	Discourse Processes (3109–3126)
Explicit Memory II (3025–3039)	Language Production/Writing (3127–3137)
Recognition Memory II (3040–3051)	Letter and Word Processing II (3138–3154)
Collaborative Memory (3052–3057)	Judgment and Decision Making I (3155–3170)
Metamemory/Metacognition II (3058–3074)	Animal Learning and Cognition (3171–3179)
Memory and Aging (3075–3090)	Statistics and Methodology (3180–3190)
Prospective Memory (3091–3099)	

SATURDAY MORNING, NOVEMBER 16, 2013

Letter and Word Processing I (135–139)	8:00 a.m.–9:40 a.m., Grand West
Inhibition of Thought (140–143)	8:00 a.m.–9:20 a.m., Grand East
Explicit Memory I (144–149)	8:00 a.m.–10:00 a.m., Grand Centre
Bilingualism (150–154)	8:00 a.m.–9:40 a.m., Dominion Ballroom
Action and Perception I (155–160)	8:00 a.m.–10:00 a.m., Civic Ballroom
Animal Learning and Cognition (161–166)	8:00 a.m.–10:00 a.m., Conference B & C
Selective Attention II (167–172)	10:00 a.m.–12:00 noon, Grand West
Metamemory/Metacognition I (173–177)	10:20 a.m.–12:00 noon, Grand Centre
Associative Learning (178–183)	10:00 a.m.–12:00 noon, Dominion Ballroom
Event Processing (184–188)	10:20 a.m.–12:00 noon, Civic Ballroom
Speech Perception I (189–193)	10:20 a.m.–12:00 noon, Conference B & C
SYMPOSIUM III: Memory & The Law: Lessons from Cases	9:50 a.m.–12:00 noon, Grand East
POSTER SESSION IV	10:00 a.m.–1:30 p.m. (Author present between12:00 noon–1:30 p.m.), Sheraton Hall
Action and Perception III (4001–4011)	Divided Attention (4093–4097)
Testing Effects II (4012–4019)	Cognitive Control II (4098–4118)
Associative Learning II (4020–4027)	Bilingualism II (4119–4136)
Explicit Memory III (4028–4043)	Psycholinguistics III (4137–4149)
Working Memory III (4044–4056)	Speech Perception II (4150–4164)
Attention and Aging (4057–4062)	Judgment and Decision Making II (4165–4178)
Human Learning and Instruction II (4063–4077)	Concepts and Categories II (4179–4190)
Selective Attention II (4078–4092)	

SATURDAY AFTERNOON, NOVEMBER 16, 2013

Priming (203–207)	1:30 p.m.–3:10 p.m., Grand West
Testing Effects in Memory (208–213)	1:30 p.m.–3:30 p.m., Grand East
Working Memory II (214–218)	1:30 p.m.–3:10 p.m., Dominion Ballroom
Psycholinguistics I (219–224)	1:30 p.m.–3:30 p.m., Civic Ballroom
Cognitive Control II (225–230)	1:30 p.m.–3:10 p.m., Conference B & C
SYMPOSIUM IV: Exploring the Canine Mind: Studies of Dog Cognition	1:30 p.m.–3:40 p.m., Grand Centre
Explicit Memory II (237–242)	3:30 p.m.–5:30 p.m., Dominion Ballroom
Speech Perception II (243–247)	3:50 p.m.–5:10 p.m., Civic Ballroom
Human Learning and Instruction II (248–253)	3:30 p.m.–5:30 p.m., Grand West
Multisensory Integration (254–258)	3:50 p.m.–5:30 p.m., Conference B & C
Judgment and Decision Making II (259–263)	3:50 p.m.–5:30 p.m., Grand East
Business Meeting	5:10 p.m.–6:00 p.m., Grand Centre



SATURDAY EVENING, NOVEMBER 16, 2013

Hospitality	5:30 p.m.–7:30 p.m., Sheraton Hall
POSTER SESSION V	4:30 p.m.–7:30 p.m. (Author present between 6:00 p.m.–7:30 p.m.), Sheraton Hall
Music Perception (5001–5005)	Selective Attention III (5094–5112)
Event Cognition (5006–5010)	Consciousness (5113–5117)
Action (5011–5015)	Letter and Word Processing III (5118–5139)
Autobiographical Memory (5016–5025)	Bilingualism III (5140–5155)
Explicit Memory IV (5026–5040)	Concepts and Categories III (5156–5169)
False Memory (5041–5062)	Reasoning and Problem Solving II (5170–5180)
Working Memory IV (5063–5077)	Judgment and Decision Making III (5181–5190)
Human Learning and Instruction III (5078–5093)	

SUNDAY MORNING, NOVEMBER 17, 2013

Metamemory/Metacognition II (266–271).....	8:00 a.m.–10:00 a.m., Dominion South
Judgment and Decision Making III (272–276)	8:00 a.m.–9:40 a.m., Grand West
Selective Attention III (277–282)	8:00 a.m.–10:00 a.m., Grand Centre
Action and Perception II (283–288)	8:00 a.m.–10:00 a.m., Dominion North
Letter and Word Processing II (289–294).....	8:00 a.m.–10:00 a.m., Grand East
Cognitive Skill Acquisition (295–299)	8:00 a.m.–9:40 a.m., Conference B & C
Explicit Memory III (300–304)	10:20 a.m.–12:00 noon, Dominion South
Perceptual Processes (305–310)	10:00 a.m.–12:00 noon, Conference B & C
Working Memory III (311–315).....	10:20 a.m.–12:00 noon, Grand Centre
Concepts and Categories II (316–320)	10:20 a.m.–12:00 noon, Dominion North
Psycholinguistics II (321–325).....	10:20 a.m.–12:00 noon, Grand East
Judgment and Decision Making IV (326–331)	10:00 a.m.–12:00 noon, Grand West



Condensed Schedule B

Dominion Ballroom	Civic Ballroom	Conference B & C
Thursday Evening, November 14		
Friday Morning, November 15		
Spatial Cognition 8:00 a.m.–9:40 a.m.	Bilingual Language Control 8:00 a.m.–10:00 a.m.	Auditory Processes 8:00 a.m.–9:40 a.m.
Language Processing 10:00 a.m.–12:00 noon	Selective Attention I 10:20 a.m.–12:00 noon	Cognitive Aging 10:00 a.m.–12:00 noon
Friday Noon, November 15		
Friday Afternoon, November 15		
Cognitive Control I 1:30 p.m.–3:30 p.m.	Reasoning/Problem Solving 1:30 p.m.–3:10 p.m.	Visual Processing 1:30 p.m.–3:10 p.m.
Concepts and Categories I 3:50 p.m.–5:30 p.m.	Word Recognition 3:30 p.m.–5:30 p.m.	Organization and Configurality in 2D and 3D Perception 3:30 p.m.–5:30 p.m.
Friday Evening, November 15		
Saturday Morning, November 16		
Bilingualism 8:00 a.m.–9:40 a.m.	Action and Perception I 8:00 a.m.–10:00 a.m.	Animal Learning and Cognition 8:00 a.m.–10:00 a.m.
Associative Learning 10:00 a.m.–12:00 noon	Event Processing 10:20 a.m.–12:00 noon	Speech Perception I 10:20 a.m.–12:00 noon
Saturday Noon November 16		
Saturday Afternoon, November 16		
Working Memory II 1:30 p.m.–3:10 p.m.	Psycholinguistics I 1:30 p.m.–3:30 p.m.	Cognitive Control II 1:30 p.m.–3:10 p.m.
Explicit Memory II 3:30 p.m.–5:30 p.m.	Speech Perception II 3:50 p.m.–5:10 p.m.	Multisensory Integration 3:50 p.m.–5:30 p.m.
Saturday Evening, November 16		
Sunday Morning, November 17		
(Dominion North) Action and Perception II 8:00 a.m.–10:00 a.m.	(Dominion South) Metamemory/Metacognition II 8:00 a.m.–10:00 a.m.	Cognitive Skill Acquisition 8:00 a.m.–9:40 a.m.
Concepts and Categories II 10:20 a.m.–12:00 noon	Explicit Memory III 10:20 a.m.–12:00 noon	Perceptual Processes 10:00 a.m.–12:00 noon



Grand Centre	Grand East	Grand West	Sheraton Hall
	Keynote Address: The Memory Factory, Elizabeth Loftus, University of California, Irvine 8:00 p.m.		Hospitality 5:30 p.m.-7:30 p.m. Poster Session I 6:00 p.m.-7:30 p.m.
Human Learning and Instruction I 8:00 a.m.-9:40 a.m.	Statistics and Methodology 8:00 a.m.-9:20 a.m.	Working Memory I 8:00 a.m.-9:40 a.m.	
Judgment and Decision Making I 10:00 a.m.-12:00 noon	SYMPOSIUM I: Future Global Change and Cognition 9:50 a.m.-12:00 noon	Embodied Cognition 10:00 a.m.-12:00 noon	
			Poster Session II 12:00 noon-1:30 p.m.
SYMPOSIUM II: Experience—Induced Neuroplasticity: Evidence from Bilingualism 1:30 p.m.-3:40 p.m.	Visual Search 1:30 p.m.-3:10 p.m.	Recognition Memory 1:30 p.m.-3:30 p.m.	
Action 4:10 p.m.-5:30 p.m.	False Memory and Eyewitness Identification 3:30 p.m.-5:30 p.m.	Language Production 3:50 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.
Explicit Memory I 8:00 a.m.-10:00 a.m.	Inhibition of Thought 8:00 a.m.-9:20 a.m.	Letter and Word Processing I 8:00 a.m.-9:40 a.m.	
Metamemory/Metacognition I 10:20 a.m.-12:00 noon,	SYMPOSIUM III: Memory & The Law: Lessons from Cases 9:50 a.m.-12:00 noon	Selective Attention II 10:00 a.m.-12:00 noon	
			Poster Session IV 12:00 noon-1:30 p.m.
SYMPOSIUM IV: Exploring the Canine Mind: Studies of Dog Cognition 1:30 p.m.-3:40 p.m.	Testing Effects in Memory 1:30 p.m.-3:30 p.m.	Priming 1:30 p.m.-3:10 p.m.	
Business Meeting 5:10 p.m.-6:00 p.m.	Judgment and Decision Making II 3:50 p.m.-5:30 p.m.	Human Learning and Instruction II 3:30 p.m.-5:30 p.m.	
			Hospitality 5:30 p.m.-7:30 p.m. Poster Session V 6:00 p.m.-7:30 p.m.
Selective Attention III 8:00 a.m.-10:00 a.m.	Letter and Word Processing II 8:00 a.m.-10:00 a.m.	Judgment and Decision Making III 8:00 a.m.-9:40 a.m.	
Working Memory III 10:20 a.m.-12:00 noon	Psycholinguistics II 10:20 a.m.-12:00 noon	Judgment and Decision Making IV 10:00 a.m.-12:00 noon	



THURSDAY, NOVEMBER 14, 2013

6:00 P.M.–7:30 P.M.

POSTER SESSION I (1001–1191)

SHERATON HALL

Vision I (1001–1008)

- (1001) LaCombe Jr., Dickinson
- (1002) Bushmakim, James
- (1003) Wnuczko, Kennedy, Niemeier
- (1004) Kahan, Lathrop
- (1005) Gordon, Kobylarz, Edewaard
- (1006) Roye, Ross, Alain
- (1007) Shyi, Lin
- (1008) Papesh, Goldinger

Perception I (1009–1018)

- (1009) Purcell, Stewart
- (1010) Hopper, Huber
- (1011) Obermeyer, Kolling
- (1012) Peissig, Wiese
- (1013) Savage, Lipp
- (1014) Huang, Lee
- (1015) Brodeur, Guérard, Lagacé, Arguin
- (1016) Cate, Tzur
- (1017) Friedenber, Rotondo, Rypl
- (1018) Beckett, Cardwell, Mantonakis, Newman, Garry

Action and Perception I (1019–1036)

- (1019) Namdar, Algom, Ganel
- (1020) Ladwig, Köhler, Müsseler, Sutter
- (1021) Chen, Song, Proctor
- (1022) Liepelt
- (1023) Morrisey, Rutherford, Reed, McIntosh
- (1024) Katsuhara, Iseki, Ueda, Kumada
- (1025) Ueda, Iseki, Katsuhara, Kumada
- (1026) Farshid, Katz, Barker
- (1027) Brunyé, Hayes, Mahoney, Gardony, Taylor, Kanarek
- (1028) Konvalinka, Skewes, Michael, Skewes
- (1029) Stubblefield, Fournier, Behmer Jr.
- (1030) da Silva, McBeath
- (1031) Wifall, Buss, Spencer, Hazeltine
- (1032) Nalepka, Van Der Wege, Strand
- (1033) Risko, Dunn, Medimorec
- (1034) Gill, Jordan
- (1035) Twedt, Bakdash, Proffitt
- (1036) Shin, Key, Simmons

Embodied Cognition I (1037–1049)

- (1037) Larre-Perez, Jacob, Collins
- (1038) Oakes, Searleman, Shea-Gander
- (1039) McWilliams, Sohn
- (1040) Autry, Dunn, Levine
- (1041) Lindemann, Wiemers
- (1042) Liu, Schunn
- (1043) Nasiopoulos, Cywinska, Badiudeen, Kingstone
- (1044) Sidhu, Pexman
- (1045) Dennehy, Hayes, Boehm

- (1046) Kacinik, El-Haddad, Eskine, Starr-Glass, Salamon
- (1047) Hubbard, Magne, Langston, Shields
- (1048) Huang, Tse
- (1049) Hayes, Dennehy, Callow

Spatial Cognition I (1050–1064)

- (1050) Xiao, Lian
- (1051) Julian, Epstein
- (1052) Rand, Thompson, Creem-Regehr
- (1053) Nelligan, Carlson, Shelton
- (1054) Chang, Moon, Cho
- (1055) Tarampi, Creem-Regehr
- (1056) Varner, Dopkins, Hoyer
- (1057) Steele, Roskos
- (1058) Srikanth, Gonzalez, Costales, Herradon, Pruden
- (1059) Bennett, Giudice, Klatzky, Loomis
- (1060) Gagnier, Shipley
- (1061) Police, Bodily
- (1062) Mou, Zhang
- (1063) Brunstein, Brunstein, Nour, Waheed
- (1064) Leising, Ruprecht, Wolf, Quintana

Cognitive Skill Acquisition (1065–1072)

- (1065) Greenlee, Boles
- (1066) Katz, Jaeggi, Buschkuhl, Shah, Jonides
- (1067) Ljung
- (1068) Sprute, Beilock
- (1069) Sowinski, LeFevre
- (1070) Kallai, Tzelgov
- (1071) Flanagan, Mathis
- (1072) Jones, Moss

Explicit Memory I (1073–1092)

- (1073) Langley
- (1074) Martin, Lane
- (1075) Williams, Rappa
- (1076) Buchli, Bjork, Storm
- (1077) Cox, Dobbins
- (1078) Prince, Criss, Malmberg, Peckoo
- (1079) Lanska, Westerman
- (1080) Konkel, Selmeczy, Dobbins
- (1081) Szani, Bowers, Pereira-Pasaran, Lloyd
- (1082) VanArsdall, Nairne, Cogdill, Pandeirada
- (1083) MacKenzie, Donaldson
- (1084) Karam-Zanders, Lane
- (1085) Otani, Senkova, Knoll, Foster, Libkuman
- (1086) Nairne, Cogdill, Lehman
- (1087) Weatherford, Carlson, Tucker
- (1088) Turner, Rhodes
- (1089) Wammes, Fernandes
- (1090) Wenzel, Gerrig, Rajaram
- (1091) Robin, Wynn, Moscovitch
- (1092) Fujita, Cho

Working Memory I (1093–1111)

- (1093) Bancroft, Servos, Hockley
 (1094) Lin, Oberauer
 (1095) Festini, Reuter-Lorenz
 (1096) Knickerbocker, Altarriba
 (1097) Nolden, Lefebvre, Bermudez, Grimault, Jolicoeur
 (1098) Richmond, Wolk, Olson
 (1099) Lefebvre, Audevar, Jolicoeur
 (1100) Rzucidlo, Roseman, Laurienti, Dagenbach
 (1101) Hwang, Luck, Hollingworth
 (1102) Anderson, Vogel, Awh
 (1103) Moffitt, Hutchison
 (1104) Miller, Becker, Liu
 (1105) Oswald, McAbee, Redick, Hambrick
 (1106) Pearce, Lale, Turley-Ames, Miyake
 (1107) Horne, Deary, Brown, Logie
 (1108) Chow, Conway
 (1109) Dorsi, Viswanathan, George, Cassidy
 (1110) Shipstead, Engle
 (1111) Moreno, deSouza, Gauer

Metamemory/Metacognition I (1112–1126)

- (1112) Feltman, Ferraro
 (1113) Yue, Oppenheimer, Castel
 (1114) Hohmann, Kuhlmann, Erdfelder, Touron
 (1115) Mueller, Dunlosky, Tauber
 (1116) Beziat, Was
 (1117) Tauber, Dunlosky, Urry, Opitz
 (1118) Tullis, Benjamin
 (1119) Stevens, Carlson
 (1120) Wong, Moss, Eakin, Tan
 (1121) Soderstrom, Bjork
 (1122) Hartwig
 (1123) Mullet, Marsh
 (1124) Brashier, Umanath, Cabeza, Marsh
 (1125) Ariel, Price, Hertzog
 (1126) Williams, Lindsay

Human Learning and Instruction I (1127–1147)

- (1127) Küpper-Tetzel, Kapler, Wiseheart
 (1128) Yan, Garcia, Bjork, Bjork
 (1129) Vaughn, Rawson, Carpenter
 (1130) Szpunar, Schacter
 (1131) Rice, Church, Mercado III
 (1132) Yue, Bjork
 (1133) Bellinger, DeCaro
 (1134) Pyke, Anderson
 (1135) Flores, Serra, England
 (1136) Ortega-Tudela, Lechuga, Gómez-Ariza
 (1137) Barideaux Jr, Maass, Pavlik Jr
 (1138) Barhorst, Taraban
 (1139) Snow, Jackson, Varner, McNamara
 (1140) Sana, Allen, Teeter, Kim
 (1141) Clark, Bjork, Castel
 (1142) Fiorella, Mayer
 (1143) Arnold, McDermott
 (1144) Smith, Handy, Nichols, Angello
 (1145) Macnamara, Hambrick, Oswald
 (1146) Yamaguchi
 (1147) Clark, Allen

Attentional Processes (1148–1157)

- (1148) Li
 (1149) Miller, Dixon, Young, Lloyd, Hartman
 (1150) Millar, Arslan, Gutches, Boduroglu, Sekuler
 (1151) Lanagan-Leitzel, Cousins
 (1152) Young
 (1153) Zupan, Blagrove, Watson
 (1154) Buetti, Lleras, Cronin
 (1155) Minear, Brasher, Moore, Price, Sukeena
 (1156) Orozco, Collins, Boucher
 (1157) Nöstl, Sörqvist

Letter and Word Processing I (1158–1164)

- (1158) Davis, Johnson, McCormick, McKague, Kinoshita, Bowers, Perry, Forester, Cortese, Scaltritti, Aschenbrenner, Coane, White, Yap, Davis, Kim, Adelman
 (1159) Massol, Midgley, Holcomb, Grainger
 (1160) Siakaluk, Moffat, Knol, Sidhu, Pexman
 (1161) Armstrong, Laszlo
 (1162) Wetherill, Jones
 (1163) Van Der Wege, Nathan
 (1164) Glaholt, Reingold, Rayner

Psycholinguistics I (1165–1180)

- (1165) Tanner, Van Hell
 (1166) Thomas, Cirelli, Dickinson
 (1167) Columbus
 (1168) Roman, Ray, Contemori, Kaan, Dussias
 (1169) Robertson, MacDonald, Gallant, Kozera
 (1170) Bernard, Onishi
 (1171) Luka, Rich, Benowitz
 (1172) Zamuner, Morin-Lessard, Page
 (1173) Ramey, Thompson
 (1174) Orihuela, Carreiras, Duñabeitia
 (1175) Morrill, McAuley, Jones, Zdziarska, Dilley, Sanders
 (1176) Smith, Gupta
 (1177) DeSantis, Johnson, Chambers
 (1178) Patson, George, Warren
 (1179) Peters, Almor
 (1180) Faust, Hill, Pierce

Judgment and Reasoning (1181–1191)

- (1181) Wong, Kose, Kosegarten
 (1182) Stephens, Dunn
 (1183) Armstrong
 (1184) Friel
 (1185) Kramer, Sharma
 (1186) Bradley, Burns, Campanello, Castle, Grunewald, Harbison, Michael, Saner
 (1187) Navarrete, Santamaria
 (1188) Casteel, Downing
 (1189) Jahn, Braatz
 (1190) Cooper, Gorlick, Worthy, Beevers, Maddox
 (1191) Hoffman, Zivotofsky



FRIDAY, NOVEMBER 15, 2013

8:00 A.M.–12:00 NOON

Spoken Sessions (1–68)

Spatial Cognition (1–5), Dominion Ballroom

- 8:00 a.m.–8:15 a.m. Wang, Taylor, Brunyé
8:20 a.m.–8:35 a.m. Burte, Hegarty
8:40 a.m.–8:55 a.m. Maloney, Waechter, Soliman,
Schaeffer, Owens, Risko, Beilock,
Fugelsang
9:00 a.m.–9:15 a.m. van der Ham, de Zeeuw, Braspenning
9:20 a.m.–9:35 a.m. Hubbard, Ruppel

Statistics and Methodology (6–9), Grand East

- 8:00 a.m.–8:15 a.m. Myung, Cavagnaro, Kim, Pitt
8:20 a.m.–8:35 a.m. Morey, Hoekstra
8:40 a.m.–8:55 a.m. Mata, Kuenzli, Leuker, Hertwig
9:00 a.m.–9:15 a.m. Willits, Seidenberg

Working Memory I (10–14), Grand West

- 8:00 a.m.–8:15 a.m. Basak
8:20 a.m.–8:35 a.m. Loaiza, Camos
8:40 a.m.–8:55 a.m. Anderson, Vogel, Awh
9:00 a.m.–9:15 a.m. Barrouillet, Plancher, Guida, Camos
9:20 a.m.–9:35 a.m. Joui

Bilingual Language Control (15–20), Civic Ballroom

- 8:00 a.m.–8:15 a.m. Gollan, Schotter, Gomez,
Murillo, Rayner
8:20 a.m.–8:35 a.m. Hartsuiker, Declerck
8:40 a.m.–8:55 a.m. Van Assche, Duyck, Gollan
9:00 a.m.–9:15 a.m. Grainger, Peeters,
Runnqvist, Bertrand
9:20 a.m.–9:35 a.m. Goldrick, Engstler, Gustafson,
Runnqvist, Costa
9:40 a.m.–9:55 a.m. Emmorey, Petrich, Gollan

Auditory Processes (21–25), Conference B & C

- 8:00 a.m.–8:15 a.m. Halpern
8:20 a.m.–8:35 a.m. Wisniewski, Mercado III, Church
8:40 a.m.–8:55 a.m. Fostick
9:00 a.m.–9:15 a.m. Weisman, Hoeschele, Guillette,
Hahn, Sturdy
9:20 a.m.–9:35 a.m. Neuhoff, Schott, Kropf

Human Learning and Instruction I (26–30), Grand Centre

- 8:00 a.m.–8:15 a.m. Finn, Roediger III
8:20 a.m.–8:35 a.m. Karpicke, Lehman
8:40 a.m.–8:55 a.m. Fernandes, Fugelsang, Manios,
Skinner
9:00 a.m.–9:15 a.m. Kornell
9:20 a.m.–9:35 a.m. Fazio, Siegler

SYMPOSIUM I: Future Global Change and Cognition (31–39), Grand East

- 9:50 a.m.–10:00 a.m. Lewandowsky
10:00 a.m.–10:15 a.m. Berman
10:15 a.m.–10:30 a.m. Torcello
10:30 a.m.–10:45 a.m. Young
10:45 a.m.–11:00 a.m. Hennes, Jost, Ruisch
11:00 a.m.–11:15 a.m. Myers, Maibach, Leiserowitz
11:15 a.m.–11:30 a.m. Markowitz
11:30 a.m.–11:45 a.m. Shtulman
11:45 a.m.–12:00 noon Zelenski

Selective Attention I (40–44), Civic Ballroom

- 10:20 a.m.–10:35 a.m. Most, Wang
10:40 a.m.–10:55 a.m. Burnham
11:00 a.m.–11:15 a.m. Lleras, Chu, Buetti
11:20 a.m.–11:35 a.m. Hoffman, McLean
11:40 a.m.–11:55 a.m. Belopolsky, Awh

Embodied Cognition (45–50), Grand West

- 10:00 a.m.–10:15 a.m. Gagnon, Geuss, Stefanucci,
Creem-Regehr
10:20 a.m.–10:35 a.m. Knoblich
10:40 a.m.–10:55 a.m. Kuperman, Sneffella
11:00 a.m.–11:15 a.m. Jamalian, Giardino, Tversky,
Brockmole, Davoli, Ehrman,
McNeil
11:40 a.m.–11:55 a.m. Moreau, Conway

Language Processing (51–56), Dominion Ballroom

- 10:00 a.m.–10:15 a.m. Johnstone, Trueswell, Dahan
10:20 a.m.–10:35 a.m. Nozari, Mirman
10:40 a.m.–10:55 a.m. Singer
11:00 a.m.–11:15 a.m. Sumner, King
11:20 a.m.–11:35 a.m. Richter, Isberner
11:40 a.m.–11:55 a.m. Rapp, Andrews, Jacovina, Hinze

Cognitive Aging (57–62), Conference B & C

- 10:00 a.m.–10:15 a.m. Shafto, White, Tyler
10:20 a.m.–10:35 a.m. Cyr, Anderson
10:40 a.m.–10:55 a.m. Ballesteros, Mayas, Reales, Toril,
Pita, Prieto, Ponce de León
11:00 a.m.–11:15 a.m. Pyc, Balota
11:20 a.m.–11:35 a.m. MacKay, James, Johnson
11:40 a.m.–11:55 a.m. Frank, Nara, Zavagnin, Touron, Kane

Judgment and Decision Making I (63–68), Grand Centre

- 10:00 a.m.–10:15 a.m. Reyna, Chick, Ojalehto, Weldon,
Corbin, Wilhelms
10:20 a.m.–10:35 a.m. Wilke, Sherman, Curdt, Mondal,
Fitzgerald, Kruger
10:40 a.m.–10:55 a.m. Kwak, Cohen, Payne, Huettel
11:00 a.m.–11:15 a.m. Chaxel, Russo, Wiggins
11:20 a.m.–11:35 a.m. Wang, Emery, Wang
11:40 a.m.–11:55 a.m. Stevenson, Cabrera, Gerardo

FRIDAY, NOVEMBER 15, 2013

12:00 NOON–1:30 P.M.

POSTER SESSION II (2001–2191)

SHERATON HALL

Perception II (2001–2019)

- (2001) Yakushijin, Ueda
 (2002) Tajima, Mizuno, Kume, Yoshida
 (2003) Barnhart, Goldinger
 (2004) Kanaya, Mori, Yokosawa
 (2005) Eddy, Tower-Richardi, Kuperberg, Brunyé
 (2006) Mayr, Regenbrecht, Lange, Lang, Buchner
 (2007) Voyer, Reuangrith
 (2008) Hickok, Brewer, Saberi
 (2009) Kikuchi, Mori, Hirose
 (2010) Komatsu, Ushitani
 (2011) Alards-Tomalín, Leboe-McGowan, Shaw, Leboe-McGowan
 (2012) Edewaard, Gordon
 (2013) Getz, Kubovy
 (2014) Kim, Porter, Weatherford, Goolkasian
 (2015) Chan, Dyson
 (2016) Boltz
 (2017) Ngo, Minakata, Vu
 (2018) Shaw, Rubin, Castagnetti, Bortfeld
 (2019) Overvliet, Wagemans, Krampe

Spatial Cognition II (2020–2033)

- (2020) Ploran, Rovira, Thompson, Parasuraman
 (2021) Sargent, Zacks, Philbeck, Flores
 (2022) Vaid, Kharkhurin, Liew, Kim
 (2023) Beighley, Tornetta, Intraub
 (2024) Freiberg, Riecke
 (2025) Gardony, Brunyé, Taylor, Wolford
 (2026) Street, Wang
 (2027) Klein
 (2028) Weisberg, Newcombe, Shipley
 (2029) Siegel, Sjolund, Kelly, Avraamides
 (2030) Holden, Hampson
 (2031) Yamamoto, DeGirolamo, Fox
 (2032) Marchette, Ryan, Epstein
 (2033) Trice, Emerzian, Prinzmetal, Isham

Associative Learning I (2034–2047)

- (2034) Ball, Kang
 (2035) Gregory, Landau, McCloskey
 (2036) Chubala, Jamieson
 (2037) Walk, Conway
 (2038) Freedberg, Lee, Hazeltine
 (2039) Yeates, Jones, Wills, McLaren
 (2040) Shone, Livesey
 (2041) Meier, Lea, McLaren
 (2042) Thomas, Didierjean, Maquestiaux, Ruthruff, Goujon
 (2043) Bercovitz, Simone, Bell
 (2044) Scholz, Mehlhorn, Krems
 (2045) Weber, Thompson-Schill
 (2046) Matsuda, Kusumi, Hosomi, Osa, Miike
 (2047) McAndrew, Yeates, Verbruggen, McLaren

Eyewitness Memory and Identification (2048–2054)

- (2048) Moreland, Rim, Clark
 (2049) Terrell
 (2050) Stacy, Goodsell, Neuschatz, Gronlund
 (2051) Goodsell, McAdoo, Kepler
 (2052) Wilson, Fantino, Stolarz-Fantino, Mickes
 (2053) Azad, Lindsay
 (2054) Collins, Banks, Berger

Recognition Memory I (2055–2062)

- (2055) Griffin, Benjamin
 (2056) Olchowski, Starns
 (2057) Chen, Starns, Rotello
 (2058) Kantner, Vettel, Miller
 (2059) Dopkins, Varner, Hoyer
 (2060) Did-Barnea, Goshen-Gottstein
 (2061) Dube, Payne, Sekuler, Rotello
 (2062) Chalmers

Implicit Learning and Memory (2063–2076)

- (2063) Terasawa, Yoshida
 (2064) Kim, Lewis-Peacock, Norman, Turk-Browne
 (2065) Marin-Garcia, Gabrieli
 (2066) Ferrara, Landau, Park
 (2067) Otsuka, Koch, Saiki, Kawaguchi
 (2068) Daily, Chiarello
 (2069) Daltrozzo, Deocampo, Trapani, Sims, Conway
 (2070) Stephan, Dovern, Weiss-Blankenhorn, Fink, Koch
 (2071) Tollemache, Tolan, Tehan, Chalmers
 (2072) Höfler, Gilchrist, Krieger, Ischebeck, Körner
 (2073) Annis, Malmberg
 (2074) Prull
 (2075) Herdener, Burros, Lien, Ruthruff, Allen
 (2076) Cravalho, Morris, Was, Masnick

Working Memory II (2077–2092)

- (2077) Blalock, VanWormer
 (2078) Trani, Shipstead, Engle
 (2079) Harrison, Engle
 (2080) Healey, Crutchley, Kahana
 (2081) Smeekens, Kane
 (2082) Huebner, MacKay, LeFevre
 (2083) Chrabaszcz, Sprenger, Atkins, Bolger, Colflesh, Bunting, Dougherty
 (2084) Devkar, Wright, Ma
 (2085) Matzen, Haass, Trumbo
 (2086) Wilmer, Blacker, Schneider, Chein
 (2087) Hsu, Buschkuhl, Jonides, Jaeggi
 (2088) Harris, Elliott, Hill, Barker, Boettcher
 (2089) Foster, Hicks, Engle
 (2090) Hicks, Foster, Engle
 (2091) Pecchinenda, Ferlazzo, Lavidor
 (2092) Mızrak, Öztekin



Testing Effects I (2093–2101)

- (2093) Grimaldi, Karpicke
- (2094) Picklesimer, Mulligan
- (2095) Luhmann, Congleton, Zhou, Rajaram
- (2096) Cho, Veltre, Neely
- (2097) Keresztes, Racsomány
- (2098) Wahlheim, Jacoby
- (2099) Racsomány, Keresztes, Pajkossy
- (2100) Crisostomo, Kimball
- (2101) Hotta, Tajika, Neumann

Selective Attention I (2102–2122)

- (2102) Lewis, Neider
- (2103) Gaspelin, Ruthruff, Lien
- (2104) Sato, Kawahara
- (2105) Stokes, Arnell
- (2106) Chao
- (2107) Kim, Kim, Cho
- (2108) Gozli, Moskowitz, Pratt
- (2109) Pricop, Yanko, Spalek, Di Lollo
- (2110) Murphy, Dalton
- (2111) Yamamoto, Donaldson-Misener
- (2112) Ericson, Beck, Parr, Wolshon
- (2113) Freedman, Farmer, Yeary, Molloseau, Hilgendorf
- (2114) Theodosis, Rapp
- (2115) Noyce, Sekuler
- (2116) Lagroix, Spalek, Di Lollo
- (2117) Murchison, Proctor
- (2118) Becker, Peltier, Liu
- (2119) Moher, Anderson, Song
- (2120) Shirakawa, Itsukushima, Naka
- (2121) Leonard, Luck
- (2122) Koshino, Tsukahara

Cognitive Control I (2123–2137)

- (2123) Spape, Ravaja
- (2124) Theeuwes, Liefvooghe, De Houwer
- (2125) Olsen, Hutchison
- (2126) Atalay, Misirlisoy
- (2127) Reynolds, Mulatti, Peressotti, Job, Dell'Acqua
- (2128) Reiman, Arrington
- (2129) Weaver, Wylie, Shpaner, Foxe
- (2130) Arrington, Reiman
- (2131) Healey, Ngo, Hasher
- (2132) D'Souza, Blumenthal, Moradzadeh, Wiseheart
- (2133) Miller, Watson, Strayer
- (2134) Vinski, Wong, Smallwood, Watter
- (2135) Sekiguchi, Otsuka
- (2136) Tall, Mathews, Lane, Acklin
- (2137) Yang, Yang

Speech Perception I (2138–2150)

- (2138) Newman, Kidd Jr., Ahsan, Morini
- (2139) Paquette-Smith, Johnson
- (2140) Dey, Sommers
- (2141) Hunter
- (2142) Olsen, Connine
- (2143) Lehet, Ly, Holt
- (2144) Pufahl, Samuel
- (2145) Thomas, Pitt
- (2146) Kim, Dahan
- (2147) Livesay, Broussard
- (2148) Luce, Hunter
- (2149) Zhang, Samuel
- (2150) Magnotti, Ma, Beauchamp

Psycholinguistics II (2151–2169)

- (2151) Boiteau, Almor
- (2152) Hong, Ferretti, Craven, Hepburn
- (2153) Larsen, Ferretti
- (2154) Izura, Davies
- (2155) Sohail, Johnson
- (2156) Balass
- (2157) Brothers, Swaab, Traxler
- (2158) Carranza, Bachman, Kaschak, Bernat, Jones, Stutts
- (2159) Earles, Kersten, Moriarity
- (2160) Falkauskas, Kuperman
- (2161) Jacobs, Dell, Benjamin, Bannard
- (2162) Mirkovic, Gaskell
- (2163) Tan, Martin
- (2164) Aschenbrenner, Balota
- (2165) Kenett, Gold, Faust
- (2166) Tamaoka, Makioka, Sanders, Verdonshot
- (2167) Plummer, Perea, Rayner
- (2168) Lowder, Gordon
- (2169) Leinenger, Myslin, Levy, Rayner

Bilingualism I (2170–2180)

- (2170) Strobach, Francis, Perea, Motta
- (2171) Fernandez, Chryssikou
- (2172) Bovee, Brill-Schuetz, Raney, Morgan-Short
- (2173) Zirnstein, van Hell, Kroll
- (2174) Martín, Bajo, Kroll
- (2175) Declerck, Philipp
- (2176) McClain, Rossi, Kroll
- (2177) Chung-Fat-Yim, Friesen, Bialystok
- (2178) Litcofsky, van Hell
- (2179) Jouravlev, Lupker, Jared
- (2180) Rossi, Dussias, Ting, van Hell

Reasoning and Problem Solving I 2181–2190)

- (2181) Kenett, Anaki, Faust
- (2182) Barr, Pennycook, Stolz, Fugelsang
- (2183) Vendetti, Wu, Knowlton, Holyoak
- (2184) Chan, Schunn
- (2185) Galotti
- (2186) Jarosz, Wiley
- (2187) Talboom, Rice, Ball, Brewer
- (2188) Thompson, Johnson
- (2189) Adachi, Kiyokawa, Matsuka
- (2190) Johnson, Gibson
- (2191) Hamilton, Su, Long

FRIDAY, NOVEMBER 15, 2013

1:30 P.M.–5:30 P.M.

Spoken Sessions (69–134)

Recognition Memory (69–74), Grand West

1:30 p.m.–1:45 p.m.	Lindsay, Kantner, Fallow
1:50 p.m.–2:05 p.m.	Kılıç, Öztekin
2:10 p.m.–2:25 p.m.	Dunn, Keech, Stephens
2:30 p.m.–2:45 p.m.	Mewhort, Johns
2:50 p.m.–3:05 p.m.	Starns, Ratcliff
3:10 p.m.–3:25 p.m.	Criss, Koop, Malmberg

Visual Search (75–79), Grand East

1:30 p.m.–1:45 p.m.	Horowitz
1:50 p.m.–2:05 p.m.	McDonald, Christie, Livingstone
2:10 p.m.–2:25 p.m.	Wolfe, Boettcher, Drew
2:30 p.m.–2:45 p.m.	Becker, Choi
2:50 p.m.–3:05 p.m.	Meeter, Kruijne

Cognitive Control I (80–85), Dominion Ballroom

1:30 p.m.–1:45 p.m.	Cain, Finn, Gabrieli, Mitroff
1:50 p.m.–2:05 p.m.	Stoet, O'Connor, Conner
2:10 p.m.–2:25 p.m.	Jentsch
2:30 p.m.–2:45 p.m.	Maquestiaux, Ruthruff, Didierjean
2:50 p.m.–3:05 p.m.	Bugg, Smallwood
3:10 p.m.–3:25 p.m.	Lemaire, Hinault

Visual Processing (86–90), Conference B & C

1:30 p.m.–1:45 p.m.	Reeves, Lei
1:50 p.m.–2:05 p.m.	Johns, Shiffrin
2:10 p.m.–2:25 p.m.	Bowers, Vankov, Ludwig
2:30 p.m.–2:45 p.m.	Malcolm, Shomstein
2:50 p.m.–3:05 p.m.	Cole, Wilkins

Reasoning/Problem Solving (91–95), Civic Ballroom

1:30 p.m.–1:45 p.m.	Coenen, Rehder, Gureckis
1:50 p.m.–2:05 p.m.	Hayes, Newell, Hawkins
2:10 p.m.–2:25 p.m.	Park, Brannon
2:30 p.m.–2:45 p.m.	Ellefsen, Sobel
2:50 p.m.–3:05 p.m.	Hostetter, Wieth, Foster, Moreno, Washington

SYMPOSIUM II: Experience—Induced Neuroplasticity: Evidence from Bilingualism (96–102), Grand Centre

1:30 p.m.–1:40 p.m.	Bialystok
1:40 p.m.–1:55 p.m.	Abutalebi
2:00 p.m.–2:15 p.m.	Thierry, Wu
2:20 p.m.–2:35 p.m.	Novick, Teubner-Rhodes, Hussey, Thompson-Schill, Trueswell
2:40 p.m.–2:55 p.m.	Titone, Pivneva, Sheikh, Whitford, Mercier
3:00 p.m.–3:15 p.m.	Bialystok, Luk, Olsen, Grady
3:20 p.m.–3:35 p.m.	Kroll

Word Recognition (103–108), Civic Ballroom

3:30 p.m.–3:45 p.m.	Brybaert, Van der Haegen
3:50 p.m.–4:05 p.m.	Content, Chetail
4:10 p.m.–4:25 p.m.	Johnson, Staub, Brown
4:30 p.m.–4:45 p.m.	Wurm, Fiscaro
4:50 p.m.–5:05 p.m.	Chetail, Balota, Treiman, Content
5:10 p.m.–5:25 p.m.	Davis

Language Production (109–113), Grand West

3:50 p.m.–4:05 p.m.	Kempe, McLean, Meyer, Rookes, Swarbrigg
4:10 p.m.–4:25 p.m.	James, Schmank, Castro
4:30 p.m.–4:45 p.m.	O'Seaghdha, Packer, Frazer, Preusse, Hatalis, Munoz-Avila, Hupbach
4:50 p.m.–5:05 p.m.	Ivanova, Wardlow, Gollan, Ferreira
5:10 p.m.–5:25 p.m.	Humphreys, D'Angelo

False Memory and Eyewitness Identification (114–119), Grand East

3:30 p.m.–3:45 p.m.	Ball, Brewer
3:50 p.m.–4:05 p.m.	Tekman, Şahin
4:10 p.m.–4:25 p.m.	Van Damme, Kaplan, Levine, Loftus
4:30 p.m.–4:45 p.m.	Gray, Gallo
4:50 p.m.–5:05 p.m.	Wixted, Mickes
5:10 p.m.–5:25 p.m.	Mickes, Wixted

Concepts and Categories I (120–124), Dominion Ballroom

3:50 p.m.–4:05 p.m.	Rabi, Minda
4:10 p.m.–4:25 p.m.	Clapper
4:30 p.m.–4:45 p.m.	Bohil, Hill, Wismer
4:50 p.m.–5:05 p.m.	Kelly, Magnotti, Wright, Katz
5:10 p.m.–5:25 p.m.	Lupyan

Organization and Configurality in 2D and 3D Perception (125–130), Conference B & C

3:30 p.m.–3:45 p.m.	Townsend, Wenger
3:50 p.m.–4:05 p.m.	Kimchi, Behrmann, Avidan, Amishav
4:10 p.m.–4:25 p.m.	Pomerantz
4:30 p.m.–4:45 p.m.	Wagemans, van Doorn, Koenderink
4:50 p.m.–5:05 p.m.	Cacciamani, Scalf, Peterson
5:10 p.m.–5:25 p.m.	Scheid, Gepshtein, Kubovy

Action(131–134), Grand Centre

4:10 p.m.–4:25 p.m.	Chapman, Coelho, Gong, Studenka, Rosenbaum
4:30 p.m.–4:45 p.m.	Masson, Bub, Till
4:50 p.m.–5:05 p.m.	Riecke, Sigurdarson
5:10 p.m.–5:25 p.m.	Rieger, Schmied, Saxl



FRIDAY, NOVEMBER 15, 2013

6:00 P.M.–7:30 P.M.

POSTER SESSION III (3001–3190)

SHERATON HALL

Vision II (3001–3011)

- (3001) Fan, Hutchinson, Turk-Browne
(3002) Schwark, Dolgov
(3003) Hout, Papesh, Goldinger
(3004) Bel-Bahar, Gentzler, Adamo, Wang, Krasich, Hughes, Appelbaum, Mitroff
(3005) Wiley, Rapp
(3006) Haase, Fisk, Kline, Oster
(3007) Arguin, Marleau
(3008) Qadri, Cook
(3009) Appelbaum, Bel-Bahar, Wang, Hughes, Krasich, Mitroff
(3010) Sugimori, Kusumi
(3011) Curby, Entenman, Fleming

Action and Perception II (3012–3024)

- (3012) Musicant, Hiller, Hein, Wallin, Brunas, Hunt
(3013) Hajnal, Kelty-Stephen, Bunch
(3014) MacLean, Klein, Hilchey
(3015) von Helversen, Schooler, Czienskowski, Jablonskis
(3016) Vlasov, Simen
(3017) Holm, Madison, Schrater
(3018) Bangert, Heydarian, Hughes, Edwards
(3019) Thomas, Davoli, Brockmole
(3020) Suh, Abrams
(3021) Day, Wagman
(3022) Chiappe, Vu, Strybel, Morgan
(3023) Laurent, Welklen, Noiret
(3024) Ramenzoni, Sebanz, Knoblich

Explicit Memory II (3025–3039)

- (3025) Kazanas, Altarriba
(3026) Bates, Maxfield
(3027) Robinson, Altarriba
(3028) Petrella, McBride
(3029) Corts, Depa, Kutcher, Moriarty
(3030) Suzuki, Ito, Kiyama, Tanabe, Ohira, Kawaguchi, Kunimi, Nakai
(3031) Hemmer, Persaud, Steyvers, DeAngelis, Venaglia
(3032) Carlson
(3033) Rogers, Emmert Jr., Drummey, Kan
(3034) Abushanab, Sahakyan
(3035) deWinstanley, Wittenberg, Gilfix
(3036) Hiraoka
(3037) Ortega, Gómez-Ariza, Bajo, Ibáñez
(3038) Giebl, Miyatsu, Castel, Bjork
(3039) Koppel, Wiley, Storm

Recognition Memory II (3040–3051)

- (3040) Collins, Sawh, Orsini, Cohen
(3041) Li, Wang, Yang
(3042) Bowen, Spaniol
(3043) Steen, Luttrell, Mutter
(3044) Hanczakowski, Zawadzka, Coote

- (3045) Ahmad, Hockley
(3046) Etienne, Guillaume
(3047) Franks, Hicks
(3048) Aue, Prince, Criss
(3049) Hawkins, Hayes, Heit
(3050) Stahl, Araujo
(3051) Koop, Criss

Collaborative Memory (3052–3057)

- (3052) Bays
(3053) Wissman, Rawson
(3054) Kelley, Pentz, Reysen, Hardy, Estruth
(3055) Luhmann, Rajaram
(3056) Blumen, Li, Stern
(3057) Barber, Mather

Metamemory/Metacognition II (3058–3074)

- (3058) Sitzman, Rhodes
(3059) Pagano, Toppino
(3060) England, Serra
(3061) Murayama, Blake, Castel
(3062) Magreehan, Serra
(3063) Kelly, Metcalfe
(3064) Toth, Lasecki, Northcutt, Daniels
(3065) Hourihan, Burse
(3066) Cardwell, Newman, Foster, Henkel, Garry
(3067) Zawadzka, Higham
(3068) Miller, Geraci
(3069) Thomas, Finn, Jacoby
(3070) Roberts, Davis, Franco-Watkins, Callender, Johnson
(3071) Thiede, Brendefur, Carney, Osguthorpe, Snow, Bremner, Oswald, Woodard
(3072) de Bruin, van Loon, van Gog, van Merriënboer
(3073) Arnold, Chisholm
(3074) Ball, Brewer

Memory and Aging (3075–3090)

- (3075) Kurby, Zacks, Sargent, Bailey
(3076) Emery, Burkett
(3077) Maddox, Balota
(3078) Madore, Gaesser, Schacter
(3079) Badham, Maylor
(3080) Garrison, Drummey, Rogers, Kan
(3081) Fraundorf, Hourihan, Benjamin
(3082) Bouazzaoui, Follenfant, Ric, Fay, Croizet, Isingrini, Taconnat
(3083) Chung, Bower, Thrumston, Blacher
(3084) Smyth, Naveh-Benjamin, Hastings
(3085) Hughes, Geraci, De Forrester
(3086) Gilchrist, Duarte, Verhaeghen, Solanki
(3087) Morrison, Parker, Jha
(3088) Taconnat, Frasca, Vibert
(3089) Josef, Mata, Pachur, Hertwig
(3090) Ramscar, Hendrix, Shaoul, Baayen

Prospective Memory (3091–3099)

- (3091) Pitaes, Ball, Brewer
 (3092) Karidi, Zecker, Rendell
 (3093) Meeks, Zurick, Rosnick
 (3094) Cook, Merritt, Clark-Foos, Meeks
 (3095) Meldrum, Smith
 (3096) Pascale, Toth, Daniels
 (3098) Imai, Ishii
 (3099) Martin, Verhaeghen

Visual Search (3100–3108)

- (3100) Yokosawa, Nakashima, Kawai
 (3101) Horstmann, Herwig, Becker
 (3102) Hess, Wismer, Bohil, Neider
 (3103) Anderson, Humphreys
 (3104) Weidler, Abrams
 (3105) Goldstein, Beck
 (3106) Ueda, Chen, Cramer, Rensink, Saiki
 (3107) Hon, Jabar
 (3108) Biggs, Mitroff

Discourse Processes (3109–3126)

- (3109) Farley, Dixon
 (3110) Foy, Gerrig
 (3111) Campbell, Raney
 (3112) Bowes, Katz
 (3113) Cech, Melvin, Albarado
 (3114) Liu, Fox Tree, Blackwell, Walker
 (3115) Stafura, Perfetti
 (3116) Kovaz, Riordan, Boyd, Kreuz
 (3117) Griffiths, Levine
 (3118) Clinton, Kurby, Magliano, Rapp
 (3119) Varner, Crossley, Snow, McNamara
 (3120) Tosun, Vaid
 (3121) Schmader, Horton
 (3122) Noble, Horton
 (3123) Scherr, Agauas, Ashby
 (3124) Shears, Ariza, Sam, Kim, Flax, Onorati
 (3125) Bailey, Zacks
 (3126) Wiemer, Asiala

Language Production/Writing (3127–3137)

- (3127) Johannes, Wilson, Landau
 (3128) DiBattista, Pearlmutter
 (3129) Preusse, Frazer, O'Seaghdha
 (3130) Kleinman, Ferreira
 (3131) Heller, Goldrick
 (3132) Hughes, Schnur
 (3133) Kutta, Kaschak
 (3134) White, Collins, Koehler, Abrams
 (3135) Chen, Chen
 (3136) Garvey, Middleton
 (3137) Breining, Rapp

Letter and Word Processing II (3138–3154)

- (3138) Wear, Gorfein
 (3139) Gorfein, Schweinle
 (3140) Rogers, Wingfield
 (3141) Sturz, Green, Locker, Boyer
 (3142) Kearns, Xu, Putnam, Al Ghanem
 (3143) Ponari, Vinson, Bahrami, Vigliocco
 (3144) Kim, Pitt, Myung
 (3145) Risse, Kliegl
 (3146) Mathôt, Vitu, Grainger
 (3147) Pagan, Blythe, Liversedge
 (3148) Van Petten, Luka
 (3149) Khalifian, Federmeier, Laszlo
 (3150) Chang, Stafura, Perfetti
 (3151) Martin, Lien, Allen
 (3152) Grossi, Heimbender, Sacchi
 (3153) Morett
 (3154) Saint-Aubin, Klein, Deacon

Judgment and Decision Making I (3155–3170)

- (3155) Nakamura, Brainerd, Reyna
 (3156) Schwikert, Curran
 (3157) Calvillo, Gomes
 (3158) Grounds, Joslyn
 (3159) Fechner, Schooler, Pachur
 (3160) Zdziarska, Yu, Pleskac
 (3161) Webb, Young
 (3162) Fleming
 (3163) Voskuilen, Ratcliff, Smith
 (3164) Losee, Naufel, Locker
 (3165) LeClerc, Joslyn
 (3166) Cassey, Hawkins, Donkin, Brown
 (3167) Alzahrani, Kusev, van Schaik
 (3168) Cavrak, Kleider
 (3169) Hubert-Wallander, Boynton
 (3170) Fiorenzo, Cohen

Animal Learning and Cognition (3171–3179)

- (3171) Grant
 (3172) Stagner, Sticklen, Zentall
 (3173) Goodman, Magnotti, Wright, Katz
 (3174) Hardt, Miguez, Wong, Ko, Lyu, Wang, Nader
 (3175) Lopatin, Ropat, Mineau, Cohen
 (3176) Matteo, Keshen, Cohen
 (3177) Duque, Stevens
 (3178) Parrish, Beran
 (3179) Marsh, MacDonald

Statistics and Methodology (3180–3190)

- (3180) Margulieux, Catrambone
 (3181) Vandekerckhove
 (3182) Blaha, Menneer, Wenger
 (3183) Botella, Suero, Privado
 (3184) Semizer, Boduroglu
 (3185) Buchanan, Valentine, Cota, Derringer, Melia
 (3186) Hoekstra, Morey, Rouder, Wagenmakers
 (3187) Hout, Fific
 (3188) Campbell, Thompson
 (3189) Fagot, Mella, de Ribaupierre
 (3190) Finley, Brewer



SATURDAY, NOVEMBER 16, 2013

8:00 A.M.–12:00 NOON

Spoken Session (135–202)

Letter and Word Processing I (135–139), Grand West

- 8:00 a.m.–8:15 a.m. Stephanie, Blythe, Liversedge
8:20 a.m.–8:35 a.m. Frost, Molfese, Paz-Alonso, Bick,
Kuo, Pugh, Rueckl
8:40 a.m.–8:55 a.m. Perea, Jiménez, Martín-Suesta,
Gomez
9:00 a.m.–9:15 a.m. Drieghe, Cutter, Liversedge
9:20 a.m.–9:35 a.m. Cohen, Blanc-Goldhammer

Inhibition of Thought (140–143), Grand East

- 8:00 a.m.–8:15 a.m. Angello, Storm, Smith
8:20 a.m.–8:35 a.m. Gagnepain, Henson, Anderson
8:40 a.m.–8:55 a.m. Hyman, Cutshaw
9:00 a.m.–9:15 a.m. Schooler, Gable, Hopper, Mrazek

Explicit Memory I (144–149), Grand Centre

- 8:00 a.m.–8:15 a.m. Liu, Liang, Li, Reder
8:20 a.m.–8:35 a.m. McDermott, Nelson, Savalia, Fishell,
Zou
8:40 a.m.–8:55 a.m. Mulligan, Spataro, Picklesimer
9:00 a.m.–9:15 a.m. Storm, Patel
9:20 a.m.–9:35 a.m. Kersten, Earles, Paulvin
9:40 a.m.–9:55 a.m. Negley, Kelley

Bilingualism (150–154), Dominion Ballroom

- 8:00 a.m.–8:15 a.m. Weiss, Poepsel, Zinszer
8:20 a.m.–8:35 a.m. Dussias, Guzzardo Tamargo
8:40 a.m.–8:55 a.m. Kroll, Rossi
9:00 a.m.–9:15 a.m. Sheikh, Titone
9:20 a.m.–9:35 a.m. Francis, Strobach

Action and Perception I (155–160), Civic Ballroom

- 8:00 a.m.–8:15 a.m. Sebanz, Tsai, Knoblich
8:20 a.m.–8:35 a.m. Palmer, Spidle, Koopmans, Schubert
8:40 a.m.–8:55 a.m. Brown, Cassey, Heathcote, Ratcliff
9:00 a.m.–9:15 a.m. Wagman, Hajnal, Jackson
9:20 a.m.–9:35 a.m. Miles, Vu
9:40 a.m.–9:55 a.m. McBeath, da Silva

Animal Learning and Cognition (161–166), Conference B & C

- 8:00 a.m.–8:15 a.m. Bisbing, Brown
8:20 a.m.–8:35 a.m. Cole, Keshen, Buck, Phillips
8:40 a.m.–8:55 a.m. McMillan, Roberts
9:00 a.m.–9:15 a.m. Daniel, Wright, Katz
9:20 a.m.–9:35 a.m. Kirkpatrick
9:40 a.m.–9:55 a.m. Beran, Perdue, Church, Smith

Selective Attention II (167–172), Grand West

- 10:00 a.m.–10:15 a.m. Chen, Cave
10:20 a.m.–10:35 a.m. Cave, Chen
10:40 a.m.–10:55 a.m. Marsh, Sörqvist, Hughes
11:00 a.m.–11:15 a.m. Inhoff, Schofield, Coles
11:20 a.m.–11:35 a.m. Donk, Siebold
11:40 a.m.–11:55 a.m. Potter, Hagmann

Metamemory/Metacognition I (173–177), Grand Centre

- 10:20 a.m.–10:35 a.m. Schwartz, Metcalfe
10:40 a.m.–10:55 a.m. Izaute, Akdogan, Bacon
11:00 a.m.–11:15 a.m. Serra, England, Flores
11:20 a.m.–11:35 a.m. Ariel, Hines, Hertzog
11:40 a.m.–11:55 a.m. Koriat, Nussinson, Ackerman

Associative Learning (178–183), Dominion Ballroom

- 10:00 a.m.–10:15 a.m. Jones, Crawford, Hamilton
10:20 a.m.–10:35 a.m. Astley, Aird
10:40 a.m.–10:55 a.m. McLaren, Jones, Yeates, McLaren
11:00 a.m.–11:15 a.m. MacLeod, Lin, Forrin, Jonker
11:20 a.m.–11:35 a.m. Anderson
11:40 a.m.–11:55 a.m. Miller, Molet, Miguez, Mash,
Craddock, Kosinski

Event Processing (184–188), Civic Ballroom

- 10:20 a.m.–10:35 a.m. Thompson, Pettijohn, Tamplin,
Radvansky
10:40 a.m.–10:55 a.m. Cutting, Iricinschi
11:00 a.m.–11:15 a.m. Loschky, Larson, Magliano, Smith
11:20 a.m.–11:35 a.m. Henkel
11:40 a.m.–11:55 a.m. Brewer, Finley

Speech Perception I (189–193), Conference B & C

- 10:20 a.m.–10:35 a.m. Bent
10:40 a.m.–10:55 a.m. Samuel, Frost
11:00 a.m.–11:15 a.m. Baese-Berk, Dilley, Henry, Vinke,
Banzina
11:20 a.m.–11:35 a.m. Sanders, Dilley, Viswanathan
11:40 a.m.–11:55 a.m. Remez, Thomas, Wycoff, Giglio,
Crank, Cheimets, Koinis

SYMPOSIUM III: Memory & The Law: Lessons from Cases (194–202), Grand East

- 9:50 a.m.–10:00 a.m. Conway
10:00 a.m.–10:15 a.m. Howe
10:15 a.m.–10:30 a.m. Bruck
10:30 a.m.–10:45 a.m. Brainerd
10:45 a.m.–11:00 a.m. McWilliams, Goodman, Narr, Ruiz,
Mendoza
11:00 a.m.–11:15 a.m. Conway
11:15 a.m.–11:30 a.m. Loftus
11:30 a.m.–11:45 a.m. Hayne
11:45 a.m.–12:00 noon Nadel

SATURDAY, NOVEMBER 16, 2013

12:00 NOON–1:30 P.M.

POSTER SESSION IV (4001–4190)

SHERATON HALL

Action and Perception III (4001–4011)

- (4001) Makovski, Jiang, Swallow
- (4002) Gabbard, Lee
- (4003) Battaglia, Hamrick, Tenenbaum
- (4004) Wang, Müsseler
- (4006) Miller
- (4007) Gray, Jardin, Lien, Proctor
- (4008) Ueda, Yakushijin, Ishiguchi
- (4009) Zamm, Palmer, Pfordresher
- (4010) Janczyk
- (4011) Ziat, Konieczny, Kakas

Testing Effects II (4012–4019)

- (4012) Pan, Rubin, Rickard
- (4013) Doxtator, Bradshaw
- (4014) Breton, Wasserman, Woodworth, Wieboldt, Newman, Boxwala, Rungratsameetaweemana, Arndt
- (4015) Whiffen, Karpicke
- (4016) Logan, Rivas
- (4017) Bishara, Lanzo
- (4018) Bies-Hernandez, Copeland, Parks
- (4019) Nguyen, McDaniel

Associative Learning II (4020–4027)

- (4020) Pan, Rickard
- (4021) Komsky, Kelley
- (4022) Poppenk, Norman
- (4023) Lew, Vul
- (4024) Johns, Dye, Jones
- (4025) Vickery
- (4026) Campbell, Hasher
- (4027) Hsuan, Shih, Hung, Tzeng, Wu

Explicit Memory III (4028–4043)

- (4028) Smith, Sreekumar, Dennis, Sederberg
- (4029) Danckert, MacLeod, Fernandes
- (4030) Moon, Anderson
- (4031) Kiat, Belli
- (4032) Maxcey-Richard, Fukuda, Woodman
- (4033) Cole, Reysen, Kelley
- (4034) McDonough, Bui, Friedman, Castel
- (4035) Kliegl, Bäuml
- (4036) Lehman, Smith, Karpicke
- (4037) Abel, Bäuml
- (4038) Blunt, Karpicke
- (4039) Sadeh, Moran, Gottstein
- (4040) Kelley, Neath, Surprenant
- (4041) Kubik, Nilsson, Knopf, Jönsson
- (4042) Landon, Kimball
- (4043) Boywitt

Working Memory III (4044–4056)

- (4044) Fischer-Baum, Benjamin
- (4045) Vergauwe, Cowan
- (4046) Miller, Roodenrys, Mogensen
- (4047) Tsubomi, Fukuda, Watanabe, Vogel
- (4048) Faulkenberry, Montgomery
- (4049) Adam, Mance, Awb, Vogel
- (4050) Tolan, Morgan, Tehan
- (4051) Röer, Bell, Buchner
- (4052) Sandry, Schwark, MacDonald
- (4053) Langerock, Vergauwe, Barrouillet
- (4054) Ricker, Cowan
- (4055) Swan, Wyble
- (4056) Selvamenan, Service

Attention and Aging (4057–4062)

- (4057) Buttaccio, Hahn, Brand, Huffman
- (4058) Incera, Krestar, Markis, McLennan
- (4059) Isingrini, Angel, Fay, Taconnat, Vanneste, Bouazzaoui
- (4060) Hinault, Lemaire
- (4061) Allen, Lien, Buzzelli, Cooper-Shumway
- (4062) Bellana, Grady, Moscovitch

Human Learning and Instruction II (4063–4077)

- (4063) Beatty, Muller-Gass, Wojtarowicz, Jobidon, Smith, Lam, Vartanian
- (4064) Tamminen, Lambon Ralph, Lewis
- (4065) Yamaguchi, Proctor
- (4066) Foraker, Kuhl
- (4067) Schneider, Healy, Barshi
- (4068) Shintel, Anderson, Fenn
- (4069) Baggett, Ehrenfeucht
- (4070) Kiyokawa, Tomatsu
- (4071) de Jonge, Tabbers, Pecher, Zeelenberg
- (4072) Lau, Leung, Liang, Lo, Law
- (4073) Smith, Goldwater, Matlen, Ping, Levine, Gentner
- (4074) Ketels, Jones, Healy, Martichuski
- (4075) Nunes, Karpicke
- (4076) Fukaya, Uesaka
- (4077) Weinstein, Lawrence, Tran

Selective Attention II (4078–4092)

- (4078) Snyder, Bischof
- (4079) Laidlaw, Zhu, Kingstone
- (4080) Pecchinenda, Sposato
- (4081) Lanthier, Zhu, Byun, Jarick, Kingstone
- (4082) Lawrence, Johnson
- (4083) Mills, Van Der Stigchel, Dodd
- (4084) Obana, Kozhevnikov
- (4085) Patten, Spalek
- (4086) Powell, Hutchison
- (4087) Shin, Chang, Cho
- (4088) Stevanovski, Stevenson



- (4089) McDonnell, Martinez, Dodd
(4090) Tibboel, Houwer
(4091) Au-Yeung, Kaakinen, Benson
(4092) Skarratt, Kingstone, Cole

Divided Attention (4093–4097)

- (4093) Thomson, Danis, Humphreys, Watter
(4094) Pieczykolan, Huestegge
(4095) Ouellet, Fortin
(4096) Huestegge, Koch
(4097) Hahn, Buttaccio, Hahn

Cognitive Control II (4098–4118)

- (4098) Gomez, Reyna, Maimonis
(4099) Kim, Lee, Kim, Cho
(4100) Snyder, Logan
(4101) Bowditch, Verbruggen, McLaren
(4102) Pettigrew, Martin
(4103) Chang, Lyons, Beilock
(4104) Crump
(4105) Dreisbach, Fischer, Fritz
(4106) Fischer, Gottschalk, Dreisbach
(4107) Sali, Anderson, Yantis
(4108) Kuratomi, Yoshizaki
(4109) Plessow, Schade, Kirschbaum, Fischer
(4110) Washington, Blumenthal
(4111) Dowman, Toia, DeFruscio, Colbert
(4112) Medeiros-Ward, Strayer
(4113) Perry, Lupyan
(4114) Dambacher, Hübner
(4115) Isham
(4116) Oei, Patterson
(4117) Hutcheon, Spieler
(4118) Hussey, Harbison, Mishler, Teubner-Rhodes, Velnoskey, Novick

Bilingualism II (4119–4136)

- (4119) White, Isurin
(4120) Gilbert, Pivneva, Titone
(4121) Zinszer, Malt, Ameel, Li
(4122) Nichols, Joannise
(4123) Hammarlund, McDonald
(4124) Bogulski, Kroll
(4125) Berkes, Bialystok
(4126) Yip
(4127) Olmstead, Viswanathan, Reilly, Aivar
(4128) Larraza, Samuel
(4129) Antón, Casaponsa, Dimitropoulou, Carreiras, Dunabeitia
(4130) Linck, Shell, Slevc
(4131) Linck, Kroll
(4132) Van Assche, Duyck, Gollan
(4133) Donnelly Adams, van Hell, Tokowicz
(4134) Ting, van Hell
(4135) Lopez, Vaid

Psycholinguistics III (4137–4149)

- (4137) Berent, Zhao, Pan, Epstein, Stern
(4138) Hahn, Mansfield

- (4139) Gagne, Spalding, Nisbet
(4140) Brozdowski, Gordils, Magnuson
(4141) Blasko, Kazmerski, Sheik Dawood, Eimers, Marsh
(4142) Gann
(4143) Yan, Schnur, Martin
(4144) Hall, Ferreira
(4145) Abdollahi, van Hell
(4146) Schmidtke
(4147) Shook, Chabal, Bartolotti, Marian
(4148) Zhao, Berent
(4149) Dupuis, Berent

Speech Perception II (4150–4164)

- (4150) Jesse, Newman
(4151) Viswanathan, Stephens
(4152) Trude, Brown-Schmidt, Fenn
(4153) Tzeng, Duan, Namy, Nygaard
(4154) Coderre, Bosley, Chernenok, Gordon, Ledoux
(4155) Kurian, Zhao, Magnuson, Rueckl
(4156) Braun, Pohl
(4157) Atagi
(4158) Kim, Sumner
(4159) Kirk, Kempe, Scott-Brown
(4160) Morini, Newman
(4161) Mitchel, Lusk
(4162) Blazej, Cohen-Goldberg
(4163) Alexander, Cline
(4164) Zeamer, Fox Tree

Judgment and Decision Making II (4165–4178)

- (4165) White, Poldrack
(4166) Schulze, van Ravenzwaaij, Newell
(4167) Beam, Miyamoto
(4168) Bixter, Trimber, Luhmann
(4169) Wilson, Hinson, Whitney
(4170) Myerson, Baumann, Green
(4171) Thompson, Chrysikou
(4172) Trueblood, Brown, Heathcote
(4173) Heilman, Kusev
(4174) Stevens, Regenwetter, Guo, Popova, Zwilling
(4175) Hotaling, Busemeyer
(4176) Tsuzuki, Honma
(4177) Wedell, Kim
(4178) Rebitschek, Krems, Jahn

Concepts and Categories II (4179–4190)

- (4179) Boomer, Zakrzewski, Johnston, Church, Musgrave, Ashby, Smith
(4180) Little, McDaniel
(4181) Clapper, Miller, Smith
(4182) Kurtz, Conaway, Levering, Eisenberg
(4183) Miles, Minda
(4184) Nadler
(4185) Chin-Parker
(4186) Corral, Kurtz, Jones
(4187) Foster, Jones
(4188) Wismer, Bohil
(4189) Jung, Hummel
(4190) Lancaster, Homa

SATURDAY, NOVEMBER 16, 2013

1:30 P.M.–5:30 P.M.

SPOKEN SESSIONS (203–263)

Priming (203–207), Grand West

- 1:30 p.m.–1:45 p.m. Su, Mauner
- 1:50 p.m.–2:05 p.m. Maples, Burgess
- 2:10 p.m.–2:25 p.m. Forster, Bell
- 2:30 p.m.–2:45 p.m. Kinoshita, Norris
- 2:50 p.m.–3:05 p.m. Rieth, Huber

Testing Effects in Memory (208–213), Grand East

- 1:30 p.m.–1:45 p.m. Roediger III, Nestojko
- 1:50 p.m.–2:05 p.m. Brennan, Cho, Neely
- 2:10 p.m.–2:25 p.m. Hupbach
- 2:30 p.m.–2:45 p.m. Garcia-Marques, Marques, Nunes, Carneiro, Weinstein
- 2:50 p.m.–3:05 p.m. Zeelenberg, de Jonge, van Mierlo, Pecher
- 3:10 p.m.–3:25 p.m. Carr, Batsell, Hostetter, Hicks, Dewey

Working Memory II (214–218), Dominion Ballroom

- 1:30 p.m.–1:45 p.m. Heathcote, Eidels, Strayer, Coleman, Houpt
- 1:50 p.m.–2:05 p.m. Oberauer, Souza, Rerko
- 2:10 p.m.–2:25 p.m. Mall, Morey, Wolff, Lehnert
- 2:30 p.m.–2:45 p.m. Drew, Boettcher, Wolfe
- 2:50 p.m.–3:05 p.m. Lewandowsky, Ecker, Oberauer

Psycholinguistics I (219–224), Civic Ballroom

- 1:30 p.m.–1:45 p.m. Almor, Boiteau, Nair
- 1:50 p.m.–2:05 p.m. Pozzan, Trueswell
- 2:10 p.m.–2:25 p.m. Willits, Jones
- 2:30 p.m.–2:45 p.m. Huettig, Mani, Mishra, Brouwer
- 2:50 p.m.–3:05 p.m. Chabal, Marian
- 3:10 p.m.–3:25 p.m. Vigliocco, Clarke, Ponari, Vinson, Fucci

Cognitive Control II (225–230), Conference B & C

- 1:30 p.m.–1:45 p.m. Reinhart, Woodman
- 1:50 p.m.–2:05 p.m. Meiran, Pereg
- 2:10 p.m.–2:25 p.m. Watson, Miller, Moffitt, Strayer, Lambert
- 2:30 p.m.–2:45 p.m. Liefoghe, De Schryver, De Houwer
- 2:50 p.m.–3:05 p.m. Logan, Van Zandt, Verbruggen, Wagenmakers

SYMPOSIUM IV: Exploring the Canine Mind: Studies of Dog Cognition (231–236), Grand Centre

- 1:30 p.m.–1:35 p.m. Roberts
- 1:35 p.m.–1:55 p.m. Coren
- 2:00 p.m.–2:20 p.m. Pattison, Zentall
- 2:25 p.m.–2:45 p.m. Macpherson, Roberts
- 2:50 p.m.–3:10 p.m. MacLean, Reinhardt, Suchindran, Hare
- 3:15 p.m.–3:35 p.m. Fiset, Plourde

Explicit Memory II (237–242), Dominion Ballroom

- 3:30 p.m.–3:45 p.m. Fitzgerald
- 3:50 p.m.–4:05 p.m. Loft, Heathcote, Remington
- 4:10 p.m.–4:25 p.m. LeBoeuf, Choplin, Pogrund Stark
- 4:30 p.m.–4:45 p.m. Bell, Buchner, Kroneisen, Giang
- 4:50 p.m.–5:05 p.m. Ngo, Lloyd
- 5:10 p.m.–5:25 p.m. Brainerd, Gomes, Reyna

Speech Perception II (243–247), Civic Ballroom

- 3:50 p.m.–4:05 p.m. Feldman, Cho, Milin, Moscoso del Prado Martín, Baayen
- 4:10 p.m.–4:25 p.m. Salverda, Kleinschmidt, Tanenhaus
- 4:30 p.m.–4:45 p.m. Pardo, Gash, Apfelbaum
- 4:50 p.m.–5:05 p.m. Mattys

Human Learning and Instruction II (248–253), Grand West

- 3:30 p.m.–3:45 p.m. Wolfe, Reyna, Brust-Renck, Weil, Widmer, Cedillos, Fisher
- 3:50 p.m.–4:05 p.m. Rastle, Tamminen, Davis
- 4:10 p.m.–4:25 p.m. Lindsey, Shroyer, Pashler, Mozer
- 4:30 p.m.–4:45 p.m. Naaz, Chariker, Pani
- 4:50 p.m.–5:05 p.m. Clark, Yan, Bjork
- 5:10 p.m.–5:25 p.m. Taraban, Seegan

Multisensory Integration (254–258), Conference B & C

- 3:50 p.m.–4:05 p.m. Sutter, Müsseler
- 4:10 p.m.–4:25 p.m. Norman, Kappers, Cheeseman, Ronning, Thomason, Baxter, Calloway, Lamirande
- 4:30 p.m.–4:45 p.m. Diederich, Schomburg, Colonius
- 4:50 p.m.–5:05 p.m. Vroomen, Stekelenburg
- 5:10 p.m.–5:25 p.m. Juola, van Eijk, Kohlrausch, Brandt

Judgment and Decision Making II (259–263), Grand East

- 3:50 p.m.–4:05 p.m. Newell, van Ravenzwaaij, Lee
- 4:10 p.m.–4:25 p.m. Moore, Conway, Niv
- 4:30 p.m.–4:45 p.m. Hilbig
- 4:50 p.m.–5:05 p.m. Otto, Raio, Phelps, Daw
- 5:10 p.m.–5:25 p.m. Nakamura



SATURDAY, NOVEMBER 16, 2013

6:00 P.M.–7:30 P.M.

POSTER SESSION V (5001–5190)

SHERATON HALL

Music Perception (5001–5005)

- (5001) Kleinsmith, Bostwick, Seror, Neill
- (5002) Rae, Dean, Heathcote, Brown
- (5003) Bowman, Yamauchi
- (5004) Erdemir, Bingham, Beck, Rieser
- (5005) Valtonen, Gregory, Ramirez, McCloskey, Landau

Event Cognition (5006–5010)

- (5006) Bezdek, Gerrig, Wenzel, Shin, Pirog Revill, Kumar, Schumacher
- (5007) Huff, Meitz, Papenmeier
- (5008) Solomon, Hindy, Altmann, Thompson-Schill
- (5009) Okubo, Ishikawa, Kobayashi
- (5010) Eisenberg, Zacks, Li

Action (5011–5015)

- (5011) Slifkin, Eder, Byrne
- (5012) Pacione, Ray, Ou, Neyedli, Welsh
- (5013) Huhn, Schimpf, van der Wel
- (5014) Vaughan, Lantz, Karki, Bottini, Cabush, Cates, Mandel
- (5015) Pfister, Wirth, Schwarz, Kunde

Autobiographical Memory (5016–5025)

- (5016) Karadöller, Mutafoğlu, Tekcan
- (5017) Multhaup, Erwin
- (5018) Tekcan, Boduroglu, Mutlutürk, Aktan Erciyes
- (5019) Ece-Usta, Oner, Ayturk, Semin, Gulgoz
- (5020) Ayturk, Gulgoz
- (5021) Kawaguchi, Murayama, Nakamura
- (5022) Yang, Chen, Ng, Fu
- (5023) Wright, Jones
- (5024) Deffler, Umanath, Rubin
- (5025) Barry, Tomes

Explicit Memory IV (5026–5040)

- (5026) Osth, Dennis
- (5027) Ozubko, Seli
- (5028) Cohen, Rissman, Harbert, Castel, Knowlton
- (5029) Ingram, Wixted
- (5030) Lyle, Hacklaender
- (5031) Stanley, Benjamin
- (5032) Huff, Bodner
- (5033) Crutcher
- (5034) Naveh-Benjamin, Guez, Brubaker, Hara, Lewanschuss
- (5035) Gómez-Ariza, Aguirre, Andres, Mazzoni, Bajo
- (5036) Propper, Barr, Molloy, Brunyé
- (5037) Forrin, Groot, MacLeod
- (5038) Werner, Hoover
- (5039) Wilson, Aue, Criss
- (5040) Jonker, Levene, MacLeod

False Memory (5041–5062)

- (5041) Cervantes, Gallo
- (5042) Greenstein, Franklin
- (5043) Tat, Azuma
- (5044) Dasse, Weaver
- (5045) Andrews, Hinze, Rapp
- (5046) Wong, Gallo
- (5047) Rindal, Chrobak, Zaragoza
- (5048) Butler, Franks, Bishop, Liberman
- (5049) Carneiro, Garcia-Marques, Fernandez
- (5050) DeSoto, Roediger
- (5051) Griffin, Uitvlugt, Ravizza, Fenn
- (5052) Jones, Eakin
- (5053) Toglia, Giraldo, Febles
- (5054) Ritchie, Tollemache, Wynne, Parham, Tolan, Tehan
- (5055) Nozoe
- (5056) Ensor, Goodwin
- (5057) Rich, Zaragoza
- (5058) Lee, Chen, Gordon, Tenbrink, Thomas
- (5059) Coane, McBride, Termonen, Cutting
- (5060) Dolan, Gray, Gallo
- (5061) Gillespie, Smith, Cunningham, Sederberg
- (5062) Wynne, Tolan, Tehan

Working Memory IV (5063–5077)

- (5063) Downing-Doucet, Guérard
- (5064) Poirier, Tasnim, Heussen, Hampton
- (5065) Higgs, Larson, Loschky, Magliano
- (5066) Kang, Williams
- (5067) O'Connell, Ramakrishnan, Basak
- (5068) Kobayashi, Okubo
- (5069) von Bastian, Eschen
- (5070) Gregg, Snyder
- (5071) Lau, Goh
- (5072) Carlei, Kerzel
- (5073) Sanchez
- (5074) Kuhlmann, Meier, Arnold
- (5075) Clevinger, Kleider
- (5076) Gordon
- (5077) Román, Botella, García-Rubio, Privado, López-Martín, Martínez, Carretié, Colom

Human Learning and Instruction III (5078–5093)

- (5078) Green, Seymour
- (5079) Hays, Finley
- (5080) Tran, Pashler
- (5081) Anderson, Healy, Jones, Rozbruch
- (5082) Poston, Smith, Karpicke
- (5083) Yan, Murayama, Castel
- (5084) Callender, Paneerselvam, Widder
- (5085) Butler, Verdin, von Borries, Marsh
- (5086) Wilford, Carpenter, Kornell, Mullaney
- (5087) Matsuka, Honda
- (5088) Kurtz, Honke

- (5090) Gomez, Piazza, Jobert, Dehaene, Dehaene, Huron
 (5091) Gomez, Piazza, Jobert, Dehaene, Dehaene, Huron
 (5092) Durmysheva, Burshteyn, Robertson
 (5093) Dye, Ramscar

Selective Attention III (5094–5112)

- (5094) Tidikis, Ash
 (5095) Jackson, Weinstein
 (5096) Kreutzfeldt, Stephan, Sturm, Willmes, Koch
 (5097) Naparstek, Leibovich, Henik
 (5098) Vachon, Labonte, Latulippe-Theriault, Marois
 (5099) Lutfi-Proctor, Elliott
 (5100) Koch, Lawo
 (5101) Lawo, Koch
 (5102) Tellinghuisen, Bender, Lee
 (5103) Yang, Chang
 (5104) Yanko, Spalek
 (5105) Sager, Yanko, Bernstein, Dastur, Froc, Spalek
 (5106) Park, Reed
 (5107) Gibson, Szttybel
 (5108) Shivde, Andracchio, Scharadin, Morrissey, Kumar
 (5109) Yang, Song, Pöppel, Bao
 (5110) Dolgov, Schwark, Sandry, Volkman
 (5111) Gao, Baker, Tenenbaum
 (5112) Dyson, Harley

Consciousness (5113–5117)

- (5113) Kramer, Ulrich, Sharma
 (5114) Dewey, Knoblich, Carr
 (5115) Xiao, Yamauchi
 (5116) Fisk, Haase
 (5117) Taylor, Gozli, Pratt

Letter and Word Processing III (5118–5139)

- (5118) Jones
 (5119) Westbury
 (5120) Kim, Bolger
 (5121) Eskenazi, Folk
 (5122) Gregg, Inhoff
 (5123) Jared, O'Donnell, Agauas, Ashby
 (5124) Al Farsi, Rule, Liversedge
 (5125) Angele, Laishley, Rayner, Liversedge
 (5126) Schotter
 (5127) Dickins, Blythe, Liversedge
 (5128) Cutter, Drieghe, Liversedge
 (5129) Kusunose, Nakayama, Hino
 (5130) Zhou, Christianson
 (5131) Reimer, Carlos, Verduzco
 (5132) Geller, Still, Morris
 (5133) Yap, Aschenbrenner, Balota
 (5134) Ulicheva, Weekes
 (5135) de Wit, Kinoshita
 (5136) Tao, Healy
 (5137) Mander, Keuleers, Brysbaert
 (5138) Rimzhim, Fowler, Katz
 (5139) Robidoux, Kohnen, Kezilas

Bilingualism III (5140–5155)

- (5140) Britt, Dandotkar, Magliano
 (5141) Bélanger, Morford, Rayner
 (5142) Lin, Schwartz
 (5143) Ando, Matsuki, Sheridan, Jared
 (5144) Whitford, Titone
 (5145) Martin, Altarriba, Pagano
 (5146) Giezen, Emmorey
 (5147) Lebkuecher, Malt, Li
 (5148) Ivanova, Gollan
 (5149) Lempert, Chwalek, Zimonjic
 (5150) Lauro, Schwartz
 (5151) Jobe, Malt, Li, Ameer, Pavlenko
 (5152) Khan, Gullifer, Kroll
 (5153) Castonguay, Andruski
 (5154) Ratiu, Azuma
 (5155) Martin, Blanco, Duñabeitia

Concepts and Categories III (5156–5169)

- (5156) Dumesnil, Cousineau
 (5157) Storms, Stukken, Vanpaemel
 (5158) Herring, Terrazas, Jabeen, Kidder, Hernandez, Balderrama, Rodriguez, Crites
 (5159) Braithwaite, Goldstone
 (5160) Noh, Yan, Vendetti, Castel, Bjork
 (5161) Mack, Preston, Love
 (5162) Carvalho, Vales, Fausey, Smith
 (5163) Spalding, Gagné
 (5164) Geng, Schnur
 (5165) Chen, Ross, Murphy
 (5166) Marsh, Hooten, Cooper
 (5167) Verheyen, Voorspoels, Van Rensbergen, Pothos
 (5168) Jenny, Pachur
 (5169) Wang, Little

Reasoning and Problem Solving II (5170–5180)

- (5170) Harada, Suto, Yamaguchi
 (5171) Park, Park
 (5172) Martin, Rehder
 (5173) Gazes, Diamond, Hampton, Stoinski
 (5174) Sheridan, Reingold
 (5175) Pennycook, Fugelsang, Koehler
 (5176) Gauffroy, Vergauwe, Charreau, Barrouillet
 (5177) Trippas, Verde, Handley, Pennycook
 (5178) Ryskin, Brown-Schmidt
 (5179) Caparos, Blanchette
 (5180) Rhodes, Rodriguez, Shah

Judgment and Decision Making III (5181–5190)

- (5181) Ishimatsu, Mori, Hirose
 (5182) Thompson, Tangen, McCarthy
 (5183) Blanco, Otto, McGeary, Love, Maddox
 (5184) Rydecky, Yazbec, Fific
 (5185) Byrne, Worthy
 (5186) Pang, Worthy
 (5187) Malavanti, Weaver III
 (5188) Davis, Franco-Watkins
 (5189) Zaporozhets, Kusev
 (5190) Pisklak, Ludvig, Madan, Spetch



SUNDAY, NOVEMBER 17, 2013

8:00 A.M.–12:00 NOON

SPOKEN SESSIONS (266–331)

Metamemory/Metacognition II (266–271), Dominion South

8:00 a.m.–8:15 a.m. Schwartz, Pillot, Bacon
8:20 a.m.–8:35 a.m. Dunlosky, Tauber, Thiede, Metcalfe
8:40 a.m.–8:55 a.m. Bernstein, Kumar, Levitin
9:00 a.m.–9:15 a.m. Ackerman
9:20 a.m.–9:35 a.m. Zawadzka, Higham
9:40 a.m.–9:55 a.m. Bodner, Burnett

Judgment and Decision Making III (272–276), Grand West

8:00 a.m.–8:15 a.m. Fific, Buckmann
8:20 a.m.–8:35 a.m. Maloney, Tee, Zhang
8:40 a.m.–8:55 a.m. Zhang, Maloney
9:00 a.m.–9:15 a.m. Chechile, Barch
9:20 a.m.–9:35 a.m. Rabinowitz, Landers

Selective Attention III (277–282), Grand Centre

8:00 a.m.–8:15 a.m. Raymond, Sawaki, Luck
8:20 a.m.–8:35 a.m. Moher, Lakshmanan, Egeth, Ewen
8:40 a.m.–8:55 a.m. Wyble, Tan, Bay
9:00 a.m.–9:15 a.m. Franconeri, Lustig, Smith, Stoughton, Yuan, Shah, Uttal
9:20 a.m.–9:35 a.m. Eidels, Fallon, Ross, Algom
9:40 a.m.–9:55 a.m. Franco-Watkins

Action and Perception II (283–288), Dominion North

8:00 a.m.–8:15 a.m. Cook, Qadri
8:20 a.m.–8:35 a.m. Geuss, Du Toit, Stefanucci
8:40 a.m.–8:55 a.m. Fournier, Gallimore, Feiszli, Logan
9:00 a.m.–9:15 a.m. Gozli, Ardon, Chan, Pratt
9:20 a.m.–9:35 a.m. Herbort, Rosenbaum
9:40 a.m.–9:55 a.m. Rieser, Weaver, Erdemir, Khuu, Johnson, Pomeranz, Beck

Letter and Word Processing II (289–294), Grand East

8:00 a.m.–8:15 a.m. Treiman, Seidenberg, Kessler
8:20 a.m.–8:35 a.m. Lerner, Armstrong, Frost
8:40 a.m.–8:55 a.m. Rey, Madec, Grainger, Courriou
9:00 a.m.–9:15 a.m. Crepaldi, Rastle, Davis
9:20 a.m.–9:35 a.m. Keuleers, Mandera, Brysbaert
9:40 a.m.–9:55 a.m. Choi, Gordon

Cognitive Skill Acquisition (295–299), Conference B & C

8:00 a.m.–8:15 a.m. Speelman, Johnson
8:20 a.m.–8:35 a.m. Watter, Loureiro-Kent, Karle
8:40 a.m.–9:55 a.m. Humphreys, Watter, Karle, Loureiro-Kent
9:00 a.m.–9:15 a.m. Barker
9:20 a.m.–9:35 a.m. Slevc, Davey, Buschkuehl, Jaeggi

Explicit Memory III (300–304), Dominion South

10:20 a.m.–10:35 a.m. Delaney, Verkoeijen, Godbole
10:40 a.m.–10:55 a.m. Verde
11:00 a.m.–11:15 a.m. Thomas, Parsow, Bulevich
11:20 a.m.–11:35 a.m. Dennis, Osth
11:40 a.m.–11:55 a.m. Duncan

Perceptual Processes (305–310), Conference B & C

10:00 a.m.–10:15 a.m. Gronau, Shachar
10:20 a.m.–10:35 a.m. Vo, Draschkow, Farmer, Wolfe
10:40 a.m.–10:55 a.m. Castelhana, Witherspoon
11:00 a.m.–11:15 a.m. Christman, Baker
11:20 a.m.–11:35 a.m. Reinitz, Seguin, Loftus
11:40 a.m.–11:55 a.m. Zhou, Liu

Working Memory III (311–315), Grand Centre

10:20 a.m.–10:35 a.m. West, Bailey, Mlynarczyk, Anderson
10:40 a.m.–10:55 a.m. Kessler, Rac, Lichtstein, Markus, Simchon, Moscovitch
11:00 a.m.–11:15 a.m. Matsukura, Vecera
11:20 a.m.–11:35 a.m. Peterson, Blumberg, Sachdeva
11:40 a.m.–11:55 a.m. Donkin, Nosofsky, Shiffrin, Gold

Concepts and Categories II (316–320), Dominion North

10:20 a.m.–10:35 a.m. Duke, McRae, Bowles, Gilboa, Rosenbaum, Kohler
10:40 a.m.–10:55 a.m. Cordes, Young, Heller
11:00 a.m.–11:15 a.m. Bryant, Barrett
11:20 a.m.–11:35 a.m. Carvalho, Goldstone
11:40 a.m.–11:55 a.m. Tangen, Laukkonen, Baird, McCarthy

Psycholinguistics II (321–325), Grand East

10:20 a.m.–10:35 a.m. Brozdowski, Gordils, Magnuson
10:40 a.m.–10:55 a.m. Mozuraitis, Chambers, Daneman
11:00 a.m.–11:15 a.m. Oppermann, Kielar, Panamsky, Meltzer
11:20 a.m.–11:35 a.m. Christianson, Zhou
11:40 a.m.–11:55 a.m. Woollams, Moy, Keeble, Krajewski, Theakston

Judgment and Decision Making IV (326–331), Grand West

10:00 a.m.–10:15 a.m. Pleskac, Hertwig
10:20 a.m.–10:35 a.m. Kusev, Love, van Schaik
10:40 a.m.–10:55 a.m. Hoffmann, von Helversen, Rieskamp
11:00 a.m.–11:15 a.m. Love, Hornsby
11:20 a.m.–11:35 a.m. Sieck, Merkle
11:40 a.m.–11:55 a.m. Pachur, Hertwig, Rieskamp



Spatial Cognition

Dominion Ballroom, Friday Morning, 8:00-9:40

Chaired by Holly Taylor, Tufts University

8:00-8:15 (1)

Tracking Spatial Representation Development: Sources and Goals. QI WANG, *Tufts University & Sun Yat-Sen University*, HOLLY A. TAYLOR, *Tufts University*, TAD T. BRUNYÉ, *Tufts University; U.S. Army NSRDEC* (read by Holly A. Taylor)—How has your spatial representation of this conference hotel changed since you arrived? People learn a new environment layout from a map, by navigating (actually or virtually), and/or from a description. With more experience and information, one's mental representation develops. One critical aspect of general mental model development involves incorporating new with known information. For a spatial representation of a new environment, what does this known information involve? In a series of experiments, we explored how spatial representations develop from different information sources (navigation, maps, VR) and are accessed with different retrieval goals. Dependent measures included standard (accuracy, response time) and on-line processing measures derived from tracking mouse trajectories (area under the curve, proportional Euclidean proximity over time, and initial response time) during responses via Mousetracker (Freedman & Ambady, 2010). Results suggest that spatial concepts, reflecting linguistic spatial terms, form a base for the developing spatial representation. Once developed, these spatial concepts can be used flexibly to service retrieval-based goals.

Email: Holly Taylor, holly.taylor@tufts.edu

8:20-8:35 (2)

Individual Differences and Strategies in the Allocentric-Heading Recall Task. HEATHER BURTE and MARY HEGARTY, *University of California, Santa Barbara* (read by Mary Hegarty)—Everyday tasks, such as route planning and giving directions, require the ability to flexibly manipulate one's spatial knowledge. The allocentric-heading recall task measures ability to judge the orientation from which a photograph of a familiar environment was taken. Sholl et al., (2006) found that this task was strongly correlated with self-reported sense-of-direction (SOD) and showed an alignment effect, supporting their hypothesis that SOD reflects a human head-direction system. In three experiments, we provide evidence for strategy differences in this task. Participants differed in whether they used a predominantly egocentric strategy and showed the alignment effect, or used a predominantly allocentric strategy and showed no alignment effect. The allocentric strategy was more successful and spontaneously adopted by high SOD individuals. These experiments demonstrate that strategy choice is important in understanding individual differences within large-scale spatial tasks, and these differences exist within tasks that are conceptualized as measuring invariant cognitive processes.

Email: Mary Hegarty, hegarty@psych.ucsb.edu

8:40-8:55 (3)

Math Anxiety Relates to Poor Spatial Processing That Cannot be "Written Away". ERIN A. MALONEY, *University of Chicago* (Associate Member Select-Speaker Award Recipient), STEPHANIE WAECHTER and SHERIF SOLIMAN, *University of Waterloo*, MARJORIE W. SCHAEFFER and WILLIAM OWENS, *University of Chicago*, EVAN F. RISKO, *University of Memphis*, SIAN L. BEILOCK, *University of Chicago*, JONATHAN A. FUGELSANG, *University of Memphis*—Strong mathematical skills are important for success in school as well as the workforce, and as technology advances our need for a mathematically competent workforce grows. Math anxiety—feelings of fear that many people experience when engaging in math—is associated with underachievement in math and avoidance of math-related careers. Here, we provide the first evidence that math anxiety is also associated with poor performance in spatial tasks. We show this via two correlational studies and one experimental study demonstrating that interventions that help reduce worries associated with math anxiety do not help students on spatially based math problems where poor performance is indicative of poor spatial ability. These results suggest that poor spatial ability is a component of math anxiety and that remediations for this widespread phenomenon should focus not only on math-related skills but also on bolstering spatial skills.

Email: Erin Maloney, erinmaloney@uchicago.edu

9:00-9:15 (4)

Order Memory of Routes: Based on Space, Not Time. INEKE J.M. VAN DER HAM, SUZE C. DE ZEEUW and MEREL E. BRASPENNING, *Utrecht University*—Human navigation ability is a complex cognitive construct. Recent neuropsychological evidence indicates that order memory is a dissociable component of navigation ability, yet it is a relatively new territory within navigation research. Order memory could be coded either spatially (based on metric distances of a route) or temporally (based on temporal features of route progression). This large-scale individual differences study (N=572) was aimed at determining the type of coding used in order memory of a navigated route. Furthermore, the effects of several individual differences were studied, including age (range 7-81 years old). Participants viewed a movie through a realistic, virtual environment, which was manipulated in speed for half the participants (first half slower, second half faster, same total viewing time). Participants were asked to indicate the relative position of scenes from the route on a continuous scale. Results indicate that participants based their responses concerning order memory on the spatial, not temporal qualities of the route viewed. Age effects include a significant increase in order memory accuracy between 8 and 14 year olds and a significant decrease in older adults (over 50 years).

Email: Ineke van der Ham, c.j.m.vanderham@uu.nl

9:20-9:35 (5)

Effects of Contrast and Background on Visual Representational Momentum. TIMOTHY L. HUBBARD, *Texas Christian University*, SUSAN E. RUPPEL, *University*

of South Carolina, Upstate—Implied motion targets were presented on a white or black background, and targets exhibited high, increasing (low to high), decreasing (high to low), or low contrast with the background. In Experiment 1, participants indicated the final location of the target. Forward displacement of remembered final location was larger if contrast was high or increasing but smaller if contrast was low or decreasing. If contrast increased or decreased, the magnitude of forward displacement was more strongly linked to the final contrast than to the average contrast. Forward displacement was larger on a white background, but effects of contrast were larger on a black background. In Experiment 2, participants predicted where the target would have been presented next (had motion continued). Forward displacement of predicted location did not occur, and if targets were presented on a white background, displacement was backward. Implications for theories of spatial localization are considered.

Email: Timothy Hubbard, timothyleehubbard@gmail.com

Statistics and Methodology

Grand East, Friday Morning, 8:00-9:20

Chaired by Jay Myung, *The Ohio State University*

8:00-8:15 (6)

Squeezing Every Ounce of Information From an Experiment: Adaptive Design Optimization. JAY I. MYUNG, *The Ohio State University*, DANIEL R. CAVAGNARO, *California State University at Fullerton*, WOOJAE KIM and MARK A. PITT, *The Ohio State University*—Experimentation is ubiquitous in the field of psychology and fundamental to the advancement of its science, and one of the biggest challenges for researchers is designing experiments that can conclusively discriminate the theoretical hypotheses or models under investigation. The recognition of this challenge has led to the development of sophisticated statistical methods that aid in the design of experiments and that are within the reach of everyday experimental scientists. We introduce an implementable experimentation methodology, dubbed Adaptive Design Optimization (ADO), that can help scientists to conduct “smart” experiments that are maximally informative and highly efficient, which in turn should accelerate scientific discovery in psychology and beyond.

Email: Jay Myung, myung.1@osu.edu

8:20-8:35 (7)

Perceptions of Statistical Evidence Among Scientists. RICHARD D. MOREY and RINK HOEKSTRA, *University of Groningen*—In science it is critical that claims be backed by evidence. Within the social sciences, evidence is often statistical in nature. Statistical outcomes such as p values or confidence intervals are frequently used to communicate results, and are often described using terms like “strong evidence”, “weak evidence”, and even “no evidence” which seems to imply that scientists believe that the weight of statistical evidence can be quantified using commonly reported statistics. We present the outcomes of a questionnaire of scientists in which scientists were asked to evaluate the weight of statistical evidence in

fictitious studies reported with commonly used inferential statistics. Perhaps surprisingly, we found that many scientists deny that the strength of evidence is quantifiable given these statistics. Furthermore, scientists indicating that the weight of evidence was quantifiable were enormously variable in their estimates. The unconstrained nature of these epistemic judgments has potentially severe implications for science.

Email: Richard Morey, richarddmorey@gmail.com

8:40-8:55 (8)

Behavioral and Neural Meta-Analyses of Decision Making. RUI MATA, *Max Planck Institute for Human Development*, MELANIE KUENZLI, *University of Basel*, CHRISTINA LEUKER and RALPH HERTWIG, *Max Planck Institute for Human Development*—What are the cognitive and neural bases of decision making? We conducted a series of systematic literature searches and quantitative meta-analyses to evaluate the psychometric properties and uncover the behavioral and neural correlates of the three most cited behavioral measures of decision making: the Iowa Gambling Task (151 effects), the Balloon Analogue Risk Task (68 effects), and monetary gambles (67 effects). The results do not show significant overall correlations between the three tasks and suggest that these have different (and weak: $d < .2$) correlates: IGT with cognitive ability measures, and BART with self-reported impulsivity and sensation-seeking. Further, our meta-analysis of fMRI studies using versions of these risk measures (72 studies) suggests communalities but also task-specific brain activations, which may reflect their different learning and information-integration demands. We conclude that more work needs to be conducted to investigate the cognitive and neural substrates of different measures of decision making.

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9:00-9:15 (9)

Political Attitudes for Presidential Candidates Measured Through Language Statistics in Televised News. JON A. WILLITS, *Indiana University*, MARK S. SEIDENBERG, *University of Wisconsin–Madison* (read by Mark S. Seidenberg)—Languages exhibit statistical regularities concerning the frequencies and co-occurrences of words. Language users learn from such patterns without being consciously aware of them. We investigated statistical properties of the language used on television news in discussing politicians. We compiled corpora consisting of language used on four networks (MSNBC, ABCNews, CNN, FOXNews) from 2007-2012. We analyzed the frequencies with which 500 affectively valenced words co-occurred with politicians’ names (Obama, McCain, Romney) during the run-ups to the 2008 and 2012 elections. We used these co-occurrences to derive a summary measure, their net positivity score. Positivity scores for candidates changed over time in ways that reflect real-world events. Positivity towards candidates differed across networks. Net positivity toward President Obama during his first term was strongly correlated with approval ratings. The results show that statistical aspects of language, of which people are not consciously aware, convey varying attitudes on network news.

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Working Memory I

Grand West, Friday Morning, 8:00-9:40

Chaired by Chandramallika Basak,
University of Texas at Dallas

8:00-8:15 (10)

A New Model of Working Memory: Investigating the Best Strategies to Enhance Attentional Focus and Untrained Cognitive Skills. CHANDRAMALLIKA BASAK, *University of Texas at Dallas*—Less than six hours of practice in the N-back task increases the capacity of the core focus of working memory from 1 to 4 items (Verhaeghen, Cerella & Basak, 2004), but focus is immutable in other memory updating tasks (Basak, 2006; Oberauer, 2006). We have recently proposed a new model of working memory that emphasizes the role of pointer predictability (Basak & Verhaeghen, 2011) and effects of practice on automatizing specific aspects of working memory, thus allowing for expansion of focus (Basak & Zelinski, in press). In this experiment, we trained 32 adults (ages 18 to 22) for 2 weeks either on a new memory updating paradigm - the predictable N-match task, or on a variation of this paradigm - the unpredictable N-Match task. Training on predictable task, not unpredictable, expanded the focal attention from 1 to 4 items, supporting our model. The study was also aimed to investigate the optimal strategies needed to engender broader transfer to fluid cognition. We propose that unpredictable training will engender broader transfer, compared to predictable and a no-contact control, to untrained higher-order cognitive skills via increased efficiency of cognitive control mechanisms.

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8:20-8:35 (11)

The Nature of the Stored Representations in Working Memory Depends on the Maintenance Strategy. VANESSA M. LOAIZA (Associate Member Select-Speaker Award Recipient) and VALÉRIE CAMOS, *Université de Fribourg*—This project investigated the effectiveness of semantic and phonological cues during immediate recall from working memory (WM) in order to elucidate underlying encoding mechanisms during WM tasks. During the recall phase of a complex span task, participants could ask for a cue word that was either semantically related or rhymed with the target. Whereas in a first experiment, participants received no instruction about maintenance strategy, they were asked to either use rehearsal-based or refreshing-based maintenance strategies in Experiment 2. Both experiments revealed that use of the cues was similar between cue types, but the effectiveness of cues on recall depended on the maintenance strategy. The advantage of semantic over phonological cues was stronger when using the refreshing instead of the rehearsal strategy. This extends current research showing that rehearsal and refreshing are distinguishable maintenance mechanisms, affecting the nature of the stored representations, because they induce different levels of processing of these representations.

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8:40-8:55 (12)

Long-Range and Local Synchronization of Neural Activity Predict the Precision of Representations in Working Memory. DAVID E. ANDERSON, EDWARD K. VOGEL and EDWARD AWH, *University of Oregon* (read by Edward Awh)—A longstanding hypothesis is that rhythmic neural activity may bind together the neural activity that represents information in working memory. We provide critical new evidence for this hypothesis by showing that inter-hemispheric coherence in the 10-15 Hz frequency band and cross-frequency coupling in the gamma band (40-100 Hz) were independent and robust predictors of both between- and within-subject variations in working memory precision. These two forms of synchrony were observed with both visual and auditory memoranda, and differences in the relevant electrode sites and frequency bands across modalities established the sensory locus of these effects. Thus, the integrity of representations in working memory is strongly tied to the precise temporal coordination of neural activity in the sensory areas that encode the stored items.

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9:00-9:15 (13)

Forgetting at Short Term: When do Event-Based Interference and Temporal Factors Have an Effect? PIERRE BARROUILLET, *Université de Genève*, GAËN PLANCHER, *Université de Lyon*, ALESSANDRO GUIDA, *Université de Rennes*, VALÉRIE CAMOS, *Université de Fribourg*—Memory tasks combining storage and distracting activities performed at either encoding or retrieval have provided divergent results pointing towards accounts of forgetting in terms of either temporal decay or event-based interference respectively. This study sheds light on the possible sources of such a divergence. Methodological issues were explored in a first series of experiments by introducing at retrieval computer-paced distracting tasks that involved articulatory suppression, attentional demand, or both. The second series of experiments induced differences in the nature of memory traces by increasing the encoding time. Although the introduction of computer-paced distracting tasks allowed for a strict control of temporal parameters, the first series of experiments replicated the effects usually attributed to event-based interference. However, deeper encoding abolished these effects while time-related effects remained unchanged. These findings suggest that the interplay between temporal factors and event-based interference in forgetting at short term depends on the nature of memory traces.

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9:20-9:35 (14)

Memory Retrieval Profile of the DRM False Memory in the Sternberg's Paradigm. JERWEN JOU, *University of Texas-Pan American*—The recognition memory response-time curves as a function of memory-set size of the presented as well as nonpresented critical words, studied semantic associates, and unrelated distractors in the DRM false memory paradigm were examined in a Sternberg recognition memory task. None of the four RT functions showed the typical linear increase with the memory-set size. The nonpresented critical words



displayed a decreasing RT function. The studied critical words and the semantic associates produced bowed RT functions with the peak at memory-set size 10 rather than the largest set size of 14. The unrelated distractors showed a flat, low RT function. It is proposed that the words used in the DRM paradigm are retrieved differently than other more typical words.
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Bilingual Language Control

Civic Ballroom, Friday Morning, 8:00-10:00

Chaired by Tamar Gollan, *University of California, San Diego*

8:00-8:15 (15)

What Bilingual Speech Errors Reveal About Inhibition, Grammatical Encoding, and Monitoring. TAMAR H. GOLLAN, ELIZABETH R. SCHOTTER, JOANNE GOMEZ, MAYRA MURILLO and KEITH RAYNER, *University of California, San Diego*—Bilinguals rarely produce words in an unintended language. However, we induced such intrusion errors (e.g., saying EL instead of HE) in 32 Spanish-English bilinguals who read aloud mixed-language paragraphs with English or Spanish word order. Bilinguals produced intrusion errors most often when attempting to produce dominant-language targets. Bilinguals also produced accent-only errors, and these too exhibited reversed language dominance effects. Intrusion errors mostly had function word targets, especially when they did not match paragraph language word order. Eye movements showed that fixating a word in the non-target language increased intrusion errors only for function word targets. These results imply multiple mechanisms of language control, including (a) inhibition of the dominant language at both lexical and phonological processing levels, (b) automatic forces of grammatical encoding including special retrieval mechanisms for function words in mixed-language utterances (e.g., Myers-Scotton, 1993), and (c) attention's role in monitoring target language for match with intended language.
Email: Tamar Gollan, tgollan@ucsd.edu

8:20-8:35 (16)

Language Intrusion in Bilingual Production: The Effect of Famous Faces and Names. ROBERT J. HARTSUIKER, *Ghent University*, MATHIEU DECLERCK, *RWTH Aachen*—A striking aspect of language production is the excellent ability of bilingual speakers to restrict their output to the language they intend to speak. To better understand language control, we developed a new paradigm that elicits unintended other-language intrusions. We hypothesized that famous people's faces and names would activate the language these famous people speak and thereby elicit language intrusions on words in close proximity to these names. In five experiments, Dutch-English-French trilinguals described animations of famous people's faces, leading to utterances like Tom Boonen and Guy Verhofstadt move up while Urbanus stays put. The language associated with the famous people (Dutch in the example) created language intrusion errors (e.g., Dutch "en" instead of and). Intrusions occurred both in written and spoken production and occurred with several function

words. Intrusions occurred more frequently in L2 than L1. Thus, faces and names provide language cues that can affect language control.

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8:40-8:55 (17)

Whole-Language and Item-Specific Control in Bilingual Language Production. EVA VAN ASSCHE and WOUTER DUYCK, *Ghent University*, TAMAR H. GOLLAN, *University of California, San Diego* (read by Wouter Duyck)—We investigated the scope of bilingual language control during word production using a fluency task with repeating and non-repeating letter categories. Dutch-English and Chinese-English bilinguals produced items in different language blocks and orders. Both bilingual groups showed reduced dominant language fluency after producing items from the same categories in the non-dominant language. Non-dominant language production was not influenced by prior production of words from the same categories in the other language. Chinese-English, but not Dutch-English bilinguals exhibited similar testing order effects for different phoneme categories. In addition, Chinese-English bilinguals who exhibited significant testing order effects in the repeated categories condition of the fluency task, exhibited no such effects when naming repeated pictures after a language switch. These results pinpoint a lexical locus of bilingual language control, and shows that only some bilinguals use global inhibition of the entire non-target language.

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9:00-9:15 (18)

No More Cued Pictures! Asymmetric Switch Costs in Bilingual Language Production Induced by Reading Words. JONATHAN GRAINGER, *Aix-Marseille University*, DAVID PEETERS, *Radboud University of Nijmegen*, ELIN RUNNQVIST and DAISY BERTRAND, *Aix-Marseille University*—French-English bilinguals named pictures in the same language (French or English) within a block of trials, and on each trial pictures were preceded by a printed word from the same language or from the other language. Participants had to make a language decision on the word or to categorize it as an animal name or not. Picture naming latencies in French (L1) were slower when pictures were preceded by an English word compared with a French word, independently of the task performed on the word. There were no language-switching effects when pictures were named in English (L2). This replicates asymmetrical switch costs found with the cued picture-naming paradigm, and shows that the asymmetrical pattern can be obtained (i) in the absence of artificial language cues, (ii) when the switch involves a shift from comprehension in one language to production in another, and (iii) when the naming language is blocked.

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9:20-9:35 (19)

Losing Control of One's Accent. MATTHEW GOLDRICK, *Northwestern University*, CAROLINE ENGSTLER, *EF Education First*, ERIN GUSTAFSON, *Northwestern University*,



ELIN RUNNQVIST, *Université Aix-Marseille*, ALBERT COSTA, *Universitat Pompeu Fabra*—Bilinguals' non-native productions are accented, deviating towards the phonetic properties of their first language. These deviations have been argued to reflect mis-learning of non-native sound categories. We review two studies that suggest accent is also modulated by on-line language control processes. English-French bilinguals are highly accented when naming pictures in French; however, these same speakers are far less accented when they repeat French words. This suggests accent does not simply reflect the inability of speakers to produce the appropriate articulations; it is stronger when highly demanding semantic processes are engaged. When Spanish-English bilinguals are required to unexpectedly switch the language of production between picture naming trials, their English productions are more accented relative to trials where they did not switch languages. This suggests accent increases under conditions stressing language control. Accent does not only reflect difficulty in learning non-native sound categories; it reflects difficulty in controlling the language of production.

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9:40-9:55 (20)

Cost Free Switches but Not Where You Expect Them: Evidence From ASL-English Bilinguals. KAREN EMMOREY and JENNIFER AF PETRICH, *San Diego State University*, TAMAR H. GOLLAN, *University of California, San Diego*—Bimodal bilinguals often produce code-blends – the simultaneous production of a sign and a word. Using cued picture-naming, we investigated whether a processing cost is incurred when switching from a code-blend into either ASL alone or English alone. When switching out of a code-blend, one language always remains “on” (there is no language switch). We also included a “pure switch” condition in which bilinguals switched just between English and ASL. Equal switch-costs were observed when switching to English from either a code-blend or an ASL sign and when switching to ASL from a code-blend. Surprisingly, no cost was observed for ASL when switching from English alone. A follow-up study with non-signers using cued production of spoken numbers and gestured numbers revealed parallel results for all conditions. These results indicate bimodal bilinguals and speaking gesturers cannot simply keep one communication mode “on” and that manual productions are uniquely affected by switch type.

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Auditory Processes

Conference B & C, Friday Morning, 8:00-9:40

Chaired by Andrea R. Halpern, Bucknell University

8:00-8:15 (21)

Differences in Auditory Imagery Self-Report Predict Neural and Behavioral Outcomes. ANDREA R. HALPERN, *Bucknell University*—Mental imagery abilities vary among individuals, as shown both by objective measures and by self-report. Few imagery studies consider auditory imagery, however. The Bucknell Auditory Imagery Scale is a short self-

report measure encompassing both Vividness and Control subscales for musical, verbal, and environmental sounds. It has high internal reliability, a coherent factor structure, no relation to social desirability, and only a modest relation to musical training. Higher scores predict fewer source memory errors in distinguishing heard from imagined tunes on a recognition test, and better performance on pitch imitation tasks. Furthermore, the Vividness scale is related to hemodynamic response and gray matter volume in several brain areas that are known to be involved in auditory imagery. Even though self-report measures encompass both cognitive and metacognitive aspects, they are useful tools in accounting for individual differences in high-level cognitive skills.

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8:20-8:35 (22)

Generalization of Auditory Learning to an Untrained Dimension. MATTHEW G. WISNIEWSKI, EDUARDO MERCADO III and BARBARA A. CHURCH, *University at Buffalo, SUNY* (read by Eduardo Mercado III)—Previous perceptual learning studies have found both positive and negative effects of learning on untrained discrimination tasks. In this study, participants were trained in a same-different task to distinguish trains of frequency modulated sweeps varying in rate. Participants' ability to discriminate the pitch range of sweep trains (a feature irrelevant to rate discrimination) was tested in pre- and post-tests. Results show that generalization to this untrained dimension may be positive or negative depending upon; 1) the extent of training; and 2) whether or not novel sweep trains presented during generalization tests are in the same frequency range as trained stimuli. Theories of perceptual learning allowing representational modification may provide a better account of the data than theories relying on attention and/or representational reweighting mechanisms.

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8:40-8:55 (23)

The Efficacy of Temporal Processing Training to Improve Phonological Awareness Among Students With Dyslexia. LEAH FOSTICK, *Ariel University*—Studies testing the temporal processing theory for dyslexic show (1) difference between dyslexic and normal readers in performing temporal processing tasks; and (2) correlation between reading measures and temporal processing. However, (1) group comparisons do not necessarily mean that the variables are related; and (2) correlations do not prove causality (third factor problem) or its direction. In the current study we tested the efficacy of temporal processing training to improve reading and phonological awareness and examined the causal relationship between them. Sixty-four dyslexic readers and 47 normal readers received temporal processing or non-temporal processing training, or no training. All participants were tested at day 1 and day 5 on reading and phonological awareness tasks. Only groups who had temporal processing training (both dyslexic and normal readers), improved on

reading and phonological measures. These results show causal relationship between temporal processing and reading and support its efficacy.

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9:00-9:15 (24)

Octave Equivalence Testing Humans and Black-Capped Chickadees. RONALD WEISMAN, *Queen's University*, MARISA HOESCHELE, LAUREN GUILLETTE, ALLISON HAHN and CHRISTOPHER STURDY, *University of Alberta*—Octave equivalence occurs when notes separated by a doubling in frequency are judged perceptually similar. We used a go/no-go discrimination, generalization and transfer in nonverbal tests of octave equivalence. These protocols have been used to test for a variety of auditory skills in humans, rats, and songbirds. The results of our equivalence testing showed that humans perceive the octave relationship between pitches in generalization and transfer of a simple operant discrimination. In contrast, black-capped chickadees, a North American songbird, failed to perceive octave equivalence in comparable tests: instead chickadees appear to have generalized a discrimination between alternating go and no-go note ranges. Our results suggest chickadees used that skill, rather than octave equivalence, in transferring the note-range discrimination from one octave to the next. The octave forms the basis of pitch change in all human cultures and thus may be of biological origin, but apparently not in songbirds.

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9:20-9:35 (25)

Change Deafness: Listeners Perform Better in Unfamiliar Languages. JOHN G. NEUHOFF, STEVEN SCHOTT and ADAM KROPE, *The College of Wooster*—Change deafness occurs when listeners fail to notice major changes in an auditory scene. Examples include failing to notice a change in talkers (Vitevitch, 2003; Fenn, et al. 2011) or failing to notice when sounding objects enter or leave an auditory scene (Gregg & Samuel, 2009). Voice identification work shows that listeners identify voices better in a familiar language because they can use both linguistic information and paralinguistic or indexical characteristics of the talker (e.g., fundamental frequency, gender, age). This suggests listeners might also detect a change of talker better in a familiar language. However, we found that English speakers detected a change in talker more often when listening to a Spanish narrative than when listening to English. Similarly, Spanish speakers detected a change more often when listening to English. Our results suggest that automatic attention to semantic information in a familiar language draws attention away from indexical changes. In an unfamiliar language, listeners are unable to process semantic information and can only attend to the indexical characteristics of the speech stream. Thus, they are more likely to notice when a talker change occurs in a language they do not understand.

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Human Learning and Instruction I
Grand Centre, Friday Morning, 8:00-9:40
Chaired by Bridgid Finn, Educational Testing Service

8:00-8:15 (26)

Interfering Effects of Retrieval in Learning New Information. BRIDGID FINN, *Educational Testing Service*, HENRY L. ROEDIGER III, *Washington University in St. Louis*—Does retrieval facilitate incorporation of new contextual detail with an established memory? Participants learned three pieces of information: a person's face, name and profession. In phase 1 all subjects learned faces and names. In phase 2, subjects in the restudy condition restudied the face and name and then were presented with new information (the profession). Subjects in the retrieval condition were shown the faces and attempted to retrieve the names; professions were presented for study after retrieval. Our prediction was that the profession would be more readily learned following retrieval as compared to restudy of the face-name association. However, we consistently found that the act of retrieval undermined rather than facilitated acquisition of new associations. This detrimental effect emerged on both immediate and delayed tests and whether or not feedback was provided after retrieval. The findings are difficult to accommodate within current theories that emphasize benefits of retrieval for learning.

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8:20-8:35 (27)

A Temporal Context Account of Retrieval-Based Learning. *JEFFREY D. KARPICKE and MELISSA LEHMAN, *Purdue University*—We propose a temporal context account of retrieval practice, founded on the temporal context theory developed by Kahana and colleagues. We assume that there is a slowly changing representation of temporal context and that retrieval involves using cues in the present to determine what occurred at a particular place and time in the past. Thus, retrieval relies on reinstating a prior temporal context (Lehman & Malmberg, 2013). The temporal context account of retrieval-based learning further assumes that during retrieval, the representation of temporal context is altered: features of the retrieved context from a previous event are added to the current context representation. When retrieval is attempted again in the future (on a final criterial test), people are better able to guide and restrict their search of memory using updated temporal context representations. Essentially, the temporal context account suggests that the act of retrieval enhances subsequent memory by altering temporal context representations, which allows people to constrain their search, reduce cue overload, and increase the likelihood of recovering a desired target. We present a variety of evidence supporting this new account of retrieval-based learning.

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8:40-8:55 (28)

Study Context Influences Brain Regions Recruited During Retrieval. MYRA A. FERNANDES, JONATHAN FUGELSANG and MICHELLE MANIOS, *University of Waterloo*, ERIN I. SKINNER, *Langara College*—We examined whether neural regions active during retrieval differed



depending on type of visual context presented during encoding. Participants saw a list of words, paired with either a picture of a famous place, face, or scrambled image. During scanned retrieval, participants made 'remember', 'know', or 'new' responses to words presented alone. Data from both a companion behavioural study, as well as during fMRI, showed that word memory was enhanced if initial encoding was accompanied by a meaningful (place or face), relative to scrambled, image. Whole brain analysis showed a double dissociation: BOLD signal in the right fusiform face area was higher for remember responses given to words studied with faces compared to places, and was higher in the left parahippocampal place area for words studied with places relative to faces. Results suggest that context-specific brain regions implicated during encoding are recruited during retrieval, showing how these processes are intimately linked.
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9:00-9:15 (29)

Do Tests Actually Prevent Forgetting? NATE KORNEILL, *Williams College*—Many studies have shown that a memory that is tested is forgotten more slowly than a memory that is restudied. This finding may be deceiving: because tests without feedback bifurcate distributions of memory strength, leaving memories either strong or weak, tests can appear to decrease forgetting rates even when they do no such thing (Kornell, Bjork, & Garcia, 2011). Data from a recent study, however, substantiated a non-deceptive mechanism for forgetting-prevention: relational processing (Congleton & Rajaram, 2012). In the study I report, being tested on a word list did more to prevent forgetting if the words in the list were categorical than if they were unrelated, which is difficult to explain based on bifurcation alone. Without diminishing the importance of bifurcation, this finding suggests that when tests engender relational processing, they truly prevent forgetting.
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9:20-9:35 (30)

The Effects of Retrieval Practice on Fraction Arithmetic Knowledge. LISA K. FAZIO and ROBERT S. SIEGLER, *Carnegie Mellon University*—Retrieval practice (or testing) is an effective instructional and learning strategy. The benefits have been shown in areas as diverse as foreign language vocabulary, general knowledge facts, maps, and in both science and social studies classrooms. Despite the wide range of materials used to demonstrate the benefits of retrieval practice, they all share the property of being stable A-B connections. In contrast, many domains require students to learn a procedure that can be used across many different problems. In two experiments we examined whether retrieval practice was beneficial for community college students' ability to solve fraction arithmetic problems. Both immediately and after a one-week delay, students were no more accurate with procedures that had been retrieved during the practice phase than with procedures that had been studied but not retrieved. Retrieval practice may not be as effective when students have to both recall and implement a procedure.
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**SYMPOSIUM I: Future Global Change and Cognition
Grand East, 9:50–12:00**

Organized by Stephan Lewandowsky, University of Bristol and University of Western Australia

9:50-10:00 (31)

Future Global Change and Cognition. STEPHAN LEWANDOWSKY, *University of Bristol; University of Western Australia*—We are living in a period of considerable global change. From climate change to resource scarcity, food security, or the presumed "peak oil", societies are facing multiple challenging problems. Cognitive psychology and allied disciplines have much to contribute to how people are likely to view those problems and how they will respond to them and manage them. This symposium highlights those psychological and cognitive aspects from an interdisciplinary perspective.
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10:00-10:15 (32)

The Restorative Benefits of Interacting With Nature. MARC BERMAN, *University of South Carolina*—For centuries people have had the intuition that interacting with nature is good for us. The question is whether this intuition is true and how or why interacting with nature can be good for us. Attention Restoration Theory (ART) provides a theoretical framework to explain how and why interacting with nature can be beneficial for cognitive functioning. A series of experiments will be presented with results that support ART, namely that interacting with nature can restore the ability to direct-attention. In addition, to ART, other theories will be presented that posit additional reasons why interacting with nature can be beneficial. Lastly, future experimental directions will be presented to understand more fully just how and why interacting with nature can be beneficial psychologically. Results from these experiments provide another reason why the advanced destruction of the natural environment can have not only adverse ecological effects, but psychological effects as well.
Email: Marc Berman, bermanm@mailbox.sc.edu

10:15-10:30 (33)

Climate Change, Science Denialism, and Ethics. LAWRENCE TORCELLO, *Rochester Institute of Technology*—The heating of the Earth's atmosphere through human activity raises issues of global justice including animal welfare, economic fairness, the ethical relevance of future generations, and global poverty. Thus the issue of climate change is not just one moral challenge but a complex interweaving of several. I review the most complex issues that arise from climate change. I then argue that the fundamental crisis they share is that of science denialism among those in countries both best equipped to deal with climate change and most responsible for it. As the disturbances caused by climate change increase, so too do effective schemes for propagating denialism. I argue that in the current context, science denialism must be understood and addressed as an ethical problem, and I suggest resources for that approach.
Email: Lawrence Torcello, lgtghs@rit.edu

10:30-10:45 (34)

Moral Cognition on High and on the Ground. LIANE YOUNG, *Boston College*—Reasoning about people's mental states (i.e., beliefs, intentions) is crucial for social interaction and moral evaluation, allowing us to distinguish between murder and manslaughter, for example. First, I'll present work on mental state reasoning for moral evaluation – judging agents from a position “on high” as an observer or a judge. We'll look at whether mental state reasoning is required for judging all moral actions, i.e., harm and purity violations. We'll also look at whether mental state reasoning is required for evaluating not just moral actions but also for moral beliefs. Second, I'll turn to moral cognition “on the ground” – mental state reasoning for social interaction. I'll present evidence indicating distinct signatures of mental state reasoning for distinct motivational contexts – for cooperation vs competition, for interacting with ingroups vs outgroups. Do we reason about mental states differently depending on whether we aim to affiliate with our allies versus anticipate enemy attacks?

Email: Liane Young, liane.young@bc.edu

10:45-11:00 (35)

System Justification Distorts Recall and Evaluation of Information about Climate Change. ERIN P. HENNES, *University of California, Los Angeles*, JOHN J. JOST, *New York University*, BENJAMIN C. RUISCH, *Cornell University*—Unlike many contentious political issues today, much of the disagreement about anthropogenic climate change centers not on how best to take action, but on whether the problem exists at all. Recent findings indicate that individuals may be motivated to deny environmental problems in order to maintain the socioeconomic status quo. In three studies, we find that system justification leads to distorted recall and evaluation of scientific information. Participants were exposed to scientific evidence of climate change and later asked to recall and evaluate what they had learned. Individuals more (vs. less) motivated to justify the economic system misremembered the evidence as less serious and judged it to be weaker. This was true whether system justification was measured (Studies 1-2) or manipulated experimentally (Study 3). These findings suggest that simply providing the public with scientific evidence may be insufficient to inspire action to mitigate the effects of climate change.

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11:00-11:15 (36)

Personal Experience of Extreme Weather and Belief in Climate Change. TERESA MYERS and ED MAIBACH, *George Mason University*, ANTHONY LEISEROWITZ, *Yale University*—Climate change can be seen by the public as a statistical abstraction that is difficult to detect and understand; however, as extreme weather becomes more obtrusive, teachable moments may arise. I will review results from the ongoing American nationally representative survey series, *Climate Change in the American Mind*, that show that a large majority of Americans say they personally experienced an extreme weather event or natural disaster in the past year. Additionally, I will discuss evaluation results—both cross-

sectional and experimental—of a weathercaster intervention in which a Columbia, South Carolina, weathercaster incorporated informal science education content about climate change into local weather stories as a strategy to enhance public climate change awareness and knowledge; demonstrating that weathercasters can play a key role in helping their audiences understand how to interpret local weather in the context of global climate change.

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11:15-11:30 (37)

Communicating Uncertainty to an Uncertain Public: Effects on Climate Change Engagement. EZRA MARKOWITZ, *Columbia University; Princeton University*—Anthropogenic climate change involves multiple sources and types of uncertainty (e.g., scientific ambiguity; disagreement between experts and elites; manufactured controversy). This uncertainty is communicated both directly and indirectly to members of the general public through a wide variety of communications channels, including interpersonal interactions and mass media. Past and ongoing work highlights the wide-ranging and critical influence that uncertainty plays in shaping how non-experts think about and respond to this and other large-scale issues. Drawing from a number of relevant literatures, I explore some of the effects of communicating uncertainty regarding climate change on individuals' engagement and action on this issue; I also discuss some of the psychological mechanisms by which uncertainty shapes the public's response to climate change.

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11:30-11:45 (38)

Conceptual and Epistemic Obstacles to Achieving Scientific Literacy. ANDREW SHTULMAN, *Occidental College*—Three decades of research in cognitive development and science education has revealed that students enter the science classroom with rich, though generally inaccurate, theories of everyday phenomena that often interfere with learning. I will present research suggesting that these “intuitive” theories are never truly replaced by scientific theories but rather coexist with them, shaping the kinds of inferences we make, the kinds of explanations we endorse, and the kinds of information we accept as true. While adults with extensive science education are typically able to discriminate between scientific and non-scientific claims, they are slower to make those discriminations for claims that are inconsistent with their intuitive theories, and they justify the endorsement of scientific claims by appealing to authority rather than evidence. The scientific literacy needed to engage with topics of global importance may thus be constrained by patterns of reasoning that emerge in childhood but persist long thereafter.

Email: Andrew Shtulman, shtulman@oxy.edu

11:45-12:00 (39)

Nature as a Path to Sustainability. JOHN ZELENSKI, *Carleton University*—Drawing on sociobiologist E.O. Wilson's biophilia hypothesis, many scholars have suggested humans' disconnection from nature as a cause of environmentally destructive behavior. I will review a line of research that tests



this basic idea with a variety of approaches. For example, in correlational work, we have found that individual differences in people's subjective sense of connection with nature ('nature relatedness') predict sustainable behavior and pro-environmental attitudes. In new experimental work, we have found that exposure to natural (vs. built) environments produces conceptually similar results, e.g., cooperative, sustainable behavior in fishing-themed commons dilemmas, more pro-social resource allocations, and increased self-reported willingness to engage in sustainable behaviors. Although these effects appear to be independent of mood, connecting with nature often makes people happy. Thus, I will conclude by exploring the idea that nature exposure could provide a 'happy path to sustainability' with both psychological and ecological benefits.
Email: John Zelenski, john_zelenski@carleton.ca

Selective Attention I

Civic Ballroom, Friday Morning, 10:20-12:00

Chaired by Steven Most, *University of New South Wales*

10:20-10:35 (40)

Conceptual Capture by Distractors Triggers Localized Target Suppression. STEVEN B. MOST, *University of New South Wales*, LINGLING WANG, *Duke University*—The appearance of a salient distractor just prior to a target within a rapid stream of items disrupts target perception. Strikingly, across several experiments, we found that the spatial pattern of disruption hinged on whether the distractor was characterized by featural salience (e.g., a uniquely colored item) or conceptual distinctiveness within the stream (e.g., a picture of a person within a stream of landscapes). When the distractor captured attention due to featural salience, disruption either was uninfluenced by the spatial relationship between target and distractor or – reflecting spatial orienting of attention – was greatest when the distractor appeared away from the target. However, when the distractor was characterized by conceptual salience, it reliably induced greater impairments when appearing in the same stream as the target. We suggest that spatiotemporally driven competition between targets and distractors may operate at the level of meaningful representations.

Email: Steven Most, s.most@unsw.edu.au

10:40-10:55 (41)

Contingent Attentional Capture by Items in Selectively Ignored Locations. BRYAN R. BURNHAM, *The University of Scranton* (Associate Member Select-Speaker Award Recipient)—Munneke, Van der Stigchel and Theeuwes (2008) demonstrated that distractor interference was reduced when a distractor appeared in a selectively ignored location; however, Moher and Egeth (2012) found that distractor interference was unaffected and responses were slower when a distractor appeared in an ignored color. Thus, locations, not features, can be selectively ignored. This study used a spatial cuing task similar to that used by Folk, Remington and Johnston (1992) to examine whether contingent attentional capture was affected when a salient, target feature-relevant cue appeared

in an ignored location. The results showed that cuing effects by target feature-relevant cues were unaffected when the cue appeared in a to-be-ignored location than in a non-ignored location. Thus, target-relevant features can override an observer's decision to ignore a location; however, responses were overall slower when cues appeared in the to-be-ignored location, suggesting they interfered with target localization.

Email: Bryan Burnham, attention.perform@gmail.com

11:00-11:15 (42)

What is the Relationship Between Perceptual Load and Attentional Capture? ALEJANDRO LLERAS, HENGQING CHU and SIMONA BUETTI, *University of Illinois*—The Load Theory of Attention proposes that "perceptual load" is a critical factor in determining attentional processing of foil stimuli: when perceptual load in the display is low, there is sufficient attentional resources to process both the target and the foil stimuli; whereas when perceptual load in the display is high, there are no left-over attentional resources to process the foils. As a result, under low load, there are large foil-target congruency effects, whereas under high load, there are none. Further, under low load, attention should be more sensitive to the onset of unexpected stimuli, producing larger attentional capture effects, than under high-load, when there is no left-over attention available to process the unexpected stimulus. Here we present results from five experiments showing the exact opposite pattern of results: higher capture under higher load, casting a serious doubt regarding the interpretation of perceptual load as a structural limitation that determines the availability of attentional resources to process foil stimuli. We propose a new framework to understand foil effects on performance and selective attention more generally.

Email: Alejandro Lleras, Alejandro.Lleras@gmail.com

11:20-11:35 (43)

Visual Attention Reveals Changing Color in Moving Objects. JAMES E. HOFFMAN and SCOTT MCLEAN, *University of Delaware*—Suchow and Alvarez (2011) showed that although continuous color change in stationary objects is immediately obvious, putting these objects into motion "silences" the perception of changing color. Several candidates, such as coherent motion and crowding, have been suggested as possible mechanisms to account for this effect (Turi and Burr, 2013). In a series of experiments, we show that neither coherent motion nor crowding is necessary for obtaining the motion silencing effect. Instead the critical factor appears to be whether visual attention is allocated to the individual moving objects that are undergoing a change. Visual attention appears to be necessary for binding the different color values of a moving object into the perception of a single object undergoing a continuous change in color.

Email: James Hoffman, hoffman@udel.edu

11:40-11:55 (44)

The Role of Goals and Selection History in Feature-Based Attention. ARTEM V. BELOPOLSKY, *VU University Amsterdam*, EDWARD AWH, *University of Oregon*—Many influential theories of visual attention suggest that attention can bias the initial feedforward visual processing for both

spatial and non-spatial information, but there is a growing amount of evidence that spatial information is special in that respect. The present study examined the contribution of selection history to goal-driven feature-based attention. Participants received a word cue that indicated the color of the search target with 80% validity. The target was presented either in pop-out or serial search display. In Experiment 1 the displays types were blocked, while in Experiment 2 and 3 they were mixed. The results showed that cueing effect is consistently present for serial search displays, but in pop-out displays the cueing effect depended on whether experience with the serial search task encouraged active selection of the relevant color. In all experiments, there was positive evidence for goal-driven selection. However, there was also a powerful bias to select recent target values. Experiment 3 replicated Experiment 2 using A' as a measure of sensitivity. Thus, goal-driven feature-based attention is possible, but selection history also has a strong influence on belief selection.

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Embodied Cognition

Grand West, Friday Morning, 10:00-12:00

Chaired by Sarah Creem-Regehr, University of Utah

10:00-10:15 (45)

The Influence of Body Size and Social Context on Action Judgments for Self and Others. KYLE T. GAGNON, MICHAEL N. GEUSS, JEANINE K. STEFANUCCI and SARAH H. CREEM-REGEHR, *University of Utah* (read by Sarah H. Creem-Regehr)—Previous research demonstrates that an observer can judge action capabilities for others by relating the other's body to the spatial layout of the environment (Stoffregen, Gorday, Sheng & Flynn, 1999). Without the other's body information, observers may use their own body to infer others' affordances (Ramenzoni, Riley, Shockley, & Davis, 2008). We asked the novel question of whether the other's body influences one's own perceived action capabilities. Participants made passability judgments for themselves and for another person, while either experiencing an increase in their body width, observing another person experience an increase in their body width, or with no change to either body. Using an actor-partner multilevel model, we demonstrate that the other's body size influenced the participant's own passability judgments, and that the participant's body size influenced passability judgments made for the other person. These results highlight the mutual influence of interpersonal level variables on perceived action capabilities.

Email: Sarah Creem-Regehr, sarah.creem@psych.utah.edu

10:20-10:35 (46)

Coordination Mechanisms in Joint Action. GÜNTHER KNOBLICH, *CEU Budapest*—Humans perform many kinds of joint actions. These include dancing, playing music together, and carrying boxes while moving house. All of these joint actions require that two or more people coordinate their individual actions to achieve joint effects. I will present evidence from recent behavioral and electrophysiological experiments that have addressed different coordination mechanisms for

joint action. The mechanisms that have been identified range from simply speeding up to achieve synchronized responses to predicting and monitoring each other's particular actions to produce a continuous joint performance. Some coordination mechanisms are domain general whereas others are highly domain specific and both have advantages and disadvantages in enabling effective joint action.

Email: Günther Knoblich, knoblichg@ceu.hu

10:40-10:55 (47)

Language Statistics Encodes Geographic and Economic Structure of the World. VICTOR KUPERMAN and BRYOR SNEFJELLA, *McMaster University*—Louwerse et al. (2009) has shown that latitudes and longitudes of cities can be retrieved from statistics of these cities' co-occurrences within a corpus. We show a simpler method of reconstructing geo-spatial relationships from linguistic data. The method evaluates similarities in frequency distributions of references to nationalities (Canadian, Yemeni) as attested in blog corpora of 20 English-speaking countries (Davies, 2013). We further assess sentiments about over 150 nationalities by predicting emotional ratings to adjectives preceding nationalities ("wealthy American", "traditional Chinese") as a function of socio-demographic variables of the evaluated country, available from UN. Countries with low life expectancy tend to elicit sad, calm descriptions while countries with high life expectancy come with high-arousal adjectives. The interaction of valence and arousal explains 13% of variance in the country's life expectancy. Our findings demonstrate that perceptual and physical information about the world is encoded in, and retrievable from, language statistics.

Email: Victor Kuperman, vickup@mcmaster.ca

11:00-11:15 (48)

Gestures Represent and Facilitate Thought. AZEDEH JAMALIAN, *Columbia Teacher's College*, VALERIA GIARDINO, *Institut Jean Nicod-Paris*, BARBARA TVERSKY, *Columbia Teacher's College*; *Stanford University* (read by Barbara Tversky)—Can gesturing help thinking? People, alone in a room, read descriptions of four spatial environments, two from a route perspective and two from a survey perspective. After studying the environments, people's memory was tested by T/F verbatim and inference questions. A majority of participants gestured for at least one description during study, and most of those who gestured at study also gestured while answering questions. Their gestures created models of the structures of the environments. Participants who gestured at least once performed better in cases where they gestured, and performed better when they gestured at both study and test than just at study. Participants rarely looked at their hands, indicating that it is the actions of gestures that facilitate thinking and memory.

Email: Barbara Tversky, btversky@stanford.edu

11:20-11:35 (49)

Getting a Grip on Concepts: Hand Position Affects Access to Mathematical Knowledge. JAMES R. BROCKMOLE, CHRISTOPHER C. DAVOLI, EMILY K. EHRMAN and NICOLE M. MCNEIL, *University of Notre Dame*—Holding



one's hands near an object improves perceptual sensitivity, prolongs and biases the allocation of attention, and leads to detail-specific episodic memory. Here, we show that these cognitive changes in turn affect the learning and recall of conceptual information. After studying a series of arithmetic facts (e.g., $17 \times 3 = 51$), participants completed a test in which they recalled the to-be-learned information. The tested facts were presented either in the same visual format as at study (e.g., $17 \times 3 = \underline{\quad}$), or in a different format (e.g., $3 \times 17 = \underline{\quad}$). Participants who placed their hands nearer to the study materials provided answers more quickly at test when problem format remained the same and more slowly when format changed. Thus, the extraction of a common concept from perceptually different exemplars is more difficult near the hands, a finding consistent with a bias toward processing perceptual detail.

Email: James Brockmole, james.brockmole@nd.edu

11:40-11:55 (50)

Designing Ecological Interventions to Enhance Cognition: Complex Motor Training. DAVID MOREAU and ANDREW R.A. CONWAY, *Princeton University* (read by Andrew R.A. Conway)—Cognitive training has received a lot of attention recently. Often based on working memory paradigms or videogames, this line of research has yielded controversial findings. In a distinct and more established literature, it is clear that physical exercise triggers broad improvements in cognitive function, in humans and animals. Here, we present the results of a training experiment bridging these two approaches, via a novel cognitive training paradigm based on complex motor coordination. Participants were randomly assigned to one of three conditions: Working Memory training, Physical Exercise, or Designed Sport (motor training). After training for eight weeks, the Designed Sport group showed the largest gains in working memory and spatial ability, along with substantial health improvements, illustrating the validity of combining physical and cognitive demands to enhance cognition. These findings provide support for complex motor activities as ecological means to develop both physical and cognitive capabilities, and offer a fresh perspective on cognitive training.

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Language Processing

Dominion Ballroom, Friday Morning, 10:00-12:00

Chaired by Delphine Dahan, *University of Pennsylvania*

10:00-10:15 (51)

Partially Activated Words Participate in Combinatory Semantic Interpretation of Phrases. SARAH JOHNSTONE, JOHN TRUESWELL and DELPHINE DAHAN, *University of Pennsylvania* (read by Delphine Dahan)—Evidence that the recognition of a spoken word involves the consideration of multiple probabilistically-weighted alternatives raises the possibility that these alternatives themselves participate in the construction of larger, multi-word phrases. In a series of visual-world eye-tracking experiments, we examined comprehension of phrases like 'shake the leash', which partially overlaps with a phrase ('rake the leaves') describing a more typical action.

We found evidence that, as the theme of the verb ('leash') was heard, listeners were more likely to consider its competitor ('leaves') than they were when exposed to a non-overlapping verb, e.g., 'rattle the leash,' indicating that 'rake the leaves' was being computed. Critically, the more typical the event described by the alternative (unheard) phrase, the more likely listeners were to consider it. Recognition of individual words in the phrase was modulated by the semantic coherence between their partially activated competitors, suggesting bidirectional interactivity between word recognition and phrase/sentence comprehension.

Email: Delphine Dahan, dahan@psych.upenn.edu

10:20-10:35 (52)

Semantic and Phonological Prediction in Spoken Language Processing. NAZBANOU NOZARI, *University of Pennsylvania*, DANIEL MIRMAN, *Moss Rehabilitation Research Institute; Drexel University* (read by Daniel Mirman)—Using semantic, syntactic, and pragmatic information to predict the upcoming word facilitates efficient sentence comprehension. Using the visual-world paradigm, we tested whether prediction also happens at lower levels of the language system. We found evidence for anticipation at both semantic and phonological levels: an object like "apple" was anticipated more often in the context of a restrictive verb, like "eat", than a non-restrictive verb like "see" (semantic prediction). Also, an object whose name started with a vowel, like "owl", was anticipated more upon hearing "an" than "the", in the absence of semantically restrictive cues (phonological prediction). Interestingly, subjects did not use "a" to anticipate an object whose name started with a consonant among three vowel-onset distractors. These results indicate that prediction happens throughout the spoken language processing system and that predictions are sensitive to differences in relative frequency (i.e., the less frequent article "an" may carry more predictive information).

Email: Daniel Mirman, dan@danmirman.org

10:40-10:55 (53)

Language Validation: Retrieval Processes and Representation Updating. MURRAY SINGER, *University of Manitoba*—Rapidly accumulating evidence suggests that validation processing is inherent to language comprehension and is immediate and non-strategic, and functions as a criterion for representational updating. Validation relies on memory processes comparable to those that support intentional retrieval, and affects implied as well as explicit discourse ideas. Behavioral and neural evidence that bears particularly on validation retrieval processes and updating is presented. People encountered text statements such as "The policeman believed that the vehicle with the flat was a truck," having previously read "Dan passed a bus stopped with a flat." Reading time and ERP measures varied systematically with the truth and affirmative/negative expression of the "target" in relation to its antecedents, reflecting the reader's validation of the current text. Validation is also guided by subtle pragmatic features of discourse.

Email: Murray Singer, m_singer@umanitoba.ca

11:00-11:15 (54)

Effects of Indexical Variation on Semantic Activation.

MEGHAN SUMNER and ED KING, *Stanford University*—The role of indexical variation in spoken word recognition is constrained to acoustically rich lexical representations. Theoretically, lexical activation depends on indexical variation, but subsequent processes like associative semantic spread depend on activation strength, not indexical variation. Social psychological theories view indexical variation as integral to online processes such as persona construal. Therefore, information gleaned from indexical variation might pervade spoken word recognition more broadly. We investigate the effects of indexical variation on semantic activation in word-association and semantic-priming paradigms. Across three studies, we show that top associates depend on the voice of the associative probe (man's_voice: space-time, woman's_voice: space-star, child's_voice: space-planet). And, we find that semantic priming is stronger for voice-congruent (spacewoman-star) than voice-incongruent targets (spacewoman-time). We argue that indexical variation affects spoken word recognition beyond an episodic lexicon and provide an account capturing effects of learned associations between acoustic patterns and linguistic and social features/categories in spoken language processing.

Email: Meghan Sumner, sumner@stanford.edu

11:20-11:35 (55)

Comprehension and Validation of Text Information: Two Faces of the Same Coin.

TOBIAS RICHTER and MAJ-BRITT ISBERNER, *University of Kassel*—Text comprehension depends on the construction of a mental model of the state of affairs described in the linguistic message. We assume that this process entails the validation of incoming information against world knowledge, which is activated during comprehension. Accordingly, comprehenders automatically reject text information if it is inconsistent with world knowledge activated during reading. A series of experiments provided evidence for this assumption by showing inhibitory effects of invalid or implausible sentences on positive responses in an unrelated task (epistemic Stroop effect). This effect was replicated across a variety of tasks, with different linguistic materials, and for different response modalities. The effect did not depend on specific mindsets or processing goals but was found to be related to the depth of semantic processing. These findings suggest the existence of a routine validation process whose purpose might be to ensure the accuracy and stability of mental representations constructed during comprehension.

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11:40-11:55 (56)

Factors Underlying Problematic Knowledge Acquisition.

DAVID N. RAPP, JESSICA J. ANDREWS, MATTHEW E. JACOVINA and SCOTT R. HINZE, *Northwestern University*—People rely on what they are told to understand the world, which is a good thing when what they are told is correct. But sometimes what they are told is wrong, for example through false reports, unintentional errors, and underspecified or biased content. Unfortunately, people can

use such misinformation even when it is patently inaccurate and they should know better. We have identified three factors that motivate the problematic use of misinformation. First, when misinformation is plausible, people are willing to use it to answer questions about related ideas. Second, the credibility of a source of misinformation directly influences people's later use of stated inaccuracies. Third, when misinformation enjoys contextual support, people show a reduced sensitivity to obvious discrepancies in content. Validation processes have been invoked as a regular component of comprehension. But the three factors highlighted here indicate that validation can regularly fail given the contingencies of everyday experiences. Email: David Rapp, rapp@northwestern.edu

Cognitive Aging
Conference B & C, Friday Morning, 10:00-12:00
Chaired by Meredith A. Shafto, University of Cambridge

10:00-10:15 (57)

Word Finding Failures in the Cam-CAN Cohort: Lifespan Interaction of Domain-General and Domain-Specific Factors.

MEREDITH A. SHAFTO, *University of Cambridge*, SIMON WHITE, *MRC Biostatistics Unit, Cambridge*, LORRAINE K. TYLER, *University of Cambridge*—A critical unresolved question in cognitive aging is the extent to which mechanisms underpinning age differences are domain-specific or domain-general. This issue underpins debates about single-factor models and whether older adults differentially recruit global cognitive resources. We investigated this in the context of word finding failures, a major source of worry for older adults. Tip-of-the-tongue states (TOTs) provide an ideal context for examining the interaction between specific and general processes as TOTs reflect (a) language-specific phonological retrieval and (b) domain-general processes involved in resolving TOTs. We tested adults aged 18-88 from a population-representative cohort at the Cambridge Centre for Ageing and Neuroscience (Cam-CAN). Participants completed measures of TOTs, language-specific priming, and domain-general processing including fluid intelligence. Across the lifespan, language-specific and domain-general factors trade-off in predicting TOTs, and both mechanisms contribute to performance in old age. Results challenge single factor models and assumptions about the compensatory role of general processes.

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10:20-10:35 (58)

Can Younger and Older Adults Learn From Their Mistakes?

ANDREE-ANN CYR, *University of Toronto*, NICOLE D. ANDERSON, *Baycrest* (read by Nicole D. Anderson)—The testing literature advocates error generation during episodic learning among younger adults, whereas the neuropsychological literature advises against it among older adults. However, we have evidence that committing errors can both benefit and hinder older and younger adults' memory performance, depending on the processing requirements at encoding. We describe a series of studies wherein learning is based on either conceptual or perceptual cues, and find



respectively a positive and negative impact of errors for both age groups. We argue that conceptual errors serve as 'stepping stones' to correct information via semantic associations whereas errors based on perceptual features add 'noise' to the target's memory signal. We discuss the findings within a framework of cognitive control inspired by the work of Craik and Braver. These results inform memory rehabilitation and educational practice by identifying the contexts in which learning errors should be harnessed in the service of memory. Email: Nicole Anderson, nanderson@research.baycrest.org

10:40-10:55 (59)

Is Training With Videogames Effective to Enhance Cognitive Function in Community-Dwelling Older Adults? SOLEDAD BALLESTEROS, JULIA MAYAS, JOSÉ M. REALES, PILAR TORIL, CARMEN PITA, ANTONIO PRIETO and LAURA PONCE DE LEÓN, *Universidad Nacional de Educación a Distancia*—Is it possible to enhance cognitive function in the elderly with computerized non-action videogames? In this longitudinal study participated 30 healthy older adults randomly assigned to either the experimental (mean age 69,7 ys, SD 5,4) or the control group (mean age 70,9 ys, SD 6,3). The trained group received 20 1/hr videogame training sessions in our laboratory with a commercially available training package involving repeated practice on a series of discrete working memory, concentration, mental calculation and problem solving tasks. The trainees showed significant improvements on attention (reduced distraction and increased alertness), speed of processing, long-term memory and subjective wellbeing when comparing pre- and post-training measures and no variation in the control group. These results suggest some neurocognitive plasticity in the older brain as training transferred to cognitive performance on non-trained cognitive functions that deteriorate with age. A new intervention study is looking for replicability of these findings.

Email: Soledad Ballesteros, mballesteros@psi.uned.es

11:00-11:15 (60)

Catastrophic Interference? The Influence of Lag and Testing on Retention in Young and Older Adults. MARY A. PYC and DAVID A. BALOTA, *Washington University in St. Louis*—Across a series of experiments, we evaluated the extent to which age-related deficits in paired-associate learning can be modulated using a criterion learning paradigm. Older and younger adults engaged in test-restudy practice until items were correctly recalled to criterion (between 1 and 7 correct recalls), and the lag between trials was short or long. Although both young and older adults overall produced an influence of lag and criterion, with performance greater for higher criterion levels and longer lags, older adult performance critically depended upon the order in which they learned lag items. Learning the more difficult long lag items second produced dramatic forgetting of the easier short lag items (with large differences in performance between short and long lag items), whereas learning long lag items first led to a complete elimination of the lag effect.

Email: Mary Pyc, mpyc@wustl.edu

11:20-11:35 (61)

Effects of Aging on Retrograde Amnesia: Longitudinal Data From Amnesic H.M. DON G. MACKAY, *University of California, Los Angeles*, LORI E. JAMES, *University of Colorado at Colorado Springs*, LAURA W. JOHNSON, *University of California, Los Angeles*—This paper reviews results from nine cross-sectional and three longitudinal studies conducted from 1983-1999 on relations between aging and retrograde amnesia (RA) in H.M. The controls included cerebellar patients and memory-normal adults carefully matched with H.M. for age, IQ, and background. Results for cross-sectional studies involving spelling, word definitions, lexical decisions, reading aloud, and picture naming indicated reliable deficits for H.M. relative to both control groups. For example, at age 73, H.M. correctly retrieved reliably fewer low-frequency (LF) words than the controls on the Boston Naming Test, with more unusual errors, and less benefit from target-related phonological cues. Longitudinal comparisons with earlier studies using similar or identical stimuli indicated that H.M.'s cross-sectional deficits worsened with aging from 57 to 73 years of age for LF but not high-frequency phonological, orthographic and lexical-semantic information. We explain the greater-than-normal effects of aging on H.M.'s RA for previously familiar LF information as reflecting interactions between aging, use frequency and anterograde amnesia predicted under binding theory.

Email: Don MacKay, mackay@ucla.edu

11:40-11:55 (62)

Why does Mind Wandering Decrease With Age? DAVID J. FRANK and BRENT J. NARA, *University of North Carolina at Greensboro*, MICHELA ZAVAGNIN, *University of Padova*, DAYNA R. TOURON and MICHAEL J. KANE, *University of North Carolina at Greensboro* (read by Dayna R. Touron)—According to Kane & McVay (2012), mind-wandering involves an executive control failure where one fails to inhibit distracting thoughts. Despite executive control declines, older adults report less mind-wandering than young. One possible explanation is that older adults' thought reports are qualitatively different than those of young, due to less awareness of distracting thoughts or willingness to report them. We therefore compared age differences in self-reports and a behavioral measure by examining eye movements while reading. When reading mindfully, young adults demonstrate meaningful patterns of eye movements that are not found during reported mind-wandering. As a separate explanation, older adults may mind-wander less due to greater mindfulness or more positive mood, each of which can impact mind-wandering rates in young. We therefore also established the influences of general mindfulness and positive/negative affect on age differences in mind-wandering.

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Judgment and Decision Making I

Grand Centre, Friday Morning, 10:00-12:00

Chaired by Valerie Reyna, Cornell University

10:00-10:15 (63)

Individual Differences in Neural Substrates of Sensation Seeking and Risky Choice Framing. VALERIE F. REYNA, CHRISTINA F. CHICK, JEREMY D. OJALEHTO, REBECCA B. WELDON, JONATHAN C. CORBIN and EVAN A. WILHELMS, *Cornell University*—Fuzzy-trace theory predicts that risk-taking is a function of cognitive (reliance on verbatim vs. gist representations) and motivational (sensation-seeking) factors, which differ developmentally and across individuals. However, little is known about their neural substrates and how these substrates vary across individuals. We conducted a functional neuroimaging study of 32 adults in which individual differences in framing bias and sensation seeking were measured, and related to neural contrasts, such as greater activation when subjects made choices consistent (vs. inconsistent) with standard framing effects. For the latter contrast, framing bias covaried with activation in such areas as superior and inferior parietal cortex and frontal cortex (BA 10). For the opposite contrast (risk-seeking in the gain frame and seeking sure losses, as opposed to standard framing), sensation-seeking covaried with activation in such areas as insula, amygdala, and temporal lobe. Thus, distinct neural substrates underlie representational and motivational differences in risk preferences across individuals.

Email: Valerie Reyna, vr53@cornell.edu**10:20-10:35 (64)**

An Evolutionary Domain-Specific Risk Scale. ANDREAS WILKE, AMANDA SHERMAN, BONNIE CURDT and SUMONA MONDAL, *Clarkson University*, CAREY FITZGERALD, *Oakland University*, DANIEL J. KRUGER, *University of Michigan*—We present a psychometric scale that assesses risk-taking in ten evolutionary content domains: Between-group competition, within-group competition, status-power, environmental exploration, food selection, food acquisition, parent-offspring conflict, kinship, mate attraction, and mate retention. We report on three studies that evaluate the scale's validity and consistency for a sample of 1326 undergraduate participants who rated their likelihood of engagement as well as their perceived risks and benefits for various risky activities. Behaviors were framed as modern-day analogues of qualitatively similar actions in reoccurring problem domains of the ancestral environment that were potentially beneficial, but also potentially costly to survival and reproductive success. Comparing our results to existing measures of risk-taking and investigating the construct validity of our content domains highlights the utility of employing an evolutionary framework when studying the functional aspects of human decision-making.

Email: Andreas Wilke, awilke@clarkson.edu**10:40-10:55 (65)**

The Rational Adolescent: Evidence From Strategic Behavior in Information Processing Revealed by Eye Tracking. YOUNGBIN KWAK, *Duke University* (Associate Member Select-Speaker Award Recipient), ANDREW L. COHEN, *University of Massachusetts, Amherst*, JOHN W. PAYNE and SCOTT A. HUETTEL, *Duke University*—Adolescence has been traditionally viewed as a time of irrational and risky decision-making, despite adolescents' relative competence in other cognitive domains. Here, we examined the strategies used by adolescents to make economic decisions, using eye tracking to measure information processing in complex multi-outcome gambles. We found that adolescents made more conservative choices compared to adults. Eye tracking data showed that, prior to decisions, adolescents acquired more information in a more thorough manner compared to adults, suggestive of a compensatory processing strategy. Among adolescents, moreover, the degree of heuristic use was correlated with one's cognitive capacity. Collectively, these results present a counter-intuitive case of adolescents' decisions being more economically rational compared to adults, as shown by adolescents' increased use of a compensatory decision strategy. Our findings propose that, depending on the characteristics of decision problems, adolescents can in fact make decisions more consistent with rational-choice models than those made by adults.

Email: Youngbin Kwak, youngbin.kwak@duke.edu**11:00-11:15 (66)**

The Goal of Cognitive Consistency Drives Multiple Psychological Phenomena. ANNE-SOPHIE C. CHAXEL, *McGill University*, JOSEPH E. RUSSO and CATHERINE E. WIGGINS, *Cornell University* (read by Joseph E. Russo)—Cognitive consistency, the agreement between beliefs, is a goal that drives multiple psychological phenomena. A new technique to activate the consistency goal is developed. In three experiments its success is validated by (a) response times to word naming, (b) a direct report by participants of goal activation and (c) the impact on the predecisional distortion of information. Individual experiments then apply the activation method to demonstrate the role of the consistency goal in the influence of prior expectations on judgment (selective perception), similarity judgments, the desirability bias, the post-decisional search for confirming information (selective exposure), and the ability of an explicit attitude to influence its corresponding implicit attitude. Some of these results verify long-standing speculation about the causal role of cognitive consistency. Taken as a whole, they also argue that the desire for cognitive consistency is fundamental to systems of beliefs and may be a driver of many psychological phenomena.

Email: Jay Russo, jer9@cornell.edu



11:20-11:35 (67)

Social Discounting Examined in Two Cultures. X.T. WANG and NOAH N. EMERY, *University of South Dakota*, PENG WANG, *East China Normal University*—People not only discount the value of future rewards over time but also the value of rewards across social distance in relationship. In two samples collected in the US and China, we examine social (relational) discounting in a choice task in which participants decide whether to forgo a certain amount of reward in order to reward another person, based on the relationship between the two. Social distance was measured as a continuous variable rather than a ranking variable as in many of previous studies. For the US sample, a hyperbolic function fits the choice data across the social distance dimension significantly better ($R^2 = .921$) than an exponential function ($R^2 = .699$). However, the opposite was observed in the Chinese sample with a higher exponential fit ($R^2 = .966$) than a hyperbolic fit ($R^2 = .871$). Social discounting of the Chinese participants was more exponential and consistent. Our data also suggest that genetic relatedness appears to be a major determinant of hyperbolic discounting. We argue that a higher exponential fit to Chinese social discounting is in part a result of cultural adaptations to a larger and more complex social network in which non-kin relations, particularly friends, are considered vital social assets.

Email: X.T. Wang, xtwang@usd.edu

11:40-11:55 (68)

Temporal Discounting as a Function of Context and Response Perspective. MARY KAY STEVENSON, JUAN CABRERA and RAYMOND GERARDO, *California State University, East Bay*—This study compares temporal discounting for gains and losses when they are presented as single outcomes and in combination. Participants were asked to provide their preference strength for pairs of delayed gains, losses and combined gains and losses occurring at different times in the future. They were also asked to judge how positive they felt about each stimulus in a judgment task. A second group of participants was asked to choose the worse option and describe how much worse it was than the alternative option. This group also rated the stimuli in relation to how unattractive they were in a judgment task. The context affected the absolute responses, while preserving the consistency of discounting for gains relative losses across contexts. The response perspective also had a consistent impact on the interpretation of the stimuli. These results are related to a general theory of temporal discounting.

Email: Mary Kay Stevenson, marykayste@gmail.com

Recognition Memory
Grand West, Friday Afternoon, 1:30-3:30
Chaired by D. Stephen Lindsay, University of Victoria
1:30-1:45 (69)

Recognition Memory Response Bias is Conservative for Paintings. D. STEPHEN LINDSAY, *University of Victoria*, JUSTIN KANTNER, *University of California, Santa Barbara*, KAITLIN M. FALLOW, *University of Victoria*—Recognition memory response bias when the stimuli are scans of paintings tends to be conservative (more misses than false alarms). This is true even if paintings are the only stimuli used in the experiment (although conservatism on paintings is even greater when both paintings and words are used as materials). Conservatism on paintings holds independent of recognition sensitivity. We summarize a lengthy series of studies aimed at understanding the cause of that conservative bias. Our results indicate that conservatism on paintings is NOT due to exaggerated expectations as to the memorability of paintings, nor to higher rates of spontaneous remindings for paintings, nor to greater subjective confusability of paintings. ROCs suggest that recollection may play a major role in recognition of paintings, whereas familiarity may play the larger role in recognition of words.

 Email: D. Stephen Lindsay, slindsay@uvic.ca
1:50-2:05 (70)

A Time Course Analysis of the Strength Based Mirror Effect. ASLI KILIÇ (Associate Member Select-Speaker Award Recipient) and ILKE ÖZTEKIN, *Koç University*—In recognition memory, when items are strongly encoded (e.g. via repetition or deep processing), higher hit rates and reduced false alarm rates are observed compared with weak items, commonly known as the strength based mirror effect (SBME). We employed the response-deadline speed-accuracy trade-off (SAT) procedure to provide a full-time course assessment of the SBME during memory retrieval, as well as investigate the differential impact of the SBME on memory accuracy and retrieval speed independently. In three experiments, a standard levels-of-processing manipulation was employed to induce the SBME using both pure and mixed study lists. Results indicated that strongly encoding study items enhanced the asymptotic accuracy, but did not have a measurable impact on retrieval speed measures, either the rate of information accrual or the point in time when information first became available. These findings provide support for the contention that strengthening study material enhances the availability of information in memory, without directly influencing the speed of processing.

 Email: Asli Kilic, akilic@ku.edu.tr
2:10-2:25 (71)

A Test of Differentiation and Criterion Shift Accounts of the Strength-Based Mirror Effect. JOHN C. DUNN, CHRISTOPHER KEECH and RACHEL STEPHENS, *University of Adelaide*—In recognition memory, a mirror effect occurs when “strong” items in one condition have a higher hit rate and lower false alarm rate than “weak” items in another condition. The strength-based mirror effect occurs

when strong items are studied under conditions that improve subsequent memory, such as increased encoding time or multiple presentations for each item. There are currently two competing explanations of this effect. The differentiation account proposes that a strong list leads to a relative increase in memory strength for targets coupled with a relative decrease in strength for lures. The criterion shift account proposes that there is no difference in the memory strength of lures but there is a difference in response criteria for weak and strong lists. We present a test of these two accounts using the word frequency mirror effect. If the differentiation account is correct then the difference in memory strength of high and low frequency lures should be greater in strong lists than in weak lists. In contrast, if the criterion shift account is correct then this difference should be the same in both lists. We discuss the results of this test and its implications for theories of the strength based mirror effect.

 Email: John Dunn, john.c.dunn@adelaide.edu.au
2:30-2:45 (72)

Familiarity Both Helps and Hurts Responding to Targets. DOUGLAS J. MEWHORT and ELIZABETH E. JOHNS, *Queen's University at Kingston*—In recognition memory, standard theory claims that familiarity helps targets but hurts foils. The theory works when targets and foils are dissimilar but fails when targets and foils are highly similar (as frog is to frogs). Such foils can elicit rapid, confident, and accurate responses (e.g., recall to reject). We explored the corresponding situation for targets. We manipulated familiarity by contrasting studied items that shared features with other studied items (familiar items) against studied items with no shared features (less familiar items). Increased familiarity facilitated responding when the task was easy but slowed responding when it was difficult. In a final experiment, we showed that global familiarity interferes with responses to targets even while item familiarity facilitates responding. Familiarity is not unidimensional: When decisions reflect item-specific information, global familiarity hurts both targets and lures while item familiarity helps both targets and lures.

 Email: Douglas Mewhort, mewhort@queensu.ca
2:50-3:05 (73)

Using Response Time Distributions to Measure Evidence Variability in Recognition Memory, Source Memory, and Perceptual Tasks. JEFFREY J. STARNES, *University of Massachusetts Amherst*, ROGER RATCLIFF, *The Ohio State University*—Recognition memory Receiver Operating Characteristic (ROC) functions indicate that memory evidence is more variable for target (studied) items than for lure (non-studied) items. Using the diffusion model, we measured the variability of memory evidence using response-time distributions instead of ROC functions. Data from 376 participants strongly supported an unequal-variance model with higher variability for targets than for lures. To ensure that the diffusion model can accurately measure evidence variability, we performed parameter-recovery simulations and analyzed data from a perceptual task with a direct manipulation of evidence variability. Variability estimates from a source-memory task with weak and strong items (studied once or



three times, respectively) also showed a pattern consistent with source memory ROC functions. The source results suggest that both memory and decision processes contribute to the strength effect on source ROC functions.

Email: Jeffrey Starns, jstarns@psych.umass.edu

3:10-3:25 (74)

Feedback and Test Composition Effects in Recognition Memory. AMY H. CRISS and GREGORY KOOP, *Syracuse University*, KENNETH J. MALMBERG, *University of South Florida*—Recent theoretical developments emphasized dynamic changes in accuracy and bias during recognition memory testing. To better understand these dynamic changes, we investigated feedback and test composition. Participants received either correct feedback, no feedback, or random feedback that was unrelated to the response. Test composition was manipulated such test lists were either standard with half targets and half foils or pure lists composed of all targets or all foils. This design provided an ideal test bed to measure adjustments to the decision criterion and changes in accuracy during the test. Overall, random feedback harmed memory and accurate feedback improved memory for pure lists. For standard lists, feedback had small effects on bias but did not change discriminability. Accuracy decreased across testing, i.e., output interference was observed, with one exception -- for pure lists with feedback performance improved over the course of testing. Implications for models of memory will be discussed.

Email: Amy Criss, acriss@syr.edu

Visual Search

Grand East, Friday Afternoon, 1:30-3:10

Chaired by Todd Horowitz, *National Cancer Institute*

1:30-1:45 (75)

Searching for Chemobrain. TODD S. HOROWITZ, *National Cancer Institute*—“Chemobrain” refers to cognitive deficits experienced by chemotherapy patients. The phenomenon is not well-characterized. For instance, it is not clear which domains are impaired. I argue that misclassification of neuropsychological tests causes confusion. Here I re-analyzed data from a recent meta-analysis (17 studies) purporting to show no effects on attention. Most tests classified under “attention” were actually memory span tests, while relevant attention tests were excluded. When I analyze tests which actually measure attention, evidence for a chemobrain effect was much stronger. Focusing on tests with a visual search component yielded a summary effect size (g) of -0.058 (95% CI: $-0.143, 0.027$; $p = .18$; negative indicating chemotherapy deficit). More specifically, 10 studies reported the Trail Making Task A (comprising search and psychomotor components). Effect size was -0.145 ($-0.277, -0.012$; $p = .03$). Chemotherapy may impair attention and search, but we need more valid and sensitive tests.

Email: Todd Horowitz, todd.horowitz@nih.gov

1:50-2:05 (76)

N2pc Reveals Efficient Attentional Selection in a Challenging Multi-Color Search Task. JOHN J. MCDONALD, GREGORY J. CHRISTIE and ASHLEY C. LIVINGSTONE, *Simon Fraser University*—Observers are often slower to search for a visual target as the number of display items increases. This positive search slope is usually attributed to the serial application of attention. However, the slope of the set-size function is typically quite shallow, leaving open the possibility that search is accomplished in parallel. Here, we used an electrophysiological marker of attentional selection – the N2pc – to determine whether search for a specific colored target presented among heterogeneously colored distractors is accomplished serially or in parallel. Although RTs increased with set size, N2pc latencies did not vary as a function of set size. Priming of pop-out was also observed: the N2pc was found to onset earlier when the target color repeated than when it changed across successive trials. These findings suggest that search was accomplished in parallel despite the fact that the RT set-size function was indicative of serial search.

Email: John McDonald, jmcd@sfu.ca

2:10-2:25 (77)

Hybrid Visual and Memory Search: Just How Ridiculously Flexible and Talented are You Anyway? JEREMY M. WOLFE, *Brigham & Women's Hospital; Harvard Medical School*, SAGE E. BOETTCHER, *Brigham & Women's Hospital*, TRAFTON DREW, *Brigham & Women's Hospital; Harvard Medical School*—When searching a visual display for any member of a set of items in memory, RTs are a linear function of visual set size and a log function of memory set size, true for even up to several hundred items held in memory. Suppose you hold two sets of arbitrary objects in memory. On each trial, the background tells you which objects are targets for that trial. Lures are presented from the other set. With target sets switching at random from trial to trial, you are perfectly capable of restricting your memory search to the relevant subset. Lures do slow you down, showing that you noticed them, but observers hardly ever mistake a lure for a target. This works for memory set sizes outside any reasonable limits for working memory. Apparently, at least two arbitrary partitions of long-term memory can coexist to serve in hybrid search tasks.

Email: Jeremy Wolfe, wolfe@search.bwh.harvard.edu

2:30-2:45 (78)

No Need For Maps: Conjunction Search Is Guided By Relative Features. STEFANIE I. BECKER and JESSICA K. CHOI, *The University of Queensland*—The visual search literature has been dominated by feature-map theories such as Feature Integration Theory and Guided Search, which assume that an item has to be similar to the search target to capture attention and distract us. Yet recent studies provided support for a relational account (Becker, 2010), which posits that attention is biased to the relative attributes of the target (e.g., larger, redder), so that items can capture attention if their relative attributes match those of the target. The current study used a spatial cueing task to examine whether attention is also

guided by relative features in conjunction search. Our results demonstrate that singleton cues defined by a conjunction of size and colour can capture attention, but only when the relative attributes of the cue match the relative attributes of the target. Importantly, cues that were identical to the target failed to capture when they did not match the relative attributes of the target. These findings demonstrate that attention is biased to feature relationships even in conjunction search, challenging the long-held belief that visual attention is guided by feature maps.

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

2:50-3:05 (79)

The Long and the Short of Intertrial Priming. MARTIJN MEETER and WOUTER KRUIJNE, *VU University Amsterdam*—It has been proposed that episodic retrieval of earlier trials underlies intertrial priming in visual search. Here, we show that SAM, a well-established model of episodic memory, can reproduce findings from the priming literature. It also makes a counterintuitive prediction, shared by other models of learning: a block with a surplus of trials in which the target has, for example, a certain color (a bias block), will speed search for such targets for the remainder of the experiment. We tested this prediction for both feature- and conjunction search. No effect of bias blocks was found for feature search, but for conjunction search, we found that a bias block affected search in later unbiased blocks without obvious forgetting. This long-term effect occurred on top of short-term intertrial priming. Some forms of priming may thus fractionate, as does episodic memory, into effects of a short-term and a long-term store.

Email: Martijn Meeter, m@meeter.nl

Cognitive Control I

Dominion Ballroom, Friday Afternoon, 1:30-3:30

Chaired by Matthew S. Cain, *Brown University*

1:30-1:45 (80)

Cognitive, Personality, and Neuroimaging Correlates of Media Multitasking. MATTHEW S. CAIN, *Brown University*, AMY S. FINN and JOHN D. GABRIELI, *Massachusetts Institute of Technology*, STEPHEN R. MITROFF, *Duke University*—A growing proportion of media is consumed simultaneously with other media (e.g., reading e-mail while watching television), a behavior known as media multitasking. While the overall rate of media multitasking has been increasing over at least the last decade (Rideout, Foehr, & Roberts, 2010), there remain broad individual differences. We examined the relationship between self-reported media multitasking behavior and a variety of cognitive laboratory tasks (e.g., N-back, Stop Signal), personality and clinical measures (e.g., Big 5, ADHD symptoms), and structural and functional neuroimaging (e.g., cortical thickness, resting-state connectivity) in samples of middle-school students, university undergraduates, and working adults. Collectively, the data suggest that differences in media multitasking behavior may be diagnostic of pervasive differences in attentional and

cognitive control, with greater media multitasking behavior correlated with less selective control of attention (i.e., a broader attentional set).

Email: Matthew S. Cain, matthew.s.cain@brown.edu

1:50-2:05 (81)

Women and Younger People are Better in Fast-Paced Multi-Tasking. GIJSBERT STOET, *University of Glasgow*, DARYL B. O'CONNOR and MARK T. CONNER, *University of Leeds*—It is well known that persons with certain mental disorders have difficulties with tasks requiring executive function (e.g., schizophrenia and task switching). But even within the neurotypical population, there is considerable variation in such tasks. We aimed to investigate the role of sex and age in this. We measured task-switching and task-mixing skills in a stratified sample of 240 neurotypical participants within the age range 18-39 years old. We used a cued task-switching paradigm with two tasks (shape vs. pattern discrimination) and measured response times and accuracy. We found that participants' age and sex were predictive of mixing costs. Men showed larger mixing costs than women, and mixing costs increased with age. No effect of sex and age on switch costs was found. Our findings are in line with a study by Ren et al. (2009) in which single task performance was contrasted with multi-tasking performance (albeit not in a task-switching paradigm). We conclude that women indeed have an advantage over men in multi-tasking when tasks are rapidly interleaved. We discuss how these findings compare to the literature focusing on more complex tasks in which no sex differences in multi-tasking have been reported.

Email: Gijsbert Stoet, gijsbert.stoet@glasgow.ac.uk

2:10-2:25 (82)

Posterror Slowing in a Dual-Task Setting: Dissociation between Task1 and Task2 Slowing. INES JENTZSCH, *University of St Andrews*—The aim of this study was to investigate mechanisms underlying error processing using a classical auditory-visual dual-task paradigm. This paradigm allows testing for the specificity and the temporal properties of the error monitoring mechanism. I found that choice errors affected both subsequent task1 and task2 performance, with task2 posterror slowing being larger for short than long SOAs. Also, posterror slowing was independent of whether an error had been committed on the previous task1 or task2. Finally, an Error-Related Negativity was present immediately after commission of a task1 or task2 error. Together, these results support the idea of a time-consuming error monitoring process (Jentzsch & Dudschig, 2009). Importantly, I suggest that this error monitoring process can continue during the SOA period of the subsequent dual-task trial, that the bottleneck occupied by the error monitoring process is not task-specific and that response errors to each of the dual-task subcomponents are detected independently.

Email: Ines Jentzsch, ij7@st-andrews.ac.uk

2:30-2:45 (83)

Bottleneck Bypassing: Sometimes Finding a Needle in a Haystack. FRANÇOIS MAQUESTIAUX, *Université Paris-Sud*, ERIC RUTHRUFF, *University of New Mexico*, ANDRÉ



DIDIERJEAN, *Université de Franche-Comté*—Hazelvine, Ruthruff, and Remington (2006) reported substantial effects of input-output modality compatibility on dual-task performance. Specifically, interference was nearly eliminated after simultaneous training with one Visual-Manual task and one Auditory-Vocal task (“compatible” modalities) but remained substantial with one Visual-Vocal task and one Auditory-Manual task (“incompatible” modalities). This finding suggests that parallel central processing – bottleneck bypassing – is possible, at least with compatible modalities. Here, we reexamined this claim in 4 experiments manipulating modality pairings, using a PRP transfer paradigm better suited to probing for bottleneck bypassing. Participants first practiced only one task (Auditory-Vocal, Auditory-Manual, Visual-Manual, or Visual-Vocal), which was later presented as Task 2 in a PRP procedure. Bottleneck bypassing was found only in some participants tested with compatible modality pairings (interference < 200 ms). However, interference was very large with incompatible modality pairings (> 400 ms). Bottleneck bypassing is within reach under the “right” pairings, but is rare overall.

Email: François Maquestiaux, francois.maquestiaux@u-psud.fr

2:50-3:05 (84)

Are there Benefits of Pre-Cueing Congruency in the Stroop Task? JULIE M. BUGG, *Washington University in St. Louis*, ALICIA SMALLWOOD, *DePauw University*—Performance on the Stroop task is enhanced when participants are provided specific pre-cues about the upcoming trial such as the color the word will be printed in or the word that is to-be-ignored. Few studies have examined whether abstract pre-cues yield similar benefits. An abstract pre-cue informs participants only of the congruency of the upcoming trial. Using a Stroop task with four words/colors, we show that validly cueing congruency produces benefits on congruent and incongruent trials, though the benefits are more pronounced for congruent trials. We then show that invalidly cueing congruency produces costs to performance, with the cue invalidity effect (i.e., slowing on invalid compared to valid trials) decreasing as a function of cue-to-stimulus interval for congruent trials but increasing for incongruent trials. These findings demonstrate that abstract pre-cues are utilized to configure attention in a proactive fashion, and suggest that proactive control can target a non-specific representation.

Email: Julie Bugg, jbugg@artsci.wustl.edu

3:10-3:25 (85)

Strategy Congruence, Conflict Adaptation, and PES Effects in Young and Older Adults’ Arithmetic. PATRICK LEMAIRE and THOMAS HINAULT, *Aix-Marseille University & CNRS*—Young and older adults use several strategies to accomplish most cognitive tasks, and aging effects on human cognition is associated with strategic variations. In this study, three new strategy phenomena, and aging effects on these phenomena, document how young and older adults use executive control mechanisms during strategy execution. Participants accomplished a computational estimation task (i.e., provide approximate products to two-digit multiplication problems like 38x74) and were cued which one of two

rounding strategies they had to execute on each problem. Their performance revealed strategy congruency effects (i.e., better performance when problem and strategy were congruent than when they were incongruent), conflict adaptation effects (i.e., smaller congruency effects after incongruent items than after congruent items), and posterror slowing effects (i.e., better performance on current problems following errors). Congruency and conflict adaptation effects increased with age, but not posterror slowing effects, especially in older adults with poorer executive control processes. Our findings have important implications regarding mechanisms underlying strategy execution and aging effects on strategic variations.

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Visual Processing

Conference B & C, Friday Afternoon, 1:30-3:10

Chaired by Adam Reeves, *Northeastern University*

1:30-1:45 (86)

Short-Term Visual Memory for Depth. ADAM J. REEVES and QUAN LEI, *Northeastern University*—Retention of the stereoscopically-defined depth of briefly-presented items (numerals) decays over one-half a second, and then recovers, as assessed by a delayed cue in the Sperling partial-report paradigm. The retention of depth is independent of the retention of a spatial array (adding depth to a standard 3x4 iconic-memory letter display has no effect on letters retained at any cue delay), and is not affected by a moderate load added to working memory (five colored shapes had to be retained throughout each trial). Since the time course of retention of depth differs markedly from that of other visual attributes, and since depth appears to act independently, we provisionally conclude that depth is retained in a visual buffer of its own. Among our 36 young adult participants, differences in retention are marked, but so far unexplained.

Email: Adam Reeves, reeves@neu.edu

1:50-2:05 (87)

Semantic and Orthographic Visual Priming. BRENDAN JOHNS and RICHARD M. SHIFFRIN, *Indiana University* (read by Richard M. Shiffrin)—Eight non-diagnostic subliminal or visible word primes appeared in a 3x3 grid, followed by a central word briefly flashed and masked, followed by target and foil choices. The primes were related semantically, orthographically (or both) to the target choice, the foil choice, or both. Semantic primes were chosen from Deese-Roediger-McDermott lists; orthographic primes overlapped in letters and position. In some conditions, one choice was related semantically to four primes, and the other orthographically to four other primes. The results were similar for semantic and orthographic priming: Brief masked primes produced a bias to choose the related item, and improved perceptual processing. Visible primes added enough noise to the decision process, and/or reduced perceptual processing enough, to harm performance (even with both-priming). In addition, long primes produced discounting, reducing the tendency to select the primed choice. We report a model for the findings.

Email: Richard Shiffrin, shiffrin@indiana.edu

2:10-2:25 (88)

Is Visual Perceptual Knowledge of Objects and Words Bound to Retinal Position? JEFFREY S. BOWERS, IVAN I. VANKOV and CASIMIR J.H. LUDWIG, *University of Bristol*—Is visual perceptual knowledge of objects and words bound to retinal position? Symbolic theories predict that a given word or object is coded in the same way regardless of where the image is projected on the retina, whereas non-symbolic models predict that different representations are involved in identifying the same image in different positions. In a recent review, Rauschecker et al. write that “the balance of evidence suggests that visual recognition of complex stimuli, including letters and words, depends on multiple retinotopically organized neural representations.” We report a series of experiments using eye-tracking technology that explore this fundamental issue using a variety of materials, including unfamiliar faces and unfamiliar written scripts. Email: Jeffrey Bowers, j.bowers@bristol.ac.uk

2:30-2:45 (89)

Object Semantic Properties’ Effect on Attentional Allocation in Naturalistic Scenes. GEORGE L. MALCOLM (Associate Member Select-Speaker Award Recipient) and SARAH SHOMSTEIN, *The George Washington University*—Our visible world is rich with semantic information: everywhere there are meaningful representations that extend beyond apparent features. It thus seems intuitive that our visual system would utilize this high-level information to bias attentional selection. Most previous research, however, has focused on how attentional systems interact with basic properties such as space and features to direct behavior. Few studies have investigated how semantic object properties bias attention and these have focused on task-relevant objects. In a set of studies we demonstrate here that high-level semantic information biases both space- and object-based attention even when it is entirely irrelevant to the present task. Furthermore, this biasing occurs early on during processing before task-relevant factors re-organize the priority map, suggesting that the visual system has an inherent preference for utilizing high-level factors in guiding attention. A final study then found that the classic object-based attention effect extends to real-world scenes. Taken together, the results suggest that while semantic information has a strong bias on attentional allocation, it does so within the constraints of scene’s inherent physical properties. Email: George Malcolm, gmalcolm@gwu.edu

2:50-3:05 (90)

A Low-Level Vision Explanation of a Phobia. GEOFF G. COLE and ARNOLD WILKINS, *University of Essex*—Phobia is often defined as an irrational fear of certain situations or objects, often attributed to learning or to innate mechanisms. Here, we describe a common phobia (tryphobia), unreported in the peer-reviewed literature, in which sufferers are averse to viewing clusters of holes. We analysed the contrast energy present at different spatial scales in a range of tryphobic images, comparing them with controls. We found that tryphobic images possess a particular visual characteristic found in other images that induce ‘visual stress’,

i.e., high contrast energy at mid-range spatial frequencies. Significantly, we also found that highly poisonous animals (e.g., Blue Ringed Octopus) also possess this spectral property. We propose that tryphobia occurs because the images coincidentally share a basic visual characteristic with poisonous organisms. This characteristic can be computed via fact acting low-level mechanisms before conscious recognition of an object occurs. The phobia may involve a contribution from both learned and innate mechanisms. Email: Geoff Cole, ggcole@essex.ac.uk

Reasoning/Problem Solving

Civic Ballroom, Friday Afternoon, 1:30-3:10

 Chaired by Todd Gureckis, *New York University*

1:30-1:45 (91)

Comparative and Confirmatory Strategies During Active Causal Learning. ANNA COENEN, BOB REHDER and TODD M. GURECKIS, *New York University* (read by Todd M. Gureckis)—Interventions allow us to tell apart causal structures that are indistinguishable through observation, but only if the right variables are intervened on. Normative models specify a process of comparing hypotheses to identify those interventions that the hypotheses predict will yield different outcomes. An experiment that asked subjects to decide between two causal hypotheses found that while they often chose useful interventions, they frequently performed interventions whose expected effects were typical of one causal structure but that did not always allow the two structures to be distinguished. We interpret this tendency as a type of positive-test-strategy or positivity bias, but with an additional preference for outcomes that are representative of a given structure. Email: Todd Gureckis, todd.gureckis@nyu.edu

1:50-2:05 (92)

Causal Model and Sampling Approaches to Improving Intuitive Statistical Judgment. BRETT K. HAYES, BEN R. NEWELL and GUY HAWKINS, *University of New South Wales*—Three studies examined whether causal explanation of false positives and sampling of base rate information facilitate intuitive probability judgments. Experiment 1a varied sampling experience and causal framing factorially. Each had an additive positive effect on the accuracy of intuitive probability estimates in a probability estimation task (the “mammogram problem”). Experiment 1b showed that description of relevant sample information produced similar facilitation to trial-by-trial sampling. Experiment 2 tested and confirmed a novel prediction of a causal Bayesian model of intuitive judgment; namely that causal framing of false positives would lead to greater stability of intuitive probability estimates across multiple judgments. These results indicate that causal and sampling approaches impact on different components of probability judgment, and provide additional support for the causal Bayesian approach. Email: Brett Hayes, B.hayes@unsw.edu.au



2:10-2:25 (93)

Improving Math With Number Sense Training: An Investigation of its Underlying Mechanism. JOONKOO PARK (Associate Member Select-Speaker Award Recipient) and ELIZABETH M. BRANNON, *Duke University*—A primitive number sense, that allows rough estimation and operation of numerical quantities, is thought to be a cognitive foundation of higher-level mathematics. This proposition is supported by numerous cross-participant correlation studies showing an association between measures of primitive number sense and math. Furthermore, a recent training study shows transfer of skills from training on an approximate arithmetic task with dot arrays to symbolic arithmetic. Here, we investigate the mechanisms underlying this transfer effect by dissecting and testing the effects of distinct cognitive components of the approximate arithmetic task. Results indicate that training on approximate arithmetic, but not on numerical comparison or visuo-spatial short-term memory, improves symbolic math. They suggest that quantity manipulation aspect of approximate arithmetic is the key component that yields improvement in math. The findings further suggest that training programs focusing on approximate arithmetic may be fruitful particularly for young children prior to learning symbolic numerals.
Email: Joonkoo Park, joonkoo.park@duke.edu

2:30-2:45 (94)

The Role of Domain Knowledge in Chemistry Reasoning. MICHELLE R. ELLEFSON, *University of Cambridge*, DAVID M. SOBEL, *Brown University*—Truly grasping scientific requires the creation of an appropriate model of the important aspects of the phenomena and how these aspects are related. Many of these relations are causal, making it important to understand students' ability to reason about causes and effects within a science context compared to non-science one. Here, participants learned about the causal efficacy of different items presented in either a non-science or chemistry scenario, with the two scenarios using identical causal rules. Performance on the non-science and chemistry scenarios was not significantly different. General education level did not predict participant performance on either tasks. Chemistry experience was a significant predictor of chemistry scenarios only; the best fit was a curvilinear one, with students having some chemistry experience performing worse than participants with either very little or more advanced chemistry experience. The findings suggest that both domain-general and domain-specific reasoning skills might influence chemistry reasoning.
Email: Michelle Ellefson, mre33@cam.ac.uk

2:50-3:05 (95)

When the Hands Lead You Astray: The Effects of Gesture on Analogous Problem Solving. AUTUMN B. HOSTETTER, *Kalamazoo College*, MAREIKE B. WIETH and KATLYN D. FOSTER, *Albion College*, KEITH MORENO and JEFFERY WASHINGTON, *Kalamazoo College*—We investigated the role of speech-accompanying gestures in analogous problem solving. Participants attempted to solve Duncker's (1945) Radiation Problem after reading and retelling a story that

described an analogous solution. Participants were either instructed to gesture, instructed not to gesture, or given no instructions regarding gesture as they retold the story. Participants were significantly less likely to solve the problem if they gestured about the critical concepts during their retelling of the analogous story than if they did not gesture. These results suggest that gestures can be detrimental to analogous problem solving when the perceptual and motor elements of a story are irrelevant to its relational similarity with a problem.
Email: Autumn Hostetter, autumn.hostetter@kzoo.edu

SYMPOSIUM II: Experience—Induced Neuroplasticity: Evidence from Bilingualism
Grand Centre, Friday Afternoon, 1:30-3:40

Organized by Ellen Bialystok, *York University*, and
Judith Kroll, *Pennsylvania State University*

1:30-1:40 (96)

Introduction. ELLEN BIALYSTOK, *York University*—Evidence for experience-based plasticity is clearly demonstrated using animal models: rats raised in stimulating environments develop greater synaptic density and perform better on learning tasks than do rats raised in simple environments. These processes are difficult to demonstrate in humans because of the complexity of human experiences and the individual differences with which they interact. However, bilingualism provides a unique forum for investigating such plasticity in human cognition. First, language use is the most intense and sustained activity we experience and engages multiple cognitive networks; second, bilingualism is widespread and can be studied across enormous variation in social backgrounds; third, most bilinguals are not pre-selected but become bilingual because of circumstances; fourth, the extent of plasticity can be examined for its effect on different domains of cognition, particularly nonverbal ones. The papers in this symposium examine changes in brain structure and function and in behavioral performance that follow from bilingualism.
Email: Ellen Bialystok, ellenb@yorku.ca

1:40-1:55 (97)

Structural Brain Consequences of Bilingualism across the Lifespan. JUBIN ABUTALEBI, *University San Raffaele Milan; The University of Hong Kong*—Culture, education and of other forms of acquired capacities act on individual differences in skill to shape how individuals perform cognitive tasks such as executive control. Of interest, bilingualism also appears to be a factor that shapes individual performance on tests of cognitive functioning. Beyond behavioral differences, bilingualism seems to affect brain structure as well. During my presentation I will show how bilinguals develop more grey matter in crucial brain areas responsible for executive control, hence, providing a neurological basis for the so-called "bilingual advantage". It was recently postulated that this bilingual advantage offers protection against cognitive decline in aging. The primary aim of this presentation is to illustrate how the bilingual brain becomes resistant to cognitive decline. New structural neuroimaging results from comparative studies between bilinguals and monolinguals during lifespan

will be illustrated in order to provide an overview of how bilingualism offers protection against cognitive decline.

Email: Jubin Abutalebi, abutalebi.jubin@hsr.it

2:00-2:15 (98)

Bilingual Context Boosts Executive Function in Bilinguals.

GUILLAUME THIERRY, *Bangor University*, YANJING WU, *University of Sheffield*—Studies testing the bilingual advantage hypothesis have compared the performance of bilingual and monolingual speakers in tasks requiring inhibitory control. Despite strong evidence for enhanced executive capacity in bilinguals, differences between groups are not always found, raising the question of participant matching. Here, we break free from the limitations of group matching by testing the bilingual advantage hypothesis within participants. Highly fluent Welsh-English bilinguals performed a classic arrow flanker task in three experimental blocks in which the incidental language context was manipulated by flashing words to be ignored either in Welsh, in English, or in both Welsh and English. Surprisingly, error rates and the amplitude of the P300 component of event-related potentials were reduced for incongruent trials in the dual language context as compared to either of the monolingual contexts. These results show that language context can modulate inhibitory control within bilingual participants and within a short period of time.

Email: Guillaume Thierry, g.thierry@bangor.ac.uk

2:20-2:35 (99)

The Bilingual Advantage in Cognitive Control and Parsing: Can We Train Monolinguals to Achieve Similar Benefits?

JARED M. NOVICK, SUSAN TEUBNER-RHODES and ERIKA HUSSEY, *University of Maryland*, SHARON L. THOMPSON-SCHILL and JOHN C. TRUESWELL, *University of Pennsylvania*—In many experimental contexts, bilinguals exhibit benefits in cognitive control. This advantage is presumed to arise from efficient and consistent management of two languages—a naturalistic form of cognitive-control training—and suggests plasticity in human cognition, particularly memory and attention. Yet few studies have tested whether such differential language experience yields benefits in real-time language processing. This is surprising because bilinguals' cognitive-control advantage is rooted in linguistic experience, and cognitive control is important in language comprehension, e.g., when revising incorrect interpretations. We report data on bilinguals' parsing/interpretation skills indicating a heightened ability to detect and resolve ambiguity related to advantages in detecting information-conflict within memory. These findings suggest cognitive control may be malleable in monolinguals through practice. Indeed, we also report data demonstrating that laboratory-based training of conflict-control yields improvements in monolinguals' language processing. Aspects of cognitive control may be plastic, offering monolinguals some bilingual-like benefits in cognition and language.

Email: Jared M. Novick, jnovick1@umd.edu

2:40-2:55 (100)

"In the Moment" Links Between Bilingualism and Executive Control and Their Relation to Enduring Changes

in Cognition. DEBRA TITONE, IRINA PIVNEVA, NAVEED SHEIKH, VERONICA WHITFORD and JULIE MERCIER, *McGill University*—Recent work investigating the relationship between bilingualism and executive control is largely comprised of two interdependent streams—investigations of what factors cause executive control to be recruited "in the moment" during bilingual comprehension and production; and investigations of whether people differ in executive control ability as a function of historical bilingual experience. Here, we report on our ongoing work with younger and older adult bilinguals that speaks to each stream using behavior-based language and executive control measures (i.e., eye tracking and standard cognitive tasks). While we generally find clear evidence of a link between bilingual language and executive control performance "in the moment", longer-term enduring effects of historical bilingual experience on executive control ability are suggestive but more difficult to specify. We believe this is likely due to inherent variability in both identifying and measuring the bilingual experience factors that drive this relationship, and behaviorally assessing executive control functions themselves.

Email: Debra Titone, dtitone@psych.mcgill.ca

3:00-3:15 (101)

Consequences of Bilingualism for Brain Structure in Older Adults: Investigating the Basis for Cognitive Reserve.

ELLEN BIALYSTOK, *York University*, GIGI LUK, *Harvard University*, ROSANNA OLSEN and CHERYL GRADY, *Rotman Research Institute*—Previous research has shown that bilinguals display symptoms of dementia later than monolinguals and that bilingual Alzheimer's patients matched on age and cognitive level with monolingual patients reveal more disease burden in the medial-temporal lobes than monolinguals despite comparable cognitive function. The present study investigated the source of compensation responsible for these effects in bilinguals. Monolingual and bilingual older adults, matched on education, English proficiency, and cognitive performance were examined for white matter structure and grey matter volume. Fractional anisotropy showed that bilinguals had better maintained white matter in the corpus callosum extending to the superior and inferior longitudinal fasciculi and significantly greater grey matter volume in the left and right temporal lobes. These differences may help reveal a possible mechanism for cognitive reserve in which better connectivity and greater cortical density in bilinguals compensate for declines in brain structure and function, including declines associated with the onset of dementia.

Email: Ellen Bialystok, ellenb@yorku.ca

3:20:3:35 (102)

Discussion: Brains, Behavior, and Bilingualism: Linking Language Experience to Structure and Function.

JUDITH F. KROLL, *The Pennsylvania State University*—In the past two decades there have been remarkable discoveries about the neural basis of language and cognition. At the same time, there has been a new recognition that bilinguals rather than monolinguals may be the most typical language users. The papers in this symposium illustrate the new research on



the impact of language experience for brain structure and function and the way that experience with multiple languages is reflected in cognitive performance and learning. In this discussion, I argue that these new discoveries not only have the consequence of requiring a revision of a widely held categorical interpretation of bilingualism, but more broadly require a revision to models of language development and cognitive processing based on monolingual experience alone. Email: Judith F. Kroll, jfk7@psu.edu

Word Recognition

Civic Ballroom, Friday Afternoon, 3:30-5:30

Chaired by Marc Brysbaert, Ghent University

3:30-3:45 (103)

Eye Movements in Reading and Atypical Brain Dominance. MARC BRYLSBAERT and LISE VAN DER HAEGEN, *Ghent University*—The left hemisphere takes the burden of language processing in most readers. However, with fMRI it is possible to find normally functioning students with right hemisphere dominance. We first show that these participants have a smaller processing cost for fixations on the end letters of words (i.e., their optimal viewing position is shifted towards the end of the word). Then we compared the eye movement patterns of this unique sample of healthy RH dominant people to that of participants with LH language dominance in a text reading study. The results revealed that the eyes of RH dominants land more to the right than the eyes of LH dominants, making more information directly available to the dominant hemisphere. We conclude that the traditional view of bilateral projections in central vision is incorrect. In contrast, interhemispheric communication is needed in central vision and eye movements are adjusted to optimize information uptake. Our findings call into question the explanation of macular sparing in hemianopia based on a bilaterally projecting fovea.

Email: Marc Brysbaert, marc.brysbaert@ugent.be

3:50-4:05 (104)

The Perceptual Structure of Printed Letter Strings: Insights From the Word Length Illusion. ALAIN CONTENT and FABIENNE CHETAİL, *Université libre de Bruxelles*—Previous studies showed that the arrangement of consonant and vowel letters determines the perceived structure of letter strings and biases the apprehension of physical length. Participants consistently estimated words comprising less orthographic units to be shorter than control words matched on number of letters. In addition, a phonological bias (syllabic length effect) appeared with longer exposure duration. In the present study, we explored the time course of the orthographic (CV pattern) and phonological (syllabic length) effects. Participants performed 1512 trials at different durations (17 to 100ms). A reliable orthographic bias was found for exposure durations above 30ms whereas the syllabic length effect emerged later. Moreover, case manipulation showed that the effects cannot be attributed to letter features. The findings provide further

support for the hypothesis that early orthographic encoding incorporates linguistic structure and that the CV pattern is one of its essential determinants.

Email: Alain Content, alain.content@ulb.ac.be

4:10-4:25 (105)

Exploring the Serial Processing of Letters During Visual Word Recognition. REBECCA L. JOHNSON, *Skidmore College*, ADRIAN STAUB, *University of Massachusetts Amherst*, JENNIFER BROWN, *Skidmore College*—The Dual Route Cascaded (DRC) Model of visual word recognition (Coltheart et al., 2001) proposes that low-frequency words with regular symbol-to-sound correspondence predominantly utilize the grapheme-to-phoneme correspondence (GPC) route in which a word's phonology is assembled serially, beginning with the first letter. To test this assumption, a naming task and a lexical decision task were conducted in which words were presented either serially left-to-right (17ms SOA), serially right-to-left, or with all letters appearing simultaneously. Words varied in their word frequency (low vs. high) and regularity (irregular vs. regular). The hypothesis from the DRC model that low frequency regular words would be disrupted the most by a serial right-to-left presentation was not supported. Instead, it was found that all words were affected by presentation type, such that serial right-to-left presentations led to longer latencies than serial left-to-right presentations. We interpret this benefit in light of previous evidence that word-initial letters have particular importance in the recognition of all words.

Email: Rebecca Johnson, rjohnso1@skidmore.edu

4:30-4:45 (106)

Residualizing Predictor Variables in Word Recognition Research. LEE H. WURM and SEBASTIANO A. FISICARO, *Wayne State University*—Regression analyses are becoming more popular among researchers interested in word recognition. There are many advantages to regression, but there is also one major disadvantage: Predictors of interest are often correlated with one another. In an attempt to deal with such collinearity, some researchers orthogonalize predictor variables by residualizing (i.e., regressing one predictor onto another, and using the residuals instead of the original predictor). To our knowledge this practice has not been used in other areas of research, but its use among word recognition researchers has increased since its introduction in 2006. In the current study, several effects of residualization are demonstrated and discussed. Some of these effects are, in all likelihood, surprising and highly undesirable. Therefore, residualizing is not a recommended strategy for dealing with collinearity.

Email: Lee Wurm, lee.wurm@wayne.edu

4:50-5:05 (107)

Effect of Consonant/Vowel Pattern in Visual Word Recognition: Evidence From the English Lexicon Project. FABIENNE CHETAİL, *Université Libre de Bruxelles*, DAVID A. BALOTA and REBECCA TREIMAN, *Washington University in St. Louis*, ALAIN CONTENT, *Université Libre*

de Bruxelles—Recent studies suggest that the organization of letters into groups of consonants and vowels constrains the orthographic structure of printed words, but the evidence is limited to French. To examine whether CV pattern effects generalize to English, we conducted regression analyses on the English Lexicon Project. Naming and lexical decision latencies were compared for words with one vowel cluster less than the number of syllables (e.g., REUNION, hiatus words, 3 syllables-2 vowel clusters) and words with the same number of vowel clusters and syllables (e.g., EVASION, control words, 3 syllables-3 vowel clusters). Naming was initiated more slowly for hiatus words than control words, especially in the low-frequency range and when the bigram corresponding to the hiatus is frequently a single grapheme. In lexical decision, the effect was inhibitory for low-frequency words and facilitatory for high-frequency words. The results suggest that the CV pattern constrains the perceived structure of English words.
Email: Fabienne Chetail, fchetail@ulb.ac.be

5:10-5:25 (108)

A Self-Organising Model of Orthographic Learning. COLIN J. DAVIS, *Royal Holloway University of London*—There has been considerable interest in orthographic processing over the past decade, and in particular on the underlying orthographic representations and mechanisms. This research has mostly focused on skilled readers, and very little attention has been paid to the mechanisms that enable orthographic representations (and in particular, lexical representations) to be learned. The SOLAR model provides an account of these learning mechanisms. I will describe this account and discuss how it can explain a range of empirical findings, including recent developmental studies that have used similar masked priming methodologies to those frequently used in experiments with adult readers. I will argue that this theoretical account may also have implications for understanding individual differences in reading ability.
Email: Colin Davis, c.davis@rhul.ac.uk

Language Production

Grand West, Friday Afternoon, 3:50-5:30

Chaired by Vera Kempe, *University of Abertay Dundee*

3:50-4:05 (109)

Does Speaker Emotion Affect Ambiguity of Referring Expressions? VERA KEMPE, JANET MCLEAN, JONA MEYER, MELISSA ROOKES and LAURA SWARBRIGG, *University of Abertay Dundee*—To examine the effects of emotional valence on speech production, participants were randomly assigned to a happy or sad music + film mood induction prior to referential communication tasks. When identifying object sequences with homophonic labels (e.g. animal bat, baseball bat), happy speakers were less likely than sad speakers to modify the second homophone to repair a temporary ambiguity (i.e. they were less likely to say...first cover the bat, then cover the baseball bat...). Similarly, when identifying one of two identical objects in an array, happy speakers were more likely to omit the modifying relative clause, e.g., by saying Put the shark underneath the sheep, when referring to one of two sharks in the array. Further

research explored whether positive mood also elicits increased ambiguity in real dialogue. The findings suggest that emotional valence can affect speech production through elicitation of more or less deliberate, effortful processing styles.
Email: Vera Kempe, v.kempe@abertay.ac.uk

4:10-4:25 (110)

The Impact of Stress on Young and Older Adults' Word Retrieval. LORI E. JAMES and CHRISTOPHER SCHMANK, *University of Colorado at Colorado Springs*, NICHOL CASTRO, *University of Kansas*—Tip-of-the-tongue (TOT) states, in which a known word is temporarily inaccessible, were predicted to increase when performing a word retrieval task under high-stress compared to low-stress conditions. Young and older adult participants were randomly assigned to a high-stress condition (standing in front of a mirror and video camera, they were told they would be evaluated on their nonverbal behavior while they performed several tasks, including a word retrieval task) or a low-stress condition (with no mirror or camera, and no evaluation component, but the same word retrieval task). We measured correct responses and TOT states during the retrieval task. Correct responding was not impacted by stress condition for either age group, but the percentage of TOT responses was greater in the high-stress than low-stress condition for both age groups. Consistent with our prediction, stressful testing conditions impaired access to known words.
Email: Lori James, ljames@uccs.edu

4:30-4:45 (111)

Does Mere Co-Activation Drive Semantic Interference? PADRAIG O'SEAGHDHA, DOMINIC PACKER and ALEXANDRA FRAZER, *Lehigh University*, KIMBERLY PREUSSE, *Georgia Tech*, KOSTAS HATALIS, HECTOR MUNOZ-AVILA and ALMUT HUPBACH, *Lehigh University*—Recent blocked cyclic naming research has brought renewed attention to an old puzzle: intrinsic categorical relations and extrinsic, ad hoc ones seem to be very different but often produce similar manifestations, in this case cumulative semantic interference. We report three new lines of blocked cyclic picture naming research that underline this puzzle. 1) Previously unknown faces grouped by race/ethnicity produced semantic interference with proper name production. 2) Category members sharing a nonsemantic attribute (first phoneme) showed increased interference even though phoneme sharing by itself is facilitatory. 3) Searching for a theme among otherwise unrelated items produced semantic interference whether the theme was actual (Remotely Associated RAT sets) or not (False RATs). A modified incremental learning mechanism (see Oppenheim et al., 2010) may account for these results if conceptual-lexical links to targets and competitors are modulated during picture naming regardless of the intrinsic or extrinsic basis of their co-activation.
Email: Padraig O'Seaghdha, pat.oseaghdha@lehigh.edu



4:50-5:05 (112)

The (Un)automaticity of Structural Alignment. IVA IVANOVA, LIANE WARDLOW, TAMAR GOLLAN and VICTOR S. FERREIRA, *University of California, San Diego* (read by Victor S. Ferreira)—Interlocutors in dialogue often mirror each other's linguistic choices (interactive alignment: Pickering & Garrod, 2004). However, speakers frequently engage in concurrent activities while in dialogue. Do the working memory demands posed by such activities affect structural alignment, suggesting that structural alignment demands attention? We conducted two structural priming experiments in which participants read prime sentences and then either held two unrelated words in memory or did nothing during target production. Experiment 1 tested dative sentences with target productions that were picture descriptions. Experiment 2 tested the priming of the optional complementizer “that” with target productions that were sentence combinations. Experiment 1 showed a smaller priming effect with memory load than without, whereas Experiment 2 showed the two effects to be similar. These findings suggest that concurrent verbal working memory load may disrupt structural alignment at a conceptual but not at a syntactic level of structural processing.

Email: Victor Ferreira, vferreira@ucsd.edu

5:10-5:25 (113)

Learned Tip-of-the-Tongue States. KARIN R. HUMPHREYS and MARIA C. D'ANGELO, *McMaster University*—A speaker's tip-of-the-tongue state can be shown to reoccur for individual words, despite being told the correct answer. We argue that this demonstrates not just idiosyncratic difficulty with certain words, but that it is a learning effect, in which an errorful state is implicitly learned, and is therefore more likely to reoccur. We present data that show this is a highly robust phenomenon: this reoccurrence can happen with as much as a week between the original TOT elicitation and retest on the same words, and can also happen on immediate retest, even when speakers are aware they will be retested. We also show that when speakers self-resolve their TOT states, they are far less likely to reoccur. Critically, a TOT resolution that is enabled by an external phonological cue is also able to prevent TOT reoccurrence.

Email: Karin Humphreys, krah@mcmaster.ca

False Memory and Eyewitness Identification

Grand East, Friday Afternoon, 3:30-5:30

Chaired by Gene Brewer, *Arizona State University*

3:30-3:45 (114)

Stable Individual Differences Across Multiple False Memory Paradigms. B. HUNTER BALL and GENE A. BREWER, *Arizona State University* (read by Gene A. Brewer)—Individual differences in false alarming to critical lures across multiple false memory paradigms were explored in a large-scale study of 169 college-aged adults. Participants completed two Deese-Roediger-McDermott semantic lure, two conjunction lure, two complex-span working memory, and two source memory tasks. The primary aim of this work was to examine whether stable individual differences in false memory held across

multiple paradigms and stimulus sets. A secondary aim was to predict the commission of false memories with working memory and source memory constructs. The results suggest that an individual's propensity to false alarm to critical lures is consistent across tasks and variability in this behavior is uniquely predicted by source monitoring abilities.

Email: Gene Brewer, gene.brewer@asu.edu

3:50-4:05 (115)

Remember/Know and Modality Effects in a Forced-Choice Test of False Memory. HASAN G. TEKMAN and GÖKHAN SAHIN, *Uludag University*—This research tried to answer three questions related to false positive responses in the Deese-Roediger-McDermott (DRM) paradigm: First, do false positives stem from a response bias or do the participants have lower sensitivity to distinguish nonstudied from studied words? We used a forced-choice recognition task in order to isolate the effect of sensitivity. Second, is a potential reduction in sensitivity related to recollection or familiarity? We asked participants to classify their responses as “remember”, “know”, or “guess” in order to explore this issue. Third, is there a difference in sensitivity for prior study in auditory and visual list learning tasks and their distribution into the three kinds of recognition responses? We observed lower sensitivity for the critical words of the DRM lists than words in unrelated lists. This was due to higher false alarm rates of the “remember” type. Modality did not make a difference in any measure.

Email: Hasan Tekman, hgtekman@gmail.com

4:10-4:25 (116)

The Relevance of Goal-Irrelevance for False Memories in the Misinformation Paradigm. ILSE VAN DAMME, *University of Leuven*, ROBIN L. KAPLAN, LINDA J. LEVINE and ELIZABETH F. LOFTUS, *University of California, Irvine*—In the misinformation paradigm, false memories are formed when misleading suggestions are remembered as part of a witnessed event. Studies about the effect of emotion on false memories typically focus on valence or arousal. To evaluate the importance of motivation, the present experiment distinguished between pregoal and postgoal emotions (i.e., experienced prior to vs. following goal attainment/failure). Participants viewed a slideshow and elaborated on true and false information regarding the main character's emotions and actions. There were six conditions: positive and negative pregoal emotion (hope, fear), positive and negative postgoal emotion (happiness, devastation), perceptual elaboration, and a control condition. Memory for both goal-relevant and goal-irrelevant details was evaluated. Participants in the pregoal conditions were more susceptible to false memories for goal-irrelevant details than participants in the other conditions, suggesting narrowed attention due to goal pursuit. Results support the view that motivational appraisals affect the type of details encoded and remembered.

Email: Ilse Van Damme, ilse.vandamme@ppw.kuleuven.be

4:30-4:45 (117)

False Memories and Fantastic Beliefs: Retrieval Monitoring in Psychic Believers. STEPHEN J. GRAY and DAVID A. GALLO, *University of Chicago* (read by David A. Gallo)—



Research suggests that there are individual differences in susceptibility to memory errors, but we know very little about the cognitive mechanisms underlying these differences. One hypothesis is that individuals differ in their use of monitoring processes to carefully scrutinize evidence, potentially affecting the accuracy of their memories as well as their worldly beliefs more generally. To investigate this potential link, we compared believers in paranormal psychic phenomena to skeptics on different measures of memory accuracy. Using a modified DRM task, we found that believers made more memory errors than skeptics, especially when given a strong warning to encourage monitoring. We also found differences between these groups on a criterial recollection task, which was designed to disentangle different kinds of retrieval monitoring processes. This link between paranormal beliefs and the accuracy of retrieval monitoring potentially reflects individual differences in evidence evaluation, although other interpretations also will be discussed.

Email: David Gallo, dgallo@uchicago.edu

4:50-5:05 (118)

Eyewitness Identification: An Old Theory of Response Bias vs. a New Theory of Discriminability. JOHN T. WIXTED, *University of California, San Diego*, LAURA MICKES, *Royal Holloway, University of London*—Some eyewitness memory researchers have long argued that sequential lineups are superior to simultaneous lineups. However, empirical evidence for the “sequential superiority effect” was based on a behavioral measure that is not useful because it inappropriately equates conservative responding with superior discriminability. Recent ROC analyses, which effectively separate response bias from discriminability, have found that the simultaneous procedure actually yields higher discriminability than the sequential procedure. An influential theory of what was previously thought to be a sequential superiority effect holds that simultaneous lineups induce a relative strategy (i.e., a tendency to choose the best match in the lineup), whereas sequential lineups induce an absolute strategy (i.e., a tendency to choose only if the lineup member exceeds an absolute criterion). However, this is essentially a theory of response bias, one that has little to say about the more important issue of discriminability. Theoretical concepts established long ago in the perceptual learning literature do speak to the issue of discriminability, and they anticipate the surprising outcome of recent ROC analyses comparing simultaneous to sequential lineups.

Email: John Wixted, jwixted@ucsd.edu

5:10-5:25 (119)

The Simultaneous Presentation of Faces in a Lineup Yields a Discriminative Advantage Over a Show-up. LAURA MICKES, *Royal Holloway, University of London*, JOHN T. WIXTED, *University of California, San Diego*—The ability of eyewitnesses to discriminate innocent from guilty suspects in a lineup is best determined by plotting the empirical ROC (Wixted & Mickes, 2012). An important goal of eyewitness memory research is to identify factors that enhance discriminability, and one such factor could be the size of the lineup. Participants watched a video of a crime and

were tested on lineups of various sizes (show-up, 2-, 4-, 6-, or 8- person). Based on the area under the curve (AUC, a non-parametric measure of discriminability), ROC plots revealed that discriminability was numerically highest using the 6-person lineup. Moreover, the AUC for the 6-person lineup was significantly greater than the AUC of the show-up. One possible explanation for the apparent diagnostic superiority of multi-person lineups over showups comes from the literature on perceptual learning (e.g., Gibson, 1969). When multiple faces are presented simultaneously, it is apparent to the witness that some features are non-diagnostic because all lineup members share them (e.g., ethnicity). This information is useful because it helps the witness focus on other features that are potentially diagnostic. No such information is provided when only one face is presented in a show-up.

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Concepts and Categories I

Dominion Ballroom, Friday Afternoon, 3:50-5:30

*Chaired by John Paul Minda,
The University of Western Ontario*

3:50-4:05 (120)

Similarities and Differences Between Children and Adults When Learning Novel Perceptual Categories. RACHEL R. RABI and JOHN PAUL MINDA, *The University of Western Ontario* (read by John Paul Minda)—Research suggests that children and adults will perform similarly when learning certain categories, but will exhibit differences when learning others. To explore these differences in learning, we examined the categorization strategies used by children and adults. When participants learned a category set (with features that were of equal or varying salience) for which a single-feature rule or overall similarity would allow for perfect performance, adults made more responses based on the single-feature rule than did children. Children displayed various categorization styles, with some relying on suboptimal rules and few relying on overall similarity. When children learned a prototype abstraction task, similar to adults, children were able to abstract a prototype. These results suggest that while children are simply not as effective as adults at searching for and applying a categorization rule, when given a categorization task that is not amenable to rule learning, children can perform quite well.

Email: John Paul Minda, jpminda@uwo.ca

4:10-4:25 (121)

Principles of Category Goodness in a Free Classification Task. JOHN P. CLAPPER, *California State University, San Bernardino*—The usual failure to obtain family resemblance sorting in category construction experiments could, at least on its face, be taken as evidence that family resemblance (overall similarity) is not the natural or primitive basis of human categorization. But if not, then what is? These experiments employed a novel category construction task, based on generating binomial labels for objects in a visual display, to investigate four structural principles that could provide a heuristic basis for recognizing (or not recognizing) novel categories. The results showed that people will readily



construct categories on the basis of abstract alignability (Principle 1) and individual matching discrete features (Principle 2), while showing little sensitivity to graded or metric variation (Principle 3) or statistical feature correlations (Principle 4), including standard family resemblance structure. Implications are discussed for current conceptions of family resemblance, category structure, and taxonomic levels; advantages and extensions of the labeling task are also described.

Email: John Clapper, jclappe@csusb.edu

4:30-4:45 (122)

Greater Oxygenation of Prefrontal Cortex During Information-Integration (vs. Rule-Based) Category Learning. COREY J. BOHIL, AUDREY P. HILL and ANDREW J. WISMER, *University of Central Florida*—The COVIS theory of categorization (Ashby et al 1998) posits that verbalizable rule learning is partly mediated by prefrontal cortex (PFC), with nonverbalizable rule learning mediated by subcortical structures. We predicted that PFC activity should decline over time if a verbalizable rule has been selected for use (when this rule-type is adequate for accurate categorization). When a nonverbalizable (implicitly-learned) rule is best, we expect PFC activity to remain at a high level over trials if the learner persists in searching for a verbalizable (but inadequate) rule. Participants completed both (explicit) rule-based and information-integration (i.e., implicit rule based) category learning conditions while hemodynamic response was measured in dorsolateral PFC using functional near infrared spectroscopy. As expected, we found similar levels of oxygenated hemoglobin (HbO₂) in DLPFC early in learning for both conditions. In later blocks, we found higher levels of HbO₂ during the information-integration task than in the rule-based task.

Email: Corey Bohil, corey.bohil@ucf.edu

4:50-5:05 (123)

The Food-Storing Corvid, Clark's Nutcracker (*Nucifraga Columbiana*), Learns an Abstract Same/Different Concept at Small Training Set Sizes. DEBBIE M. KELLY, *University of Manitoba*, JOHN MAGNOTTI and ANTHONY WRIGHT, *University of Texas Medical School at Houston*, JEFFREY KATZ, *Auburn University*—The ability to learn abstract relationships between stimuli is fundamental to higher-order cognition. Previous research on same/different abstract-concept learning has shown a wide range of species capable of this feat, once thought to be unique to humans and nonhuman primates. What differs among species is the size of the training set (e.g., number of unique pictures) to learn the abstract relation. We trained 7 wild-caught Clark's Nutcrackers in a simultaneous visual same/different task with an expanding training set (8, 16, 32, 64, etc.) and assessed relational learning via transfer tests with novel stimuli after learning at each set size. The experimental design was one used previously with monkeys (rhesus, capuchin) and pigeons. The majority of nutcrackers learned the abstract-concept with a training set of 32 and all had learned by training set of 64, surpassing both monkey species (128 set size) and pigeons (256 set size). Although the

ability of nutcrackers is well known for seed-cache recovery, these results indicate an advantage in their ability to learn an abstract same/different relationship as well.

Email: Debbie Kelly, debbie_kelly@umanitoba.ca

5:10-5:25 (124)

Is 798 an Even Number? The Gradedness of Formal Categories in Human Cognition. GARY LUPYAN, *University of Wisconsin-Madison*—It is shown that educated adults routinely make errors in placing stimuli into familiar, well-defined categories such as triangle and odd number. Scalene triangles are often rejected as instances of triangles and 798 is categorized by some as an odd number. These patterns are observed both in timed and untimed tasks and are independent of education and knowledge of how parity is computed. A sizeable minority of people believe that 400 is a better even number than 798 and that an equilateral triangle is the most "trianglest." Such beliefs predict how people conceive other categories having necessary and sufficient conditions, such as the concept of grandmother. These results are difficult to reconcile with the idea that human cognition can be described by context-free computational operations performed on fixed representations. I argue that the distributed and graded nature of mental representations means that human algorithms, unlike conventional computer algorithms, never fully abstract from the specifics of the input. This input-sensitivity is critical to obtaining the kind of cognitive flexibility that characterizes human cognition, but comes at a cost.

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**Organization and Configurality in 2D and 3D Perception
Conference B & C, Friday Afternoon, 3:30-5:30**

Chaired by James T. Townsend, *Indiana University*

3:30-3:45 (125)

A Quantitative Model for Feature and Holistic Pattern Processing in 2-D and 3-D. JAMES T. TOWNSEND, *Indiana University*, MICHAEL J. WENGER, *University of Oklahoma*—Verbal definitions have gone far in helping to investigate object and face perception. Quantitative characterizations of the information processing mechanisms of feature perception have introduced rigorous notions of architecture, stopping rules, independence, and capacity possibly associated with gestalt pattern matching. However, exact distinctions that capture the compelling properties of primary vs. secondary (relational) features vs. holism have been lacking. This study proposes new definitions of these terms and discusses implications from psychological and philosophy-of-science viewpoints.

Email: James T. Townsend, jtowsen@indiana.edu

3:50-4:05 (126)

Configural and Featural Information in Faces: Integrality in Normal Face Processing, Separability in Congenital Prosopagnosia. RUTH KIMCHI, *University of Haifa*, MARLENE BEHRMANN, *Carnegie Mellon University*, GALIA AVIDAN, *Ben Gurion University*, RAMA AMISHAV,

University of Haifa—We examined how configural and featural information interact during face processing in a group of individuals with congenital prosopagnosia (CP) and matched controls, using Garner’s speeded classification task. We replicated the finding (Amishav and Kimchi, 2010) that normal observers evince symmetric Garner interference—failure to selectively attend to features without interference from irrelevant variation in configuration, and vice versa—indicating that featural information and configural information are integral in normal face processing. In contrast, the CPs showed no Garner interference – they could attend to configural information without interference from irrelevant featural information, and vice versa – indicating that featural information and configural information are perceptually separable in CP’s face processing. These results indicate that CPs do not perceive faces holistically; rather, they process featural and configural information independently. This finding not only elucidates the underlying perturbation in CP but also confirms that intact face processing is characterized by the perceptual integrality of configural and featural information.

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4:10-4:25 (127)

Pop Out and Symmetry Breaking in 3D Space. JAMES R. POMERANTZ, *Rice University*—Pop out routinely occurs in visual search for shape singletons, such as an O in a field of Xs, arguably because only one location is activated on a retinotopic feature map. With false pop out, one of the homogeneous distractors pops out instead of (in addition to) the singleton, suggesting pop out is caused not by uniqueness but by symmetry violation. We consider new examples where symmetry breaking occurs in the 3D representation rather than the 2D stimulus plane, noting that identical 2D shapes cannot have identical retinal projections. Pop out may occur after “regression to the real object,” but the real object may be inferred only after correction for distortions beyond just 3D slant in the picture plane, including curvature in depth and even more complex 3D distortions. This may help explain anti-metamer illusions like the Jastrow, where identical shapes look different.

Email: James Pomerantz, pomeran@rice.edu

4:30-4:45 (128)

Pictorial Reliefs as Organized Local Surface Shapes. JOHAN WAGEMANS, *University of Leuven*, ANDREA VAN DOORN, *University of Utrecht*, JAN KOENDERINK, *University of Leuven; University of Utrecht*—Pictorial space—the space one sees when looking into a picture—also contains surfaces articulated in depth. Such pictorial reliefs present a continuous spatial array of local surface shapes. We studied pictorial reliefs of three observers looking at a photograph of a sculpture of a reclining nude, by probing a large number of locations with a continuous “shape index” scale (Exp. 1) and a version with only the five major shape categories: cap, ridge, saddle, rut, cup (Exp. 2). While the continuous judgments are difficult and time-consuming, the categorical distinctions quickly appear in immediate visual awareness. Judgments in

the hyperbolic regions of the stimulus (e.g., the waist area) are more variable than in the elliptic convex or concave regions. Hence, in the microgenesis of pictorial relief, the elliptic convex parts play a major role, while the hyperbolic parts appear as a kind of “glue” between the convex parts or a kind of “background” to them.

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4:50-5:05 (129)

Inhibitory Competition and Feedback in Figure-Ground Perception: fMRI Evidence. LAURA CACCIAMANI, PAIGE E. SCALF and MARY A. PETERSON, *University of Arizona* (read by Mary A. Peterson)—Current figure-ground theories entail inhibitory competition. Remaining questions concern whether grounds are suppressed and whether feedback plays a role. Using fMRI, we tested whether ground suppression in extrastriate cortex varies with the amount of higher-level competition for figural status. Participants performed a difficult RSVP task at fixation while task-irrelevant novel silhouettes appeared in the upper LVF or RVF. Gestalt configural cues favored the silhouette insides as figures; the amount of competition from the grounds varied. In low-competition silhouettes, meaningless objects were suggested in the grounds. In high-competition silhouettes, meaningful objects were suggested in the grounds, but were not consciously perceived. In LH V2, BOLD activation in the ground region was suppressed for high- relative to low-competition silhouettes; this suppression was likely mediated by feedback from higher levels with receptive field sizes large enough to encompass the competing ground objects. (No significant difference was found in RH V2.) These results support figure-ground theories involving ground suppression mediated by feedback.

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5:10-5:25 (130)

The Conjoint Effects of Proximity and Depth on Perceptual Grouping of Ambiguous Dot Patterns. STEVEN K. SCHEID, *University of Virginia*, SERGEI GEPSHTEIN, *Salk Institute*, MICHAEL KUBOVY, *University of Virginia* (read by Michael Kubovy)—The Gestalt psychologists insisted that the whole is other than the sum of its parts. This can be tested using conjoined grouping factors in multi-stable dot lattices where the factors compete or cooperate in producing a global perceptual organization. For example, when the factors of spatial proximity and similarity are conjoined, they operate additively, but when the factors of spatial and temporal proximity are conjoined, they do not. Here we studied dot lattices in which we conjoined grouping by proximity and stereoscopic depth. Briefly presented lattices could be perceived as rows of dots oriented in one of two directions, where each orientation was supported by one grouping factor. We computed the log-odds of reporting grouping in a one orientation rather than the other as a function of the relative strengths of the two grouping factors. We found that their effects combine additively when applied conjointly, but only when proximity is computed for distances in three-dimensional space. We conjecture that additivity may fail



when the conjoined factors produce an emergent perceptual property (a Gestalt) different from the property produced by each factor.

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Action

Grand Centre, Friday Afternoon, 4:10-5:30

Chaired by David Rosenbaum,
The Pennsylvania State University

4:10-4:25 (131)

Hand-to-Hand Cognition. KATE M. CHAPMAN, CHASE J. COELHO and LANYUN GONG, *The Pennsylvania State University*, BREANNA E. STUDENKA, *Utah State University*, DAVID A. ROSENBAUM, *The Pennsylvania State University* (read by David A. Rosenbaum)—Cognition is expressed through action. A primary form of action through which cognitively mediated decisions are expressed is manual object manipulation. As cognitive psychologists, we are attracted to this topic because the same object can be manipulated with different purposes and through different means – with the right hand or left, with one hand or two, and by one person or more than one. In this talk, we present new data that indicate the richness of this domain, including its potential for applications in the study of development, rehabilitation, and robotics.

Email: David Rosenbaum, dar12@psu.edu

4:30-4:45 (132)

Mind Over Motion: Cognitive Context Influences Reach and Grasp Trajectory. MICHAEL E.J. MASSON, DANIEL N. BUB and BERNIE C. TILL, *University of Victoria*—Neuroimaging evidence and neuropsychological case studies support the assertion that there is a clear division of labor between two visual pathways: vision for action (dorsal stream) and vision for perception (ventral stream). We present evidence that rather than operating independently, these two systems engage in a fundamental interaction to produce visually guided actions. Using conformal geometry to analyze the temporal dynamics of reach and grasp actions, we demonstrate that the compatibility between a handled object held in working memory (e.g., a beer mug or a frying pan) and an independently cued manual action (e.g., reaching and grasping a vertical cylinder) powerfully affects both the directional and rotational components of that action. These influences persist throughout the course of the movement and even alter the final grasp posture. The effect of congruency between the cued action and the action associated with the object held in working memory cannot be explained by a simple mixture of the trajectories that define those two actions. Altered trajectories appear to be produced by opposing forces generated by the planned action and by the action representation evoked by the object held in working memory.

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4:50-5:05 (133)

Simple Modifications of Visuals Can Enhance Spatial Orientation Ability in Virtual Environments, Whereas Adding Physical Rotations May Not. BERNHARD E. RIECKE and SALVAR SIGURDARSON, *Simon Fraser University*—Prior research suggests that human spatial orientation (in real and virtual environments) is severely impaired if physical motion cues are missing, to a point that visually simulated rotations in Virtual Reality are not updated (Klatzky et al., 1998), indicating “non-turner” behavior. Using a paradigm similar to Klatzky, participants viewed visually displayed passive movements through an optic flow field (with and without matching physical rotations) before pointing to the invisible origin. While adding physical rotations did not provide any benefit, replacing optic flow with a naturalistic yet landmark-free city environment reduced updating failures from 35% to 10% of trials. Even adding minimal structure to the optic flow environment by drawing the path on the ground reduced task difficulty and decreased updating failures by more than half (35% to 15% of trials). Results suggest that physical motions do not necessarily enhance spatial orientation ability, although even simple modifications of the visuals can.

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5:10-5:25 (134)

Symbolic Distance Effect for Action Words. MARTINA RIEGER, BIANCA SCHMIED and KATJA SAXL, *University of Health Sciences, Medical Informatics and Technology*—The time necessary to discriminate between stimuli on a certain dimension increases as the similarity of the stimuli on that dimension increases (symbolic distance effect). Does the symbolic distance effect occur for action words, which are compared in terms of bodily effort? A group of participants rated the bodily effort of action words. Based on those ratings, words were combined in pairs according to 4 different degrees of similarity in bodily effort. Another group of participants was asked to indicate which action word of each pair requires less/more bodily effort. A symbolic distance effect for actions words was observed: Participants had longer decision times the more similar the action words were in terms of bodily effort. The results are in line with the embodied approach to language comprehension, according to which action words partially reactivate the motor state that produces the denoted action.

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Letter and Word Processing I

Grand West, Saturday Morning, 8:00-9:40

Chaired by Simon Liversedge, University of Southampton

8:00-8:15 (135)

Binocular and Monocular Viewing Effects on Parafoveal and Foveal Word Identification During Normal Reading.

JAINTA STEPHANIE, *Leibniz Research Centre for Working Environment and Human Factors*, HAZEL I. BLYTHE and SIMON P. LIVERSEDGE, *University of Southampton* (read by Simon P. Liversedge)—During normal reading, vergence eye movements establish overlap between the eyes' inputs for a unified percept of the text to be perceived. Binocular fusion typically leads to superior performance (the binocular advantage). We examined the binocular advantage in reading; specifically, we compared binocular and monocular reading as binocular eye movements were recorded. We included a frequency manipulation and a gaze-contingent sentential manipulation in which viewing changed from monocular to binocular (and vice versa) part-way through each sentence. We observed a stronger frequency effect in binocular than in monocular viewing conditions, but this did not modulate vergence movements. Importantly, we also found that the viewing condition in the parafovea (monocular or binocular) affected the time course of the word frequency effect, as well as affecting processing of the word once directly fixated.

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8:20-8:35 (136)

Properties of the Writing System Determine the Overlap of the Speech and Reading Systems in the Brain.

STEPHEN J. FROST and PETER J. MOLFESE, *Haskins Laboratories*, PEDRO PAZ-ALONSO, *Basque Center on Cognition, Brain and Language*, ATIRA BICK, *Hebrew University*, WEN-JUI KUO, *National Yang-Ming University*, KENNETH R. PUGH, *Haskins Laboratories & University of Connecticut*, JAY G. RUECKL, *University of Connecticut; Haskins Laboratories* (read by Jay G. Rueckl)—Reading involves mapping between visual forms and the speech sounds of the language that they represent. Indeed, studies in English have shown that reading skill can be indexed by the degree of overlap between the reading and speech systems in both emergent readers (S. Frost et al. 2009) and adults (Shankweiler et al. 2008). In this fMRI experiment, we examined whether print-speech overlap differs for readers of different writing systems. Native speakers of Spanish, English, Hebrew, and Mandarin Chinese made animacy judgments about printed and spoken words. The results revealed that reading evoked largely similar patterns of activation, although notable language-related differences were also observed. Similarly, the pattern of print-speech overlap was also largely similar across languages, although again language-specific differences were also noted. The results are interpreted within the Orthographic Depth and Division of Labor hypotheses and reveal how the organization of the word reading system is shaped by the statistical properties a reader's linguistic environment.

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8:40-8:55 (137)

Reading Sentences With Jumbled Words in a Serial Modality (Braille).

MANUEL PEREA and MARÍA JIMÉNEZ, *Universitat de València*, MIGUEL MARTÍN-SUESTA, *Spanish National Organization of the Blind*, PABLO GOMEZ, *DePaul University*—When text is presented visually, the reading process easily adjusts to the jumbling of some letters, thus producing only small costs on reading (Rayner, White, Johnson, & Liversedge, 2005). Two explanations have been proposed: one relies on a general mechanism of perceptual uncertainty at the visual level, and the other focuses on the activation of “open bigrams” at an abstract level of representation. These two explanations make differential predictions about reading serially presented text. The most natural way to analyze this is through a reading modality like Braille, which is read serially. In the present experiment, blind readers read sentences presented on a Braille display, which tracked the finger position. The sentences were either intact or involved letter transpositions. Results revealed a substantial reading cost in the sentences with transposed-letter words. The lack of a flexible process of letter position coding in Braille adds evidence to “perceptual uncertainty” models.

 Email: Manuel Perea, mperea@uv.es

9:00-9:15 (138)

Parafoveal Processing of Spaced Compounds.

DENIS DRIEGHE, MICHAEL G. CUTTER and SIMON P. LIVERSEDGE, *University of Southampton*—This study investigated n+2 preview benefit in reading spaced English compounds embedded in sentences, when word n+2 is the second constituent of a spaced compound (e.g. “bear” in “teddy bear”). The study used a 2 (n+1 preview: identity vs. non-word) X 2 (n+2 preview: identity vs. non-word) design in order to test whether n+2 preview benefit occurs in such items, and whether this was licensed by the availability of the first constituent. Prior n+2 boundary studies have only found an n+2 preview benefit when word n+1 was short and highly frequent. In our study n+1 was neither short nor highly frequent. Nevertheless, an n+2 preview benefit was observed when an accurate preview of word n+1 was available. We argue that this novel finding is due to spaced compounds being processed as a single lexicalised element. The implications of these findings for the serial-parallel lexical processing debate will be discussed.

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9:20-9:35 (139)

Unlimited Capacity Parallel Quantity Comparison of Multiple Integers.

DALE J. COHEN and DARYN BLANC-GOLDHAMMER, *University of North Carolina at Wilmington*—Research has shown that integer comparison is quick and efficient. This efficiency may be a function of the structure of the integer comparison system. The present study tests whether integers are compared with an unlimited capacity system or a limited capacity system. Our data suggest that integers are encoded, identified, and compared within an unlimited capacity system.

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Inhibition of Thought

Grand East, Saturday Morning, 8:00-9:20

Chaired by Steven Smith, Texas A&M University

8:00-8:15 (140)

Alleviating Fixation With Suppression-Induced Forgetting of Blockers. GENNA ANGELLO, *Texas A&M University*, BENJAMIN C. STORM, *University of California, Santa Cruz*, STEVEN M. SMITH, *Texas A&M University* (read by Steven M. Smith)—How can fixation be alleviated other than by heavily presenting hints in the form of solutions, which are not known beforehand in naturalistic cases? Two experiments examined relief from fixation in a memory blocking task (Smith & Tindell, 1997). Blockers, or orthographically similar negative primes (e.g., ANALOGY), blocked solutions to word fragments (e.g., A_L__GY) in both experiments. After priming, but before the fragment completion test, participants repeatedly suppressed half of the blockers using the Think/No-Think paradigm (Anderson & Green, 2001). Suppressing the blockers did not allow participants to overcome fixation in Experiment 1 when negative primes were not mentioned at fragment completion. In Experiment 2, however, when participants were encouraged to remember negative primes at fragment completion, relief from fixation was observed. These results suggest that the negative effects of fixation can only be countered by memory suppression when explicit recollection is the cause of fixation.

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8:20-8:35 (141)

Suppressing Unwanted Memories Reduces Their Unconscious Influence via Targeted Cortical Inhibition. PIERRE GAGNEPAIN, *INSERM, France*, RICHARD HENSON and MICHAEL C. ANDERSON, *MRC Cognition and Brain Sciences Unit, Cambridge University* (read by Michael C. Anderson)—Suppressing retrieval of unwanted memories engages mechanisms that impair their later conscious recall. It remains unknown, however, whether these motivated forgetting mechanisms also disrupt a memory's unconscious influences. Using functional magnetic resonance imaging, we found that suppressing awareness of memories for everyday visual objects reduced their later influence on perception, and disrupted neural markers of unconscious memory normally observed in visual cortex. Effective connectivity analyses established that retrieval suppression recruited right dorsolateral prefrontal cortex to inhibit activity in neocortical areas involved in perceiving objects, whereas representational similarity and computational analyses, showed that this inhibition targeted neural populations most activated by reminders. These findings establish a neurobiological model of how motivated forgetting affects the unconscious influence of unwanted memories.

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8:40-8:55 (142)

Thought Suppression Increases the Frequency of Having Songs Stuck in One's Head. IRA E. HYMAN and KAYLEIGH I. CUTSHAW, *Western Washington University*—We explored

how thought suppression contributes to having a song stuck in one's head. In a survey we asked individuals about the frequency of involuntary thoughts, including having a song stuck in one's head. Involuntary thoughts were correlated with each other and with the White Bear Suppression Inventory. In an experimental study, participants listened to two popular songs or listened while performing a cognitive task. People who worked on a cognitive task while listening were more likely to have the song return to awareness later – potentially a rebound effect after suppressing the song during the original task. In a second experimental study, we replicated this suppression effect and found that the effect occurred for both popular and for disliked songs. Keeping background music from entering awareness increased the return of those songs as intrusive thoughts.

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9:00-9:15 (143)

When the Muse Strikes: Ideas of Physicists and Writers Regularly Occur During Episodes of Mind-Wandering. JONATHAN W. SCHOOLER, SHELLY L. GABLE, ELIZABETH HOPPER and MICHAEL D. MRAZEK, *University of California, Santa Barbara*—A web-based field study asked 45 physicists and 53 writers to complete a daily creativity journal for two weeks that queried them about the situations surrounding the occurrence of their ideas. The results revealed that approximately 30% of participants' ideas occurred during situations that could be characterized as mind-wandering; i.e. when they were thinking about something unrelated to the idea or problem. Overall there were no significant differences in the overall self-assessments of the quality of ideas as a function of when they occurred. However, relative to ideas that were generated when individuals were focused on the problem they were working on, ideas generated during mind-wandering were significantly more likely to be characterized both as breaking an impasse and as involving an "aha" type experience. Research is currently under way to assess how these ideas were recalled and assessed when participants were re-contacted six months after the ideas were generated. These findings converge with laboratory and anecdotal evidence in suggesting that mind-wandering may provide an important source of creative inspiration.

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Explicit Memory I

Grand Centre, Saturday Morning, 8:00-10:00

Chaired by Lynne Reder, Carnegie Mellon University

8:00-8:15 (144)

Brain Activity During Testing Predicts Later Learning Success. XIAONAN L. LIU, *Carnegie Mellon University*, PEIPENG LIANG and KUNCHENG LI, *Xuanwu Hospital, Capital Medical University*, LYNNE M. REDER, *Carnegie Mellon University* (read by Lynne M. Reder)—People learn better when re-study opportunities are replaced with tests. While researchers have begun to speculate on why testing is superior to study, few studies have directly examined the neural underpinnings of this effect. In this fMRI study, subjects engaged in a study phase to learn arbitrary word pairs, followed by a cued recall test (recall second half of pair when

cued with first word of pair), followed by immediate feedback in the form of a re-study of the pair, and finally another cycle of cued recall tests. Brain activation patterns during first test recall attempts predicted performance on the second test. Importantly, more brain regions were identified during testing that predict later memory success than were regions identified during study. The additional regions that predict subsequent memory based on their activation at test but not at encoding may be key to understanding the basis of the testing effect.

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8:20-8:35 (145)

Deactivation of the Default Mode Network Predicts Individual Differences in Long-Term Memory. KATHLEEN B. MCDERMOTT, STEVEN M. NELSON, NEIL K. SAVALIA, ANDREW K. FISHELL and FAN ZOU, *Washington University in St. Louis*—Although many neuroimaging studies have used fMRI measures to predict subsequent memory performance, relatively few have examined differences across subjects at encoding that lead to differences in performance on a final test. Here, participants studied word pairs and were tested on these pairs prior to a re-study trial. Subjects returned to the laboratory approximately 48 hours later for a final test. The fMRI signal during the initial study phase was predictive of final recall performance. Regions of the default mode network, spanning ventromedial prefrontal cortex, medial and lateral parietal cortex, as well as superior frontal and lateral temporal cortex predicted number of items recalled. These regions showed greater deactivations during the initial study phase in subjects with better memory performance. Reduced deactivation may be a hallmark of ineffective encoding attempts in healthy young adults; this may help us better understand the role of the default mode network in long-term memory.

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8:40-8:55 (146)

The Attentional Boost Effect With Verbal Materials. NEIL MULLIGAN, *University of North Carolina*, PIETRO SPATARO, *University of Rome*, MILTON PICKLESIMER, *University of North Carolina*—Study stimuli presented at the same time as unrelated targets in a detection task are better remembered than stimuli presented with distractors. This attentional boost effect (ABE) has been found with pictorial (Swallow & Jiang, 2010) and more recently verbal materials (Spataro et al., 2013). The present experiments examine the generality of the ABE with verbal materials and critically assess the visual-encoding hypothesis, the notion that the memory benefits are due to enhanced encoding of the visual properties of the study stimulus. Experiment 1 demonstrated an ABE with visual study items, comparable in size whether the recognition test was visual or auditory. Experiment 3 established an ABE for auditory study stimuli, which was again equivalent for auditory and visual recognition tests. Experiments 2 and 4 found an ABE on the test of free recall. Finally, the ABE was greater for high frequency than low frequency words. The results demonstrate the generality of the ABE over study and test modality, and over memory tests (recognition and free recall), while also documenting a

moderating factor (word frequency). Importantly, the basis for the ABE for verbal materials does not appear to be enhanced visual encoding. Other potential explanations (e.g., enhanced contextual binding) are discussed.

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9:00-9:15 (147)

Creative Thinking Causes Forgetting. BENJAMIN C. STORM and TRISHA N. PATEL, *University of California, Santa Cruz*—A new phenomenon is demonstrated in which attempting to think of new uses for an object causes participants to forget other uses for that object. In an adapted version of the Unusual Uses Task, participants studied several common uses of objects (e.g., brick, paper clip) before attempting to generate new uses for half of those objects. As shown by performance on a final cued-recall task, generating new uses caused participants to forget the studied uses. This forgetting effect was replicated several times across a number of conditions and occurred whether participants were instructed to think of highly creative and unusual uses or everyday common uses. It even occurred when participants were instructed to use the studied uses as hints or mediators while generating new uses. These findings are surprising in many ways and have important implications for understanding the interplay of memory and creativity.

Email: Benjamin Storm, bcstorm@ucsc.edu

9:20-9:35 (148)

Frontal and Medial Temporal Contributions to Memory for Actor-Action Associations. ALAN W. KERSTEN, JULIE L. EARLES and CLEOPATRE PAULVIN, *Florida Atlantic University*—This research examined relations between performance on a test of associative memory for actors and their actions and performance on composite measures of frontal and medial temporal functioning, developed by Glisky et al. (1995). Young adult participants viewed a series of brief events, each involving an actor performing a simple action such as watering a plant or cutting a string. The critical test items in a later recognition memory test involved an action seen earlier, but now performed by an actor who had previously been seen doing something else. Discrimination of these conjunction items from old items was used as a measure of associative memory performance. Memory for actor-action associations was significantly correlated with medial temporal functioning but not with frontal functioning. These results differ from prior research on source memory, which has revealed a crucial role for frontal functioning. Possible explanations for the different results include the more integral nature of the actor/action stimuli in the present research, as well as the greater difficulty in applying encoding strategies in the context of the larger number of actors and greater diversity of actions employed in the present research.

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9:40-9:55 (149)

Effects of Reminding During Repetition and Interference: The Role of Context. JACOB NEGLEY and COLLEEN M. KELLEY, *Florida State University* (read by Colleen M. Kelley)—Being reminded of an earlier event by a current event has



benefits for memory that can transform proactive interference into proactive facilitation (Wahlheim & Jacoby, 2013). We assessed the role of context in reminding. Participants studied two lists of word pairs that included pairs repeated from an earlier list (A-B, A-B), pairs with the same cue but a changed response (A-B, A-D) and control pairs (A-B, C-D). Word pairs were presented against background photographs that either matched or mismatched across repetitions and across changed pairs. Matching contexts increased the detection of change for A-B, A-D pairs, increased the recollection of change at test, and eliminated interference in recall.

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Bilingualism

Dominion Ballroom, Saturday Morning, 8:00-9:40

Chaired by Dan Weiss, *The Pennsylvania State University*

8:00-8:15 (150)

Detecting New Structures in Statistical Learning: The Challenge for Bilingual Learners. DANIEL J. WEISS, TIM POEPEL and BEN ZINSZER, *The Pennsylvania State University*—Numerous empirical demonstrations over the past two decades have confirmed that infant and adult language learners are able to track the distributional properties of their linguistic input. With few exceptions, however, most studies of statistical learning have created underlying structures that are uniformly distributed across the input corpus, such that sampling at any point during the learning phase yields identical structural information. However, this uniformity property of the input does not reflect the substantial variability inherent in natural language corpora, particularly in the case of bilingual acquisition. In several statistical learning experiments, we test how learners decide how many causal models best characterize distributional information in the input. Our results show that language learners are sensitive to structural changes in speech input and may posit multiple underlying causal models when the environment provides repeated alternations in structure, thus providing a critical link between models of statistical learning and real-world acquisition.

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8:20-8:35 (151)

Distributional Patterns in Production Impact Comprehension: Evidence From Spanish-English Codeswitching. PAOLA E. DUSSIAS, *The Pennsylvania State University*, ROSA E. GUZZARDO TAMARGO, *University of Puerto Rico*—Growing evidence suggests that frequency of exposure to certain word combinations modulates comprehension difficulty (MacDonald & Thornton, 2009). We investigate this claim by examining a particular phenomenon observed during bilingual interactions called codeswitching (the alternation of two languages in discourse). Using codeswitching allows us to disassociate grammar from usage (Newmeyer, 2006). Proficient Spanish-English bilinguals were recruited. Eye-movements were recorded while participants read switches involving the Spanish *estar* 'be' and an English participle (frequent code-switches) and the Spanish *haber* 'have' and an English participle (infrequent switches).

Findings showed that frequently produced code-switches were easier to comprehend (measured by gaze duration and regression path) than infrequent switches. This is congenial with exposure-based model of processing in which linguistic experience plays a crucial role in language comprehension (e.g., Gennari and MacDonald, 2009). Results are discussed in terms of the constraints that may be responsible for the distributional patterns of codeswitches found in production.

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8:40-8:55 (152)

How the Mind and the Brain Negotiate Competition for Selection in Bilingual Speech. JUDITH F. KROLL and ELEONORA ROSSI, *The Pennsylvania State University*—

Although proficient bilinguals are able to speak fluently in each of their two languages, recent studies suggest that both languages are continually active, to the point where the unintended language is often on the tip of the speaker's tongue. In this talk, we describe recent behavioral, ERP, and fMRI evidence on bilingual speech planning that suggests that alternatives in each language are planned but that the native or more dominant language is inhibited to allow the weaker language to be spoken. The goal of the research we report is to identify the time course and scope of the inhibitory processes that enable language production to proceed with skill. Our findings suggest that, in addition to local inhibition, there is global inhibition that extends over time and beyond the level of individual words or semantic categories to the entire dominant language.

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9:00-9:15 (153)

Second Language Readers Capitalize on Some but Not All Sources of Emotional and Sensorimotor Information During Natural Sentence Reading. NAVEED SHEIKH and DEBRA TITONE, *McGill University* (read by Debra Titone)—

We recently reported that the usual cost of reading abstract vs. concrete words in a first language (L1) was reduced when abstract words were emotionally charged (Sheikh & Titone, 2013). This suggests that feedback from semantics, grounded in emotional and sensorimotor experiences, facilitates word processing (Kousta et al., 2011; Zdravilova & Pexman, 2013). We now examine second language (L2) readers, for whom semantic feedback should be weaker compared to L1 readers due to reduced L2 experience. A total of 34 L2 participants (French L1) and 43 L1 controls read English words in neutral sentences. Both L2 and L1 readers showed shorter gaze duration for abstract positive words compared to abstract neutral words. However, L2 readers showed no gaze duration advantage for abstract negative words. Moreover, both L1 and L2 readers showed shorter gaze duration for concrete vs. abstract words overall, though this effect was smaller for L2 readers with low L2 proficiency. Taken together, these findings suggest that L2 readers capitalize on some but not all embodied sources of semantic richness during natural reading.

Email: Debra Titone, debra.titone@mcgill.ca

9:20-9:35 (154)

Prediction of Objective Bilingual Language Proficiency: Can Self-Report Measures Suffice? WENDY S. FRANCIS and ELVA N. STROBACH, *University of Texas at El Paso*—The extent to which self-reported language proficiency explains performance on objective language assessments was evaluated in a large sample of proficient and non-proficient speakers of English and Spanish. Participants completed three types of self-ratings of proficiency, answered questions about their language background and current usage, and were administered the brief version of the Woodcock-Muñoz Language Survey Revised (WMLS-R) in both English and Spanish. The rating types were absolute proficiency ratings, relative proficiency ratings, and performance prediction ratings. All three rating types explained significant and substantial variance in performance on the WMLS-R and the difference between English and Spanish performance. Other self-reported background variables explained additional variance in WMLS-R performance. The question remains whether objective assessments provide enough additional information above and beyond self-reported information to justify the time and resources necessary for their administration.

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Action and Perception I

Civic Ballroom, Saturday Morning, 8:00-10:00

Chaired by Natalie Sebanz, *Central European University*

8:00-8:15 (155)

Perception-Action Matching at an Intergroup Level: The GROOP Effect. NATALIE SEBANZ, *Central European University*, JESSICA CHIA-CHIN TSAI, *National Science Council, Taipei*, GÜNTHER KNOBLICH, *Central European University*—Research on perception-action links has focused on the interpersonal level, demonstrating effects of observing individual actions on performance. The present study investigated perception-action matching at the inter-group level. Pairs of participants responded to hand movements that were either performed by two individuals who used one hand each or they responded to hand movements that were performed by an individual who used both hands. Apart from the difference in the number of observed agents, the observed hand movements were identical. If co-actors form action plans that specify the actions to be performed jointly, then participants should have a stronger tendency to mimic joint actions than individual actions. Confirming this prediction, the results showed larger mimicry effects when groups responded to group actions than when groups responded to otherwise identical individual actions. Further experiments showed that the tendency to mimic group actions is restricted to in-group members. Overall, the results suggest that joint task representations modulate automatic perception-action links and can facilitate mimicry at an inter-group level.

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8:20-8:35 (156)

Temporal Coordination in Musical Ensembles: Influence of Group Roles and Individual Differences. CAROLINE PALMER, FRANCES SPIDLE, ERIK KOOPMANS and PETER SCHUBERT, *McGill University*—How do musicians coordinate their timing with other performers? Performers often adopt roles, such as that of a conductor or leader; we test how these roles influence group synchronization. Individual differences displayed in musicians' solo performances may also influence their group synchronization. We compared Solo and Duet performances by experienced vocalists who sang a familiar melody; in the Duet performances, each participant was assigned the role of Leader and of Follower in different trials. The Leader's tone onsets preceded those of the Follower by a small but consistent amount (10-20 ms), indicating tight synchrony. The pattern of cross-correlations between the Leader and Follower's beat durations indicated mutual adaptation between vocalists, despite the Leader/Follower instructions. Finally, the amount of asynchrony in the Duet performances correlated highly with differences in individuals' Solo performance tempo. Successful temporal coordination may therefore rely on both mutual adaptation abilities and individual behavioral predispositions.

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8:40-8:55 (157)

Evaluating Human Decision-Making Theories With Monkey Data. SCOTT D. BROWN, PETE CASSEY and ANDREW HEATHCOTE, *The University of Newcastle*, ROGER RATCLIFFE, *The Ohio State University*—Models of decision-making based on evidence accumulation have a long history of success with behavioural data from humans. More recently, these models have been given neurophysiological interpretations, evaluated by data collected from the neurons of awake, behaving monkeys. The neurophysiological data might help constrain the models and inform further development, however the process of linking the models with the neural and behavioural data is complex. We re-examined new evidence from a monkey study that has been interpreted as ruling out standard evidence accumulation models. More careful examination of the links between data and theory show that these data can be reconciled with standard evidence accumulation models after all. The key to the new analysis is considering precisely what the monkey participants might have been doing in the task, rather than assuming that they were doing as instructed.

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9:00-9:15 (158)

Functional Specificity in Perception by Means of a Wielded Object. JEFFREY B. WAGMAN, *Illinois State University*, ALEN HAJNAL, *University of Southern Mississippi*, DANIEL G. JACKSON, *Illinois State University*—Perception of properties of a wielded object is largely independent of the anatomical components used to wield that object. We investigated whether perception of properties by means of a wielded object also exhibits anatomical independence. Specifically, we compared perception of stand-on-ability of an inclined surface by means of an object wielded by different anatomical



components. Perceptual boundaries were comparable when the object was wielded with the preferred or non-preferred hand (Experiment 1), one or both hands (Experiment 2), different grasp configurations (Experiment 3), the preferred or non-preferred foot (Experiment 4), and the preferred hand or preferred foot (Experiment 5). Moreover, in each case, minimum confidence and maximum response latency occurred within the range of the perceptual boundary. The results suggest that perception by means of a wielded object is functionally specific and are consistent with a description of the touch system as a smart perceptual instrument.

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9:20-9:35 (159)

Unpredictable Response-Effects Influence Subsequent Behavior. JAMES D. MILES and KIM-PHUONG VU, *California State University, Long Beach*—Expectations of the outcome of an action, known as action or response effects (R-E), can directly influence response behavior. In two experiments, we demonstrate that the compatibility between a response and an unexpected effect can also influence performance by moderating the size of stimulus-response (S-R) compatibility effects on a subsequent trial. This is the case when response effects are physical locations preceding a location-based S-R compatibility task and when they are spatial words preceding a spatial word-based S-R compatibility task (Exp 1). However, unexpected R-E compatibility does not influence subsequent performance when the stimulus type changes (Exp 2). We suggest that individual R-E events are used strategically to modulate the influence of spatial information on subsequent S-R task performance even when response effects are task-irrelevant and unanticipated.

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9:40-9:55 (160)

The Advantages of Embodied versus Disembodied Imagery for EEG Brain-Computer Interface Control. MICHAEL K. MCBEATH and FLAVIO J.K. DA SILVA, *Arizona State University*—We tested ability to learn systematic control of movement of a computer cursor using an EEG-based brain-computer interface. Embodied imagery has advantages over disembodied imagery because it closely couples imagery to physical characteristics of movement, while disembodied imagery may be superior at providing EEG signals that are more easily distinguishable. We compared ability to learn to systematically control movement of the computer cursor within two-hour training periods for 12 participants using embodied imagery, 12 using disembodied imagery, and 12 physical movement controls. We found a significantly larger proportion of disembodied imagers versus embodied imagers were able to learn to control cursor movement during the training period. In contrast, embodied imagery resulted in greater subsequent improvements in the ability to physically perform the task. Our findings support that if the goal of EEG control training is to augment a kind of physical therapy or motor recovery, then coupled embodied imagery is advantageous. However, if the goal is to augment

a kind of occupational therapy or compensatory control, then the flexibility of disembodied imagery allows more reliable learning of robustly discriminable EEG signals.

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Animal Learning and Cognition

Conference B & C, Saturday Morning, 8:00-10:00

Chaired by Michael Brown, Villanova University

8:00-8:15 (161)

Spatial Search Under the Influence of Social Information. TEAGAN A. BISBING and MICHAEL F. BROWN, *Villanova University* (read by Michael F. Brown)—Previous experiments from our laboratory demonstrate a significant but small influence of one rat's search behavior on the spatial choices made by a second rat. A complication is that two countervailing effects appear to be important. Rats are attracted to locations where another rat is present but, on the other hand, avoid visits to locations visited earlier by the other rat when the other rat's visits result in depletion of the food in those locations. In the experiment presented here, five baited locations among 25 locations were baited but were not depleted when chosen. The baited locations were fixed over trials for each Model rat, but varied over trials for each Subject rat. Thus, the behavior of the models provided information about the baited locations. Choices made by the Model rats had strong effects on the choices of the Subject rats. The role of social memory in those effects will be explored.

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8:20-8:35 (162)

Observation Learning by Rats in a Foraging Situation. MARK R. COLE, CORRINE KESHEN, SARAH BUCK and MICHELLE PHILLIPS, *Huron University College at Western*—Observer rats observed expert demonstrator rats (cagemates or non-cagemates) forage for food on top of 12 towers arranged in a circle. 6 towers, randomly located, were striped and baited; 6 towers were white and sham baited. The observer rats foraged among the re-baited, and re-arranged, towers almost immediately after observing the demonstrators (Experiment 1) or after a delay of 24 hours (Experiment 2). In both experiments, observers found the baited towers significantly more often in their first 6 choices than the demonstrators had during their learning trials. In Experiment 1, observers performed better after watching a non-cagemate than a cagemate. Experiment 3, was a replication of Experiment 1 except that all observers and demonstrators were non-cagemates and all towers were white with a randomly chosen, but thereafter fixed, pattern of 6 baited towers. With pattern, as opposed to visual cues, observer rats failed to profit from observing demonstrators.

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8:40-8:55 (163)

Three-Stimulus Midsession Reversal of Visual and Spatial Discriminations in Pigeons. NEIL MCMILLAN and WILLIAM A. ROBERTS, *Western University*—It has been shown previously that pigeons make surprising anticipatory

and perseverative errors on a visually based midsession reversal task. More recent evidence suggests that fewer errors are made on this task when the animal is able to spatially orient during the intertrial interval (e.g., a spatial discrimination in the operant chamber) than when it is not (e.g., a visual discrimination). We have shown that anticipatory and perseverative errors also occur in a three-stimulus task (red, green, blue) with two reversal points each session. By testing the birds with a 400-s delay at the start of the session or a 200-s gap after the first reversal, we found that pigeons' choices on this task were largely controlled by interval time since first being placed in the operant chamber rather than the order of correct stimuli across the session. Differential effects in birds trained with a spatial (left/centre/right) vs. visual (red/green/blue) discrimination will be discussed.

Email: Neil McMillan, nmcmill2@uwo.ca

9:00-9:15 (164)

Non-Matching-to-Sample Abstract-Concept Learning in Pigeons. THOMAS A. DANIEL, *Auburn University*, ANTHONY A. WRIGHT, *University of Texas Medical School at Houston*, JEFFREY S. KATZ, *Auburn University* (read by Jeffrey S. Katz)—Pigeons were trained on a non-matching-to-sample (NMTS) task through a set-size expansion method previously used in same/different (S/D) and matching-to-sample (MTS) tasks. After reaching criterion performance (85% accuracy) with 3 items (cartoons), novel-item transfer tests were conducted. Then, a pattern of doubling the training set and novel-item testing was repeated 8 times to the final 768-item set. Pigeons were grouped based on whether they were naïve or experienced (same/different task). Both groups showed full-concept learning by the 384-item set-size, and the naïve group showed full-concept learning as early as the 24-item training set. Naïve birds' performance benefited from higher levels of early transfer in part due to the oddity preference effect. Further analyses show differences between these groups gradually dissipate once subjects began to apply relational rules. Transfer functions compared across MTS, S/D, and NMTS reveal the functional relationships of set size on abstract-concept learning.

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9:20-9:35 (165)

Measurement of Delay Discounting: Methodological Issues. KIMBERLY KIRKPATRICK, *Kansas State University*—Delay discounting measurements rely on a number of different methods including both systematic and adjusting manipulations of delay to and/or magnitude of reward. The key assumption is that the different methods assess the same core processes, but this has not been explicitly tested. We examined several methodological issues that may affect choice behavior in delay discounting procedures in rats including the initial choice parameters, schedule of adjustment of delays to reward, and reward magnitude contrast effects. Initial choice parameters produced a large biasing effect on choice behavior that persisted throughout the study. Reward magnitude contrast and delay adjustment schedule further affected choice behavior in subsequent choice phases. Although the different

procedures may tap into some common processes, there are also systematic deviations created by procedural factors that may impact on discounting measurements.

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9:40-9:55 (166)

Differences in Uncertainty Monitoring by Rhesus Monkeys (*Macaca mulatta*) and Capuchin Monkeys (*Cebus apella*): It's Not a Chance Thing. MICHAEL J. BERAN and BONNIE M. PERDUE, *Georgia State University*, BARBARA A. CHURCH and J. DAVID SMITH, *University at Buffalo, SUNY*—Studies have indicated that rhesus monkeys (*Macaca mulatta*) but not capuchin monkeys (*Cebus apella*) respond to difficult or ambiguous situations by choosing not to respond or by seeking more information. We assessed whether a task in which the chance of randomly making a correct response was low might diminish this species difference, presumably indicating that capuchins may be less risk averse rather than less uncertain compared to macaques. Monkeys searched for the largest of six stimuli on a computer screen. Trial difficulty was varied, and monkeys could choose to opt out of any trial. All rhesus monkeys, including some with no prior use of the uncertainty response, selectively avoided the most difficult trials, and increased their overall performance levels by doing so. The majority of capuchins rarely made uncertainty responses, and those that did showed lower levels of uncertainty responding than rhesus monkeys, particularly for the most difficult trials.

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Selective Attention II

Grand West, Saturday Morning, 10:00-12:00

Chaired by Zhe Chen, *University of Canterbury*

10:00-10:15 (167)

Attentional Focus Modulates Distractor Dilution. ZHE CHEN, *University of Canterbury*, KYLE R. CAVE, *University of Massachusetts*—In visual search there is a close link between display set size and the amount of distractor processing: increasing the number of neutral stimuli decreases distractor interference. Recent findings favor a dilution account for this pattern, which is based on a degradation in distractor representation, rather than a perceptual load account based on a reduction in spare resources. In several experiments, we show that the extent of attentional focus modulates distractor dilution. Increasing the number of neutral items decreased distractor processing only when a task induced a broad attentional focus that included the neutral stimuli, or when participants had to switch attention from a cued location to an uncued location. Subsequent experiments further indicated that dilution occurred at a semantic or response level instead of at a feature level, and that both target and distractor processing appeared to start from the onset of the target display.

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10:20-10:35 (168)

Attention Guided by Color Can Prevent Dilution From Distractors. KYLE R. CAVE, *University of Massachusetts*, ZHE CHEN, *University of Canterbury*—Visual target identification



is subject to distractor interference, but that interference can be diminished by other objects in the display. Previous experiments showed that this “dilution” can be limited by a spatial cue that focuses attention narrowly, excluding the extra objects. Our new experiments show that dilution can also be limited if the color of the target is known in advance, allowing efficient selection. Also, if attention is spatially cued but the target appears elsewhere, color grouping can quickly guide attention to the target location, thus avoiding attention to other parts of the display and the dilution that would result. This use of color grouping does not require foreknowledge of the target color. In sum, color can be used quickly to limit attention and prevent dilution. The influence of visual distractors is subject to attentional control, and their dilution provides new clues to how broadly attention is distributed.

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10:40-10:55 (169)

Cognitive Control of Distraction: How Does Task-Engagement Modulate the Effects of Between-Sequence Semantic Similarity? JOHN E. MARSH, *University of Central Lancashire*, PATRIK SÖRQVIST, *University of Gävle*, ROBERT W. HUGHES, *Royal Holloway, University of London*—Two experiments investigated the influence of top-down cognitive control on two effects of task-irrelevant speech on the immediate free recall of visually-presented words: the propensity for spoken distracters semantically related to the target words to be falsely recalled and the disruptive effect of such distracters on correct recall. These effects have previously been considered to be functionally independent. However, Experiment 1 demonstrated that promoting focal task-engagement by reducing the perceptual discriminability of the target words eliminated the disruption by distracters of correct recall and attenuated their false recall. To investigate whether the benefit of task-engagement was due to output monitoring processes or constraints on access, a recall test that eliminates the requirement of monitoring was adopted in Experiment 2. Rates of false recall were much greater than in Experiment 1 but the general pattern of results remained the same. Taken together, the results show that one way in which task-engagement reduces semantic distraction is through constraints on access: the promotion of task-engagement at study blocks distracters at encoding thereby preventing them from coming to mind at test. The results are discussed within a distinctive-processing framework.

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11:00-11:15 (170)

Disengagement of Attention From Emotion-Expressing Faces. ALBRECHT W. INHOFF, *Binghamton University, SUNY*, CASEY SCHOFIELD, *Skidmore College*, MEREDITH COLES, *Binghamton University, SUNY*—Effects of emotional content on the orienting of attention are well documented, attention being more effectively oriented toward emotion-expressing than neutral images. To examine the subsequent disengagement of attention, an emotion-expressing and a neutral face were presented to the right and left of a central fixation for 1500ms (per trial). Eye movement recordings

showed a strong initial viewing preference for the left visual field and a subtle preference for the emotion-expressing face. Growth curve analyses, used to model face viewing preferences over time, revealed that the subsequent disengagement of attention was also influenced by visual field and emotional content. Attention was less effectively disengaged when an initially viewed face was in the left visual field and when it expressed an emotion. Furthermore, socially anxious participants were more likely to disengage from the emotion-expressing face than non-anxious participants. Visual field, emotional content, and social anxiousness thus influenced the engagement and disengagement of attention.

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11:20-11:35 (171)

Saliency Rather Than Visibility Determines Visual Selection. MIEKE DONK and ALISHA SIEBOLD, *Universiteit Amsterdam*—Initial oculomotor selection is primarily stimulus-driven. The present study aimed to investigate whether this finding can be better explained by the absolute visibility (de Vries, et al., 2011) or the relative saliency (Donk & van Zoest, 2008) of competing visual elements. An experiment was performed in which observers had the task to make a saccade to either one of two simultaneously presented orientation singletons embedded in a background of homogeneously oriented background lines. The orientation contrast of one singleton, the fixed singleton, remained constant over conditions whereas the orientation contrast of the other singleton was varied. The results showed that the probability of selecting the fixed singleton strongly depended on the orientation contrast of the other singleton. A saliency model provided a better fit to the data than a visibility model suggesting that visual selection behavior cannot be explained without the concept of saliency.

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11:40-11:55 (172)

Is It a Shark or a Marine Animal? Detection and Recognition Across Categorical Levels in RSVP. MARY C. POTTER and CARL ERICK HAGMANN, *Massachusetts Institute of Technology*—Although pictures can be understood when presented as briefly as 13 ms, there is debate about the entry level for conceptual encoding and retrieval in rapid cognition. Participants attempted to detect a target presented among 6 unfamiliar pictures using RSVP at 80, 53, 27, or 13 ms/picture. The target was specified by either a basic level category (e.g., shark) or a superordinate level category (e.g., marine animal). The name was provided either before or after the picture sequence, between groups. Detection (d') increased with duration, but was significant in all conditions. Performance was better with the basic than the superordinate name only in the name-before group, showing that advance specific information facilitated visual encoding. When pictures were encoded without a target in mind, basic and superordinate post-cues were equally effective and performance was similar

to that for the superordinate name in the name-before condition. The results are consistent with the claim that the basic level is the entry level for object perception.

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Metamemory/Metacognition I

Grand Centre, Saturday Morning, 10:20-12:00

Chaired by Janet Metcalfe, Columbia University

10:20-10:35 (173)

Tip-of-the-Tongue States and Information Seeking. BENNETT SCHWARTZ, *Florida International University*, JANET METCALFE, *Columbia University* (read by Janet Metcalfe)—Tip-of-the-tongue states (TOTs) are feelings that occur when to-be-retrieved words are not accessible. Few studies have investigated their function. We propose that TOTs are associated with curiosity about the target answer. If so, they should be associated with the desire to learn the answer. In our study, participants were presented general-information questions under full-attention or divided-attention conditions—a manipulation that induces differential TOT rates. Upon hearing each question, participants indicated (a) if they were in a TOT, and (b) if they wanted to be shown the answer later. They were allowed to see only a small number of answers. Participants were more likely to request the answer when they were in a TOT than when not, indicating that TOTs are, indeed, motivating. We discuss TOTs as a marker of almost-mastered knowledge in the person's Region of Proximal Learning. In this view, the TOT reflects potential mastery and thus provokes curiosity.

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10:40-10:55 (174)

Is a Single Judgment of Learning Procedure as Effective as Testing for Memory Enhancement? MARIE IZAUTE, *LAPSCO CNRS*, ELÇIN AKDOĞAN and ELISABETH BACON, *INSERM U 1144*—Metamemory refers to the subjective awareness of one's memory capacity and the control of the related memory behavior. Judgments of learning (JOL) are metamemory judgments made after a learning session that evaluate the future recallability of recently learned items. Recent studies have developed the self monitoring approach, based on having learners monitor (with JOL) which material have been learned or not well learned. The aim of this study was to evaluate the efficiency of this learning method, the single self monitoring with two levels of difficulty, by comparison with the relearning and testing effect. The results suggested that both JOL and explicit memory testing improve long-term memory compare to relearning.

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11:00-11:15 (175)

The Problems and Promise of Forget-Framed Judgments of Learning. MICHAEL J. SERRA, BENJAMIN D. ENGLAND and FRANCESCA R. FLORES, *Texas Tech University*—Judgments of learning (JOLs) are metacognitive judgments about the likelihood of recalling recently studied information on a later memory test. Increasing the accuracy of such judgments is one way to increase the efficacy of people's study

processes. Although initial evidence suggested that forget-framed JOLs ("How likely will you be to forget this item?") are more accurate than remember-framed JOLs ("How likely will you be to remember this item?"), this finding has been difficult to replicate. More often, compared to remember-framed JOLs, forget-framed JOLs are persistently anchored at the midpoint of the judgment scale, which can impair their absolute accuracy. Forget-framed JOLs also consistently demonstrate impaired cue-utilization compared to remember-framed JOLs, which can impair their relative accuracy. Such outcomes cast doubt on strategically using forget-framed JOLs in applied settings, but we will discuss how examining the effects of framing on JOLs nevertheless inform our understanding of how people make metacognitive judgments.

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11:20-11:35 (176)

The Stability Bias in Multi-Trial JOLs Depends on Judgment Framing. ROBERT ARIEL, JARROD C. HINES and CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (read by Christopher Hertzog)—Participants instructed to make judgments of learning (JOLs) for paired associates that will receive 1, 2, 3, or 4 study opportunities predict a minimal change in learning between pairs studied 1 and 4 times despite later showing both increased performance and an awareness of those increases (Kornell & Bjork, 2009). This effect has been construed as a stability bias in JOL construction that ignores future learning. We manipulated prediction framing to emphasize the role of multiple tests vs. multiple study opportunities on memory. We also directly measured beliefs about multi-trial study effects on learning before and after the experiment with graphic rating scales that allowed participants to construct a predicted learning curve across trials. Although manifesting some stability bias, JOLs reflected pre-existing beliefs about learning over trials when performance was framed in terms of study benefits, not testing benefits. People also monitored actual multi-trial memory improvements and updated their beliefs about learning accordingly. The stability bias identified in earlier studies may be partly due to how the JOLs were framed.

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11:40-11:55 (177)

Judgments of Learning Depend on How Learners Interpret Study Time. ASHER KORIAT, *University of Haifa*, RAVIT NUSSINSON, *Open University of Israel*, RAKEFET ACKERMAN, *Technion-Israel Institute of Technology*—In self-paced learning, when the regulation of study effort is goal driven (e.g., allocated to different items according to their relative importance), judgments of learning (JOLs) increase with study time. When it is data driven (e.g., determined by the ease of committing the item to memory), JOLs decrease with study time (Koriat et al., 2006, 2013). We induced learners to interpret differences in their study time (Experiment 1) or in another learner's study time (Experiment 2) as reflecting either differences in data-driven or differences in goal-driven regulation. This manipulation was found to change the effects



of study time on JOLs, supporting the idea that JOLs are based on study effort but the effect of perceived effort is mediated by a retrospective attribution of effort to different sources.

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Associative Learning

Dominion Ballroom, Saturday Morning, 10:00-12:00

Chaired by Todd Jones, Victoria University of Wellington

10:00-10:15 (178)

Perceptual Similarity to Learned Faces Influences First Impressions. TODD C. JONES, MATTHEW T. CRAWFORD and KATHARINE S. HAMILTON, *Victoria University of Wellington*—Participants learned whether novel people were friends or enemies to set criteria and then performed a face rating task on a 9-point enemy-friend scale (Experiment 1) or a dishonest-honest scale (Experiment 2). None of the faces for the rating task was an exact match to a learned face. However, inner features (eyebrows, eyes, nose, mouth) and outer features (hair, ears, jaw, chin, cheeks) of “parent” faces from the learning phase were combined to create conjunction faces whose parents were both learned as friends (friend-conjunctions), both learned as enemies (enemy-conjunctions), or learned as one friend and one enemy (frienemy-conjunctions). Entirely new faces were included as a baseline condition. New faces were rated close to the midpoint of the scale (i.e., neutrally), friend-conjunctions were rated more as friends/honest and enemy-conjunctions were rated more as enemies/dishonest. Frienemy-conjunctions were rated close to baseline, but the outer features of these friemies carried a bit more weight than the inner features.

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10:20-10:35 (179)

Providing Outcomes on All Trials Reduces the Feature Positive Effect. SUZETTE L. ASTLEY and TAMMY AIRD, *Cornell College*—Individuals more readily learn when the addition of a feature rather than its absence predicts the occurrence of a reinforcer. This is the feature positive effect. Hearst and colleagues suggested that providing an outcome of some type on all trials might attenuate the effect. We tested Hearst’s notion using a video game format in humans in which the appearance of an enemy alien served as the US, space bar presses to “shoot” the alien through a “cloak” before it appeared were the target responses, and a glimmer of light during the cloak was the feature. For half of the participants, an asteroid followed the cloak on nonreinforced trials. Feature negative discrimination was better when an outcome (enemy or asteroid) appeared following the cloak on all trials than when an outcome (the enemy) occurred only on reinforced trials. Thus, as predicted, provision of an outcome on all trials reduced the magnitude of the feature positive effect.

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10:40-10:55 (180)

Cue Competition in Human Associative Learning. IAN P.L. MCLAREN, *University of Exeter*, FERGAL W. JONES, *Canterbury Christ Church University*, FAYME YEATES and R.P. MCLAREN, *University of Exeter*—There is a question as to

whether cue competition effects can be observed in incidental learning paradigms in humans. We used a standard SRT task in which the preceding two trials of a run of three predicted the third 2/3 of the time, and added another predictive cue, a colored square, which could also stochastically predict the next response required. The question was to what extent would these two cues compete for control of behavior? We assessed this by comparing the dual cue group to a color only control and a sequence only control. Our results showed that all three groups learned, and that the dual group learned about both cues at least as well as the individual controls, but that when switched to a test phase where each cue could be assessed independently, the dual group showed a marked decline in performance relative to the color control. We interpret this as evidence for overshadowing occurring between the two predictive cues in the dual group, such that when combined their performance is equivalent or superior to either control, but when assessed independently, the color cue actually has a weaker association to the outcome than the equivalent cue in the control group.

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11:00-11:15 (181)

What is Learned in Color Contingency Learning? COLIN M. MACLEOD, OLIVIA Y-H LIN, NOAH D. FORRIN and TANYA R. JONKER, *University of Waterloo*—On each trial in the color contingency learning task, a word is presented in color. The task is to identify the color by a key press, ignoring the irrelevant word. Each word is, however, most often presented in one color (high contingency) and less often presented in the other colors (low contingency). As an example, over a 30-trial randomized block, TABLE could be presented 8 times in red and once each in yellow and green, HORSE 8 times in yellow and once each in red and green, and MOUTH 8 times in green and once each in red and yellow. Quite quickly as trials proceed, high contingency items are responded to more rapidly than low contingency items, evidence of learning of the contingencies. We will report a series of experiments examining the underpinnings of this form of learning, including the speed of learning, the persistence of learning, the role of semantics, the extent of transfer, and other fundamental aspects. Our goal is to characterize what is being learned and how that learning develops and progresses.

Email: Colin M. MacLeod, cmacleod@uwaterloo.ca

11:20-11:35 (182)

Implicit Association Tests Reflect the Structure of Associative Knowledge, and Not Necessarily Attitudes. RICHARD B. ANDERSON, *Bowling Green State University*—Implicit association tests are widespread in the study of attitudes, but have received little attention from researchers who specialize in the study of memory. The present research tests the hypothesis that an implicit association test measures the organization of associative knowledge, without necessarily measuring attitudes. Research participants were asked to memorize novel, negation-containing sentences such as “Ampovians are not strong,” and “Bilvosians are not poor.” Following memorization, they performed an implicit

association test that required identifying the group name as “Ampovian” or “Bilvosian,” and that required identifying adjectives as positive or negative. The pattern of implicit association performance reflected the associative structure of the memorized stimuli—e.g., Ampovians and positive adjectives were relatively easy to place into the same category, despite participants’ responses to questionnaire (administered post-training) indicating negative explicit attitudes toward Ampovians. The findings suggest that implicit association can be explained parsimoniously as a basic memory phenomenon. Email: Richard Anderson, randers@bgsu.edu

11:40-11:55 (183)

Attenuating Evaluative Conditioning: A Theoretical Issue With Clinical Implications. RALPH R. MILLER, *Binghamton University, SUNY*, MIKAEL MOLET, *University of Lille*, GONZALO MIGUEZ and LISA E. MASH, *Binghamton University, SUNY*, PAUL CRADDOCK and THIERRY KOSINSKI, *University of Lille*—When a neutral stimulus is paired with an event possessing affective value, the stimulus comes not only to signal the [impending] affective event but also to acquire the event’s affective value. This latter consequence is referred to as evaluative conditioning (EC) and is differentiated from Pavlovian conditioning by a number of features, most centrally by EC being resistant to extinction (i.e., presentations of the stimulus alone following EC do not reduce the acquired affect). If EC was found to extinguish, there would be limited reason to assume that it differs appreciably from Pavlovian conditioning. We examined four different extinction-like operations and found that two of them appreciably reduced EC. Because EC is viewed as a model of select anxiety disorders, these results suggest that appropriately designed exposure therapy (which is modeled by experimental extinction) should be effective in reducing these anxieties.

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Event Processing

Civic Ballroom, Saturday Morning, 10:20-12:00

Chaired by Gabriel A. Radvansky, *University of Notre Dame*

10:20-10:35 (184)

Increasing Event Boundaries Increases Text Memory. ALEXIS N. THOMPSON, KYLE A. PETTIJOHN, ANDREA K. TAMPLIN and GABRIEL A. RADVANSKY, *University of Notre Dame* (read by Gabriel A. Radvansky)—Previous work has shown that the presence of an event boundary in a narrative text can improve later recall memory for that text. The aim of the current study was to explore whether this finding could be magnified by including more boundaries in a narrative text. In one experiment, existing data from a study involving the recall of previous read stories was used. These stories were coded for the number of event boundaries present, and the number of event boundaries was compared to later recall. In a second experiment, the number of event boundaries was explicitly manipulated across various versions of a narrative text. Across both experiments, it was consistently found that increasing the number of event boundaries in a text is accompanied by an increase in recall memory for that text. There was no

evidence that any one type of event boundary (e.g., spatial, causal, temporal, etc.) was any better at eliciting this finding. This is interpreted in the context of the Event Horizon Model of event cognition.

Email: Gabriel Radvansky, gradvans@nd.edu

10:40-10:55 (185)

Re-Presentations of Space in Hollywood Movies. JAMES E. CUTTING and CATALINA IRICINSCHI, *Cornell University*—Movies seek to tell engaging stories. In doing so they present chunk-like scenes that promote incremental updating of the viewers’ representations of the ongoing narrative. According to event-indexing theory, the beginnings of new scenes trigger these updates. Typically, a new event is signaled by an establishing shot, one providing more spatial information and a longer shot duration than average. In our analysis of 24 films we reconfirm this finding and show that, when returning to a previously shown location, the re-establishing shot reduces both context and duration while still remaining different than the average shot. In reducing information redundancy, the re-establishing shot reflects viewers’ faster responses to the revisited location. We fit our results to modified event-indexing models and compare location shifts against character and time shifts. Overall, location shifts dominate. These results suggest that film discourse is tailored to suit the rapid encoding of scenes, and that the jumps across space are more difficult to encode than jumps to different characters, even to different times. Moreover, these aspects of film discourse have changed over the last 70 years, possibly capturing viewers’ cognitive engagement.

Email: James Cutting, jec7@cornell.edu

11:00-11:15 (186)

What Would Jaws Do? Investigating the Eye Movements and Movie Comprehension Relationship. LESTER C. LOSCHKY, *Kansas State University*, ADAM M. LARSON, *University of Findlay*, JOSEPH P. MAGLIANO, *Northern Illinois University*, TIM J. SMITH, *Birkbeck University of London*—What is the relationship between viewers’ eye movements while watching a film and their comprehension of it? Viewers of Hollywood style films often look at the same things at the same time—called attentional synchrony. But does this indicate that viewers also understand the film similarly? To investigate this question, we manipulated the presence/absence of prior film context and measured resulting differences in film comprehension and eye movements. Viewers watched a 12-second James Bond movie clip showing actions of a character named “Jaws,” which ended just as viewers would typically draw a critical predictive inference about Jaws (Magliano, Dijkstra, & Zwaan, 1996). The no-context condition saw only the 12-second clip, but the context condition also saw the preceding 2.5 minutes of the movie. Both groups showed global attentional synchrony. However, the no-context viewers were significantly less likely to draw the critical inference (i.e., failure to interpret filmmaker intent), showed greater attentional synchrony (i.e., more exogenous control of attention) and longer fixation durations



(i.e., more processing difficulty). Thus, film viewers' subtle eye movement differences can indicate their comprehension differences.

Email: Lester Loschky, loschky@ksu.edu

11:20-11:35 (187)

Capturing the Moment: The Impact of Taking Photos on Memory. LINDA HENKEL, *Fairfield University*—Does taking photographs of objects or events influence what is remembered about them? In two experiments, participants took a museum tour where they were directed to photograph some objects and to simply observe others without photographing them. A photo-taking-impairment effect was found: When people took a photo of the object rather than just observed it, they remembered fewer objects, and they remembered fewer details about the objects and their locations. However, when people zoomed in and photographed a specific part of the object, their subsequent recognition and detail memory was not impaired, and in fact, memory for features that were not zoomed in on was as accurate as for features that were zoomed in on. This highlights key differences between people's memory and the camera's "memory" and suggests that the additional attentional and cognitive processes engaged by this focused activity can eliminate the photo-taking impairment effect.

Email: Linda Henkel, lhenkel@fairfield.edu

11:40-11:55 (188)

Errors in Autobiographical Memory: Evidence From a Wearable Camera. WILLIAM F. BREWER, *University of Illinois*, JASON R. FINLEY, *Washington University*—Our goal in this study was to establish some of the basic descriptive parameters of autobiographical memory through the use of a small wearable camera (SenseCam) to unobtrusively capture pictures from participants' everyday experiences. Nine undergraduates wore SenseCams that took pictures every 10 sec for two days. Cued recall was used to study the participants' memories at intervals of one week and one month. The participants scored their recalls against the pictures of the events they had recalled. The data from recall showed 10% clear memory errors. These errors were classified as: Time Shifts (42%); Substitutions (23%); Intrusions (20%); Distortions (11%); and False Assertion of Absence (5%). We interpret our data on memory accuracy to support a moderate reconstructive view of autobiographical memory as opposed to copy theories (e.g., W. Penfield; R. Brown) or strong reconstructive theories (e.g., U. Neisser; C. Barclay).

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Speech Perception I

Conference B & C, Saturday Morning, 10:20-12:00

Chaired by Tessa Bent, *Indiana University*

10:20-10:35 (189)

Children's Perception of Native and Nonnative Speech in Ideal and Adverse Conditions. TESSA BENT, *Indiana University*—The speech perception mechanism is resilient. Adult listeners can overcome substantial source and environmental degradation to accurately perceive spoken messages. However, contending with simultaneous source

and environmental degradation (e.g., communicating with nonnative talkers in a noisy environment) can cause significant speech perception decrements. The current study investigated how source and environmental degradation influence children's speech perception. Five- and six-year-old children identified sentences produced by one native and one nonnative talker in both quiet and noise-added conditions. Compared to adult listeners, children had more difficulty overcoming conditions that included one degradation type (i.e., native speech in noise or nonnative speech in quiet). Children performed particularly poorly when both source and environmental degradation were present. The results suggest that the abilities -- including perceptual flexibility and signal segregation—needed to accurately perceive speech in the presence of different degradation types are still developing in the early school-age years.

Email: Tessa Bent, tbent@indiana.edu

10:40-10:55 (190)

Do Lexical Representations Support Phonetic Perception in Non-native Listening as They do in Native Listening?

ARTHUR G. SAMUEL, *Basque Center on Cognition, Brain and Language; Ikerbasque; Stony Brook University*, RAM FROST, *The Hebrew University; Haskins Laboratories; Basque Center on Cognition, Brain and Language*—Ambiguous speech sounds are identified differently in one lexical context than another -- the same segment is heard as "d" before "ash" but as "t" before "ask" (Ganong, 1980). These lexically driven percepts are real enough to affect perception of subsequent sounds (Samuel, 2001). Here we test whether such lexical support for phonetic perception occurs in non-native listening. Native Hebrew speakers and native Arabic speakers were tested with the same American English stimuli, in the same paradigm previously used to test American English listeners. Hebrew speakers were highly proficient in English; Arabic speakers' English proficiency was more variable. With stimuli that potentially preserved some minor residual coarticulatory information about an ambiguous segment, L1 Hebrew speakers showed native-like lexical support of phonetic perception; L1 Arabic speakers did not. Neither group showed such support when residual cues were unavailable, unlike native speakers. This suggests that language experience modulates dynamic lexical activation of phonetic segments.

Email: Arthur Samuel, a.samuel@bcbl.eu

11:00-11:15 (191)

Distal Speech Rate Influences Lexical Access. MELISSA M. BAESE-BERK (Associate Member Select-Speaker Award Recipient) and LAURA C. DILLEY, *Michigan State University*, MOLLY HENRY, *Max Planck Institute*, LOUIS VINKE, *Massachusetts General Hospital*, ELINA BANZINA, *The Ohio State University*—Listeners use multiple cues to segment continuous speech into words, including distal speech rate (Dilley & Pitt, 2010, *Psychological Science*). In three experiments, we examined how distal speech rate influences lexical and phonological perception. In Experiment 1, we examined perception of phonologically similar mono- and bisyllabic words (e.g., tear, terror). While in Experiment 2, we examined perception of one- or two-word sequences



that are phonologically similar (e.g., cease, see us). In both experiments, listeners' perception of the lexical content, and thus presence or absence of weak syllables, varied as a function of distal speech rate. In Experiment 3, we examined online perception, using a word-monitoring task, and demonstrate that speech rate influences online speech perception. The findings indicate that distal speech rate influences perception of weak syllables in a variety of lexical contexts, suggesting the importance of this factor not only for word segmentation, but for speech perception more broadly.

Email: Melissa Baese-Berk, melissa.baese@gmail.com

11:20-11:35 (192)

Distal Speech Rate Can Cause Words to Disappear During Early Perceptual Processing. LISA D. SANDERS, *University of Massachusetts Amherst*, LAURA C. DILLEY, *Michigan State University*, NAVIN VISWANATHAN, *State University of New York at New Paltz*—Previous studies have shown that rate of speech context (e.g., “Glenn thought his friend and neigh...”) influences listeners' reports of reduced function words (e.g., “neighbor are like...” versus “neighbor like...”). Event-related brain potential (ERP) measures were employed to distinguish between speech rate effects on early perceptual processing of ambiguous word boundaries and later interpretation of what was heard. Slowing the context resulted in fewer explicit reports of the function words in transcriptions. Further, physically identical portions of the speech stream elicited an anterior negativity around 100 ms after onset of the function word in the context that promoted reports of that word. This ERP effect is consistent with an early negativity in response to word onsets in continuous speech and the negative anterior deflection typically observed in response to closed-class words. The short latency of the effect indicates that context speech rate modulates the online assignment of lexical boundaries.

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11:40-11:55 (193)

Using Intelligibility to Measure Asynchrony Tolerance in Speech Perception. ROBERT E. REMEZ, EMILY F. THOMAS, ANDREA M. WYCOFF, REBECCA E. GIGLIO, AISLINN T. CRANK, CHLOE B. CHEIMETS and STAVROULA M. KOINIS, *Barnard College, Columbia University*—Several techniques have been used to assess modulation sensitivity in the perception of speech. Indirect methods, including judgments of intelligibility, overestimate sensitivity. Using intelligibility as the perceptual assay with natural or natural sounding carriers also overestimates sensitivity, reflecting phonetic impressions evoked by short-term characteristics of speech and by sensitivity to modulation. Imposing the modulation characteristic of speech on a sine-wave carrier provides a cleaner benchmark of modulation sensitivity, with estimates converging on classic measures of auditory sensory decay. New tests reported here vary rate of articulation as a control. If performance varies with speech rate, then the measure of tolerable temporal distortion does not reflect the fixed pace of sensory decay, and must include the projection of sensory samples into elaborated linguistic properties. Instead, performance measures of asynchrony tolerance did not

vary when speech rate accelerated or decelerated, revealing constraints on intelligibility that are arguably sensory, auditory, and fixed.

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SYMPOSIUM III: Memory & The Law: Lessons From Cases Grand East, Saturday Morning, 9:50-12:00

Organized by Martin A. Conway and Mark L. Howe, City University, London

9:50-10:00 (194)

Introduction. MARTIN A. CONWAY, *City University London*

10:00-10:15 (195)

Courtroom Feats of Early Memory: What Adults Claim to Remember from Childhood. MARK L. HOWE, *City University London*—In the first part of this presentation, I describe a variety of cases that I have been involved with that led to my becoming an expert witness. These cases range from questions about children's memory for being raped, to remembering an ear-witnessed murder, to preventing future false memories. In the second part of this presentation, I reflect on some of the remarkable feats of remembering that complainants exhibit in their police interviews as well as the courtroom, ones that contradict much of what the scientific study of memory has shown to be true. Along the way, I argue that this scientific knowledge needs to become an integral part of a “culture of memory” familiar to triers of fact (judges, jurors), police, and laypeople. Until that time, memory experts will continue to be an inexorable part of the legal process when memory serves as the main or only evidence.

Email: Mark L. Howe, Mark.Howe.1@city.ac.uk

10:15-10:30 (196)

Expert Testimony in a Child Sex Abuse Case: Translating Memory Development Research. MAGGIE BRUCK, *John Hopkins School of Medicine*—I will describe an actual custody case that involved a pair of preschool-aged sisters accusing their biological father of various sexual acts. I testified as an expert witness for the father in this case. I will present the facts of the case and then the relevant scientific studies of memory that provide a basis to assess the reliability of the children's statements in this case. Specifically during the course of the talk I will summarize the literature on children's suggestibility while at the same time pointing out the suggestive factors present in this case.

Email: Maggie Bruck, mbruck1@jhmi.edu

10:30-10:45 (197)

Murder Must Memorize. C.J. BRAINERD, *Cornell University*—In the most serious of all criminal proceedings, capital murder trials, memory reports from witnesses, suspects, defendants, and others provide the evidence that is typically the most determinative of guilt. This makes memory research bedrock science when it comes to assessing the reliability of critical legal evidence. I illustrate how principles derived from memory research play out on the ground with a capital trial in which some of the most powerful forms of memory distortion were in evidence (e.g., phantom



recollections, robust interrogation methods that stimulate false self-incriminating reports). The key question before the jury was whether to regard the defendant's confession as true or false. The answer turned on a theoretical principle of false memory research, the verbatim-gist distinction, and on research showing that it is possible to fabricate memories of the gist of experience (e.g., intentional harm vs. accident), as well as of verbatim details.

Email: C. J. Brainerd, cb299@cornell.edu

10:45-11:00 (198)

Children's Memory for Their Mother's Murder: Accuracy, Suggestibility, and Resistance to Suggestion. KELLY MCWILLIAMS, GAIL S. GOODMAN, RACHEL NARR, SANDRA RUIZ and MACARIA MENDOZA, *University of California, Davis* (read by Gail S. Goodman)—For several decades, researchers have examined variables associated with children's memory and suggestibility for traumatic information. In the process, researchers have uncovered conditions under which children can be highly suggestible, as well as situations associated with children's accuracy and resistance to suggestion. We will discuss a case (in which Dr. Goodman testified for the prosecution) involving two young children who were eyewitnesses to events surrounding their mother's murder. We will review children's eyewitness memory literature relevant to the case, highlighting factors associated with children's reliable and consistent reports, as well as identifying several areas of interviewer error leading to potential suggestibility effects.

Email: Gail S. Goodman, ggoodman@ucdavis.edu

11:00-11:15 (199)

What Were You Wearing When You Went to Bed Aged 4? MARTIN A. CONWAY, *City University London*—Drawing on criminal cases in which I was a memory expert witness and in which memory was the only evidence, I illustrate some of the remarkable details 'recalled' by adults from childhood memories. Memory for bedclothes, household objects, clothes, verbatim recall of conversations, time of day, the weather, body positions, hand information, activities and specific actions, etc., from memories dating to below the age of 7 years and often 5 years, over retention intervals spanning decades. Explaining to courts the nature of childhood amnesia and child memory, autobiographical memory, brain development and its implications for memory, and what we currently know from scientific studies of what adults can remember from childhood memories, has proved useful in assisting courts to make more informed decisions. Although even this is often not sufficient to overcome the powerful and widely held belief that: the more specific the details the more accurate the memories.

Email: Martin A. Conway, Martin.Conway.1@city.ac.uk

11:15-11:30 (200)

Educating Jurors about Memory. ELIZABETH F. LOFTUS, *University of California, Irvine*—The Supreme Court of New Jersey embraced the science of memory in a case arising out of a crime that occurred in 2003. The defendant in that

case, Larry Henderson, had been identified as a person who participated in a murder, and he was convicted. When the appeal of his conviction reached the Supreme Court, they relied on the science and changed the legal standard for how eyewitness evidence is assessed in criminal cases throughout the state. I will discuss this development, and others that were inspired by it that are taking place throughout the country. For example, one effort to rewrite jury instructions for the State of Pennsylvania, shows an even greater appreciation for what can be done in a collaboration between a judge, a plain English expert, and a memory scientist.

Email: Elizabeth F. Loftus, eloftus@uci.edu

11:30-11:45 (201)

Treating Testimony Like Data: An Empirical Comparison of Two High Profile Cases. HARLENE HAYNE, *University of Otago*—Unfortunately, testimony about the reliability of children's evidence in cases of suspected sexual abuse often becomes a battle between clinical intuition and scientific evidence. On the clinical side, experts often express their "opinions" about the quality of the evidential interviews and about the validity of the child's response. These opinions are largely based on "gut feeling" or "professional instinct" rather than on an objective analysis of the interviews per se. In the case that I will describe, we took a different approach—we treated the case like a research project. We articulated multiple hypotheses about the quality of the evidential interviews. To test these hypotheses, we coded each question that children were asked. We then compared the questions in this case to another high profile case that has been well-recognised for poor interviewing. We used this empirical comparison to draw a number of evidence-based conclusions about the quality of the evidential interviews in our target case.

Email: Harlene Hayne, harlene.hayne@otago.ac.nz

11:45-12:00 (202)

Discussant. LYNN NADEL, *University of Arizona*

Priming

Grand West, Saturday Afternoon, 1:30-3:10

Chaired by Gail Mauner, University at Buffalo, SUNY

1:30-1:45 (203)

Strategic Processing In Semantic Priming With Very Short SOAs. CHUNG-I SU and GAIL MAUNER, *University at Buffalo, SUNY* (read by Gail Mauner)—It is typically assumed that at SOAs of less than 250 ms, semantic priming effects are the consequence of automatic processes (e.g. spreading activation or overlaps in distributed representations), while priming observed at longer SOAs is likely to be due to strategic processes (Becker, 1976; Neely, 1977). SOAs less than 250 ms are argued to be too fast for strategic processing. Consequently, at SOAs less than 250 ms, priming should primarily result from facilitatory processes. Across two experiments with SOAs of 66 ms, we compared semantic priming using the same related prime-target pairs (e.g., “stirred-spoon”) and either unrelated (“shot”) or neutral (“urged”) primes as baselines. Priming was significant only with unrelated primes, and therefore inhibition dominant. Because inhibition dominance is diagnostic of strategic processing, this pattern suggests that very short SOAs do not necessarily protect against strategic processing and assumptions about the time course of strategy formation should be re-evaluated.

Email: Gail Mauner, mauner@buffalo.edu

1:50-2:05 (204)

Primary and Secondary Meaning Activation of Emoticons. SARAH MAPLES and CURT BURGESS, *University of California, Riverside* (read by Curt Burgess)—Although the use of emoticons in electronic communication is commonplace, a recent norming study conducted by our group showed that there is a surprising range of connotation associated with emoticons. A semantic priming experiment was conducted with word primes and emoticon targets. There were three word – emoticon relationships, e.g., primary, happy :) or secondary, blushing :) or unrelated, bitter :). Primes were presented after a fixation point for 500 ms, followed by the emoticon target. Subjects made semantic relatedness judgments. Response times to emoticon targets preceded by a primary meaning were faster than unrelated targets. However, response times to secondary meaning targets were longer than the unrelated targets. These results are discussed from a multiple meaning activation viewpoint (i.e., Simpson & Burgess, 1985) and in the context of high-dimensional memory models such as HAL (Burgess & Lund, 2000).

Email: Curt Burgess, curt@ucr.edu

2:10-2:25 (205)

Is Cascaded Semantic Activation Semantic? Is it Cascaded? KENNETH FORSTER and DANE BELL, *University of Arizona*—In a semantic categorization experiment, a masked nonword prime that is similar to an exemplar will interfere with the response to a nonexemplar (e.g., spoder – LION with INSECT as category). This congruence effect can be explained by cascaded activation models, since any activation in word units is automatically transferred to a semantic level. Thus the input letter string activates the semantic properties of every

word that it resembles. This should not occur if the prime is itself a word, due to competition between word units. Using a new metric of orthographic overlap based on C.J. Davis’ Spatial Coding Model, it is shown that congruence effects are generated by both words and nonwords, even under conditions that do not favor form priming.

Email: Kenneth Forster, kforster@u.arizona.edu

2:30-2:45 (206)

Masked Inhibitory Form Priming in English: Reconsidering Lexical Inhibition. SACHIKO KINOSHITA, *Macquarie University*, DENNIS NORRIS, *MRC Cognition and Brain Sciences Unit*—A salient prediction of the interactive-activation (IA) model is the “prime lexicality effect” in masked form priming, where nonword primes (e.g., lozy-LAZY) produce facilitation, and word primes (e.g., lady-LAZY) produce inhibition. In English, findings of this effect have been mixed. We tested 200 four-letter words with word primes and nonword primes matched on the position and the consonant-vowel status of the substituted letter (e.g., book-HOOK; zook-HOOK). Contrary to the prediction of the IA model, the overall data showed a small inhibitory priming effect equal in magnitude for the word and nonword primes. The RT distribution data showed similar patterns of priming effects across RT bins for the word and nonword primes. Analyses of items suggested that the apparent prime lexicality effect reported in previous studies may be due to the difference in position and CV status of the substituted letter in the word and nonword primes used in these studies.

Email: Sachiko Kinoshita, sachiko.kinoshita@mq.edu.au

2:50-3:05 (207)

Item Effects in Perceptual Identification Word Priming. CORY A. RIETH, *University of California, San Diego*, DAVID E. HUBER, *University of Massachusetts Amherst* (read by David E. Huber)—In perceptual identification word priming, short prime durations facilitate primed words (i.e., positive priming), although this takes the form of a bias. Longer prime durations reduce or eliminate this bias for associative priming and can produce a bias against perceiving the prime word as the target (i.e., negative priming) for repetition priming. To determine if the time course of this prime duration transition depends on the particular characteristics of the prime and target, we examined item effects in this paradigm. For repetition priming, Experiment 1 compared words to non-words, finding that non-words required longer prime durations to eliminate positive priming (i.e., a slower transition). For associative priming, Experiment 2 compared word pairs with different asymmetric associations (i.e., forward versus backward), finding that forward associated word pairs required longer prime durations to eliminate positive priming. Experiment 3 used corpus co-occurrence statistics, providing a conceptual replication of the effects seen with associative priming. Furthermore, words that were expected to repeat (e.g., ‘walk the walk’) produced additive effects of repetition priming and co-occurrence priming.

Email: David Huber, dhuber68@gmail.com



Testing Effects in Memory

Grand East, Saturday Afternoon, 1:30-3:30

Chaired by Henry Roediger, Washington University in St. Louis

1:30-1:45 (208)

The Relative Potency of Study and Test Trials in Enhancing Long-Term Retention. HENRY L. ROEDIGER III and JOHN F. NESTOJKO, *Washington University in St. Louis*—In testing effect research, experimenters often hold the number of study presentations constant and manipulate the number of tests. In the current research, we orthogonally manipulated the number of study trials (1, 2 or 4) and the number of test trials (1, 2 or 4) for a 50-word list, with a final retention test given two days later. We found a main effect of both types of prior events (study and test) and no interaction. Subsequent analyses revealed that tests had a greater effect than study trials. That is, despite the fact that only 40% of the words were recalled (on average) on tests relative to 100% re-exposure of words for study trials, test trials had as large an effect as study trials on final retention. The current research confirms prior results showing that test trials have greater impact on long-term retention in free recall than do study trials.

Email: Henry Roediger, roediger@wustl.edu

1:50-2:05 (209)

The Role of Mediators in the Testing Effect in Paired-Associate Learning. MICHAEL K. BRENNAN, KIT W. CHO and JAMES H. NEELY, *University at Albany, SUNY* (read by James H. Neely)—Carpenter (2011) had subjects study Cue (C)-Target (T) pairs such as mother (C)-child (T), and then had them either restudy the pairs or tested their recall of T when given C. In a final test for T recall, subjects received as the cue either C or a strong primary associate (father) of C, which would have been activated by C and hence could have served as a mediator (M) for C-T recall. Relative to restudying, testing led to greater T recall in the final test for both the C and M cues. Carpenter argued that (a) recall of T to C was mediated by the associative chain C→M→T and (b) testing strengthened the C→M and M→T associations. We assessed an alternative explanation: (a) testing strengthens only the direct C→T association and (b) the testing effect observed for M→T recall is solely due to the strong backward M→C association leading to the retrieval of the T via the testing-strengthened C→T association. Our results support Carpenter's mediational hypothesis.

Email: James Neely, jneely@albany.edu

2:10-2:25 (210)

Testing Prevents Intrusions, but Not Interference-Based Forgetting. ALMUT HUPBACH, *Lehigh University*—Retrieval can be a powerful memory enhancer (testing effect). However, reactivation of a memory can also render it fragile and prone to disruption, as shown by studies on memory reconsolidation. The present study explored how new learning that immediately follows memory retrieval affects the future recall of the retrieved memory. Participants learned a set of objects during Session 1. Two days later, they were either (1) asked to recall the set of objects (testing condition), (2) given a subtle reminder of the first learning session, or (3) not

reminded of the previous session. Immediately afterwards, participants learned a second set of objects or performed an unrelated distractor task. Two days later, retention of Set 1 was tested. Although Set 1 memory was enhanced in the testing condition, learning a second set negatively impacted memory in all conditions. This shows that testing does not safeguard memory from the impairing effects of retroactive interference. However, testing prevented intrusions from Set 2 into Set 1 recall. The findings are discussed in reference to the reconsolidation account and the testing effect literature, and implications for educational practice are outlined.

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2:30-2:45 (211)

Adapting to Test Structure: Letting Testing Teach What to Learn. LEONEL GARCIA-MARQUES and PEDRO MARQUES, *Universidade de Lisboa*, LUDMILA NUNES, *Universidade de Lisboa*; PURDUE UNIVERSITY, PAULA CARNEIRO, *Universidade de Lisboa*, YANA WEINSTEIN, *University of Massachusetts Lowell*—In this talk, we propose that we encode and store information as a function of the particular ways we have used similar information in the past. More specifically, we contend that the experience of retrieval can serve as a powerful cue to the most effective ways to encode similar information in comparable future learning episodes. To explore these ideas, we did two studies in which all participants went through study-test cycles of single category lists while we manipulated the nature of the recognition tests. The recognition tests either included only same-category lures or only different category lures. The experience of repeated testing lead participants to avoid categorical knowledge but only when this knowledge was poorly diagnostic for recognition (i.e., in the same-category lures condition). In a second study with a similar manipulation, we showed that repeating testing with lures were from the same category as study items improved a final recall surprise tests compared to conditions in which different-category lures were used. Such a difference is akin to the one obtained when encoding instructions focus on distinctive item features compared to cases in which the focus is on relational processing (Hunt & McDaniel, 2003; Nairne, 2006). We suggest that testing requirements lead to adaptive changes at encoding.

Email: Leonel Garcia-Marques, garcia_marques@sapo.pt

2:50-3:05 (212)

Using Tests to Improve Memory: Support for a Transfer Appropriate Processing Account. RENE ZEELLENBERG, MARIO DE JONGE, HELEEN VAN MIERLO and DIANE PECHER, *Erasmus University Rotterdam*—The present study examined the effect of presentation duration on foreign vocabulary learning. Experiment 1 varied presentation durations from 1 s to 16 s per pair (e.g., kikker [Dutch] - frog [English]) while keeping the total study time per pair constant. Speakers of English studied Dutch-English translation pairs for 16 x 1 s, 8 x 2 s, 4 x 4 s, 2 x 8 s or 1 x 16 s. The results showed a nonmonotonic relation between presentation duration and translation recall for both language directions (Dutch - English and English - Dutch). Performance was best for intermediate presentation durations and dropped off for



short (1 s) or long (16 s) presentation durations. Experiment 2 showed that the nonmonotonic relation between presentation duration and translation recall was still present after a 1-day retention interval.

Email: Rene Zeelenberg, memorylab.eu@gmail.com

3:10-3:25 (213)

Test-Enhanced Learning in Visuospatial Memory: Partial Cueing is Important. THOMAS H. CARR, *Michigan State University*, ROBERT BATSELL and AUTUMN B. HOSTETTER, *Kalamazoo College*, HILLARY HICKS, *Michigan State University*, JOHN A. DEWEY, *Central European University*—Taking a practice test after new learning integrates, consolidates, and preserves what has been learned, making more of it retrievable for a longer time than does merely restudying. Such “Test-Enhanced Learning” (TEL) has been observed in a variety of domains and tasks, though most of the evidence comes from verbal memory (word lists, paired associates, written text), where the occurrence of TEL is quite systematic. Here we focus on visuospatial memory, where observations are sparser. In our experiments TEL occurs in recall of complex spatial arrays, and we observe beneficial transfer from such a TEL experience to new visuospatial learning. However, these phenomena occur only when the practice test uses partial cues that call attention to a portion of the visuospatial array rather than its entirety. Partial cueing appears to elicit strategies of remembering that facilitate the processes of integration, consolidation, preservation, and/or retrieval on which TEL relies.

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Working Memory II

Dominion Ballroom, Saturday Afternoon, 1:30-3:10

Chaired by Andrew Heathcote, *The University of Newcastle*

1:30-1:45 (214)

Capacity and Redundant Information in Working Memory. ANDREW HEATHCOTE and AMI EIDELS, *The University of Newcastle*, DAVID STRAYER and JAMES COLEMAN, *University of Utah*, JOSEPH W. HOUP, *Wright State University*—Systems Factorial Technology (SFT; Townsend & Nozawa, 1995) measures information processing capacity using a redundant target paradigm. Traditionally SFT has been applied to perceptual tasks, where, for example, participants might have to make a target response either when a high tone or bright patch, or both, are presented. Capacity is calculated by comparing performance between single and redundant target conditions. Here we report the development of a new working-memory paradigm providing data suitable for an SFT-based capacity analysis. In this mnemonic redundant-target task, participants had to make a target response if an auditory or visual stimulus, or both, occurred two-back in a trial sequence. We calculated capacity using both accuracy and response-time based SFT statistics using data from both perceptual and mnemonic redundant-target tasks and examined associations with mnemonic capacity as measured by operation span.

Email: Andrew Heathcote,

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1:50-2:05 (215)

Visual Working Memory Contains More Information Than People Recall. KLAUS OBERAUER, ALESSANDRA S. SOUZA and LAURA RERKO, *University of Zurich*—We tested visual working memory for arrays of colors with a recall paradigm (Zhang & Luck, 2008). Participants saw arrays of between 1 and 8 colored circles and were asked to recall the color of one randomly selected circle by selecting it from a color wheel. In the standard condition, the location of the to-be-recalled color was highlighted after a 1 s retention interval, and participants could respond immediately. In the delayed condition, the color wheel was presented only 1 s after highlighting the location of the to-be recalled object, delaying selection of the retrieved color. Memory was better in the delayed condition. The improvement was due to an increased chance of recalling the probed object's color, and a decreased probability of guessing. The precision of recall was not affected. The results challenge discrete-capacity models because they imply that delaying the response increases working memory capacity by about 1 slot. The results also challenge resource models assuming that resource allocation affects precision because the delay affects primarily probability of recall, not precision.

Email: Klaus Oberauer, k.oberauer@psychologie.uzh.ch

2:10-2:25 (216)

Working Memory Capacity Is More Than Just Attentional Control: Evidence From Eye-Movements During a Visual Working Memory Task. JONATHAN T. MALL, CANDICE C. MOREY, MICHAEL J. WOLFF and FRANZISKA LEHNERT, *Rijksuniversiteit Groningen* (read by Candice C. Morey)—Selective attention and working memory capacity (WMC) are related constructs, but debate about the manner in which they are related remains active. One elegant explanation is that the efficiency of filtering irrelevant information is the crucial factor underlying WMC. We examined this hypothesis by relating WMC (as measured by complex span tasks) to accuracy and eye movements during visual change detection tasks with different degrees of attentional filtering and allocation requirements. Our results did not indicate filtering differences between high and low WMC groups in the direction predicted by the attentional filtering hypothesis. We instead observed positive or null relationships between WMC and the time people spent looking at irrelevant information. These findings support a more complex interpretation of the relationship between WMC and selective attention and suggest that individual differences in working memory capacity, not only filtering efficiency, influence performance.

Email: Candice Morey, c.c.morey@rug.nl

2:30-2:45 (217)

Hybrid Visual and Memory Search Remains Efficient When Visual Working Memory is Full. TRAFTON DREW, SAGE BOETTCHE and JEREMY M. WOLFE, *Brigham & Women's Hospital*—Hybrid search asks observers to search a visual display for any member of target set of objects. RTs increase as a linear function of visual set size and a log function of the memory set. Recent research has shown that holding items in working memory slows overall visual search RTs,



sometimes decreasing search efficiency as well. How does holding information in working memory influence the rate of search through memory? We asked observers to hold 3 objects in working memory while searching a visual array for one of 2, 8, 16, or 64 target objects. We found that neither search efficiency, nor overall RT was influenced by the working memory load. Furthermore, we found no evidence that the working memory load affected the rate of search through memory. There appears to be surprisingly little overlap between the resources required to complete the hybrid search task and a working memory task.

Email: Trafton Drew, traftondrew@gmail.com

2:50-3:05 (218)

Evidence for Active Removal of Information From Working Memory. STEPHAN LEWANDOWSKY, *University of Bristol; University of Western Australia*, ULLRICH K. H. ECKER, *University of Western Australia*, KLAUS OBERAUER, *University of Zurich*—Many complex cognitive activities, such as mental arithmetic, rely on an agile and flexible working memory (WM) that can be cleared of no-longer relevant information upon demand. For example, intermediate steps during mental arithmetic need to be forgotten quickly lest they interfere with the final result. We introduce a method to examine the processes involved in the removal of information from WM. In a modified version of an established updating paradigm, to-be-updated items are cued before the new memoranda are presented. Longer cue-stimulus intervals--that is, longer times for removal of no-longer relevant items--led to faster updating, showing that people can actively remove information from WM. Moreover, well-known effects of item repetition and similarity on updating times were diminished with longer removal time, arguably because representational overlap between outdated and new information becomes less influential when outdated information can be removed prior to encoding of new information. We conclude that removal of outdated information can be experimentally isolated, and that removal is a unique, active WM updating process.

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Psycholinguistics I

Civic Ballroom, Saturday Afternoon, 1:30-3:30

Chaired by Amit Almor, University of South Carolina

1:30-1:45 (219)

The Neural Representation of Plural Discourse Entities. AMIT ALMOR and TIMOTHY W. BOITEAU, *University of South Carolina*, VEENA NAIR, *University of Wisconsin-Madison*—We report two fMRI experiments examining the neural underpinning of processing plural references in discourse. In the first experiment we found greater bilateral activation in superior parietal regions for discourses describing plural entities (e.g., John and Mike went to the store. They bought some groceries.) than for discourses describing singular entities (e.g., John went to the store last night. He bought some groceries.). In the second experiment, we found greater bilateral activation in superior parietal regions for discourses describing two separate entities (e.g.,

John went with Mike to the store. They bought some groceries) than for discourses in which the two entities were conjoined (e.g., John and Mike went to the store. They bought some groceries). These results suggest the involvement of superior parietal areas in maintaining the representation of referents in discourse with increasing activation associated with an increase in the complexity and number of discourse referents. Email: Amit Almor, almor@sc.edu

1:50-2:05 (220)

Processing Effects on Grammar Acquisition: Evidence From a Language Learning Study. LUCIA POZZAN and JOHN C. TRUESWELL, *University of Pennsylvania* (read by John C. Trueswell)—To acquire a language, learners must first be able to apply a meaningful analysis to the linguistic input. Here we explore how sentence parsing limitations, in particular difficulties revising initial syntactic/semantic commitments during comprehension, shape learners' ability to acquire morphological cues to argument structure. Results from a three-day artificial-language learning experiment with adult participants show that both comprehension and production of morphology are delayed when morphological cues to argument structure appear at the end, rather than at the beginning, of sentences, in otherwise identical grammatical systems. This suggests that real-time processing constraints impact acquisition; morphological cues that guide are easier to learn than cues that revise interpretation. Parallel performance in production and comprehension indicates that parsing constraints affect grammatical acquisition, not just real-time comprehension. Properties of the linguistic system (e.g., ordering of cues within a sentence) interact with the properties of the cognitive system (conflict-resolution) and together affect language acquisition.

Email: John Trueswell, trueswel@psych.upenn.edu

2:10-2:25 (221)

Children's Verb Acquisition: What Are the Units Over Which Statistical Learning Operates? JON A. WILLITS and MICHAEL N. JONES, *Indiana University* (read by Michael N. Jones)—Statistical learning mechanisms are important for many aspects of language acquisition. But what are the units over which statistical learning operates? Claims about the sufficiency of statistical learning mechanisms rest on which units are being used in statistical learning models and theories. In service of addressing this issue, we present an analysis of toddlers' age of acquisition (AoA) of verbs, based on statistics in child-directed speech. In these analyses, we find that these statistics significantly predict AoA ($r^2=0.355$). But these analyses show that which statistics (word frequency, repetition frequency, contextual diversity) predict AoA depends on whether verbs' inflectional morphemes are treated as separate units in the corpus. This study helps answer questions about what factors contribute to vocabulary development – specifically, that inflectional morphology is playing an important role. It also addresses the scope of statistical learning-based theories of acquisition. By testing the predictions of statistical learning models under

different assumptions about the units over which the learning mechanism is operating, statistical learning models can be constrained.

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2:30-2:45 (222)

Reading Ability Predicts Anticipatory Language Processing in Children, Low Literate Adults, and Adults With Dyslexia. FALK HUETTIG, *Max Planck Institute for Psycholinguistics*, NIVEDITA MANI, *University of Goettingen*, RAMESH MISHRA, *University of Allahabad*, SUSANNE BROUWER, *Northwestern University*—In a series of visual world eye-tracking experiments we investigated whether anticipatory language processing is related to individuals' reading abilities. In Experiment 1, eight-year old children's magnitude of anticipatory eye gaze positively correlated with children's reading scores but not with other language scores. In Experiment 2, adult high but not low literates anticipated target objects well before target word onset. In Experiment 3, adults with dyslexia anticipated target objects but much later than control participants with no history of language disorders. We conclude by discussing the mechanisms by which literacy may exert its influence on predictive language processing. We suggest that the present findings are best compatible with the notion of literacy as a proxy for experience. Better readers are more experienced and reading experience in turn may support knowledge experience based mechanisms (e.g., word associations or featural restrictions), which narrow down the possibilities for upcoming input.

Email: Falk Huettig, falk.huettig@mpi.nl

2:50-3:05 (223)

Seeing Language: Activation of Object Labels During a Non-Linguistic Task. SARAH CHABAL and VIORICA MARIAN, *Northwestern University* (read by Viorica Marian)—To determine whether visual objects automatically activate their linguistic labels, Spanish-English bilinguals and English monolinguals completed a visual search task in which no overt linguistic input was provided. Participants saw a target image (e.g., clock) and searched for that object from an array of four images while their eye-movements were tracked. English Competitor trials contained an item whose English label overlapped phonologically with the English label of the target (e.g., clock-cloud); Spanish Competitor trials contained an item whose Spanish label overlapped phonologically with the Spanish label of the target (e.g., reloj-regalo [clock-present]). Whereas all participants looked more often at English Competitor items than at items that did not overlap phonologically with the target, only the Spanish-English bilinguals looked more often at Spanish Competitor items. Results suggest that the labels of visually presented objects are automatically activated in the linguistic network and that language experience affects the processing of visual input.

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3:10-3:25 (224)

Feeling Visible and Invisible Words: Emotional Processing is Modulated by Awareness in first and second language. GABRIELLA VIGLIOCCO, RACHEL CLARKE, MARTA PONARI, DAVID VINSON and ENRICO FUCCI, *University College London*—How does emotion affect cognitive functioning? Some theories argue that negative emotional valence is associated with a general slowdown of processing of stimuli. Other theories argue that both negative and positive valence facilitates processing. Here, we show that both views are correct under different conditions. The same participants carried out a location decision task under Continuous Flash Suppression (CFS, engaging preconscious processing), and a lexical decision task (engaging conscious processing). In both tasks, items used were controlled for all known lexical and visual dimensions. We found that negative words were responded to more slowly in the location decision task under CFS than neutral and positive words. However, both negative and positive words were responded to faster in the lexical decision tasks. We further replicated the same results with another group of second language speakers. Thus, previously conflicting results may well reflect qualitatively different cognitive and neural mechanisms engaged in preconscious "quick and dirty" evaluation vs. fully conscious semantic processing of stimuli.

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Cognitive Control II

Conference B & C, Saturday Afternoon, 1:30-3:30

Chaired by Geoffrey Woodman, *Vanderbilt University*

1:30-1:45 (225)

Pushing and Pulling Current Through Medial-Prefrontal Cortex Provides Causal Control of the Neural Processing of Errors and Learning Rate. ROBERT M.G. REINHART and GEOFFREY F. WOODMAN, *Vanderbilt University* (read by Geoffrey F. Woodman)—Adaptive behavior depends on our capacity to increase cognitive control after we make an error. Here we show that transcranial direct-current stimulation targeting medial-frontal cortex provides causal control over the electrophysiological responses of the human brain to errors and feedback. Using one direction of current flow, this stimulation eliminated error-monitoring activity, impaired behavioral performance in a basic cognitive task, and slowed the rate of learning. By reversing the current flow of stimulation in the same subjects, we enhanced error-monitoring activity, improved behavioral performance, and sped the rate of learning. The stimulation selectively influenced the potentials indexing error monitoring and not other electrophysiological responses of the brain (e.g., perceptual processing and response selection). In addition, the behavioral effects on accuracy and learning rate were produced without changing the speed of responses in our modified stop-signal task. Our findings demonstrate that the functioning of a key mechanism of executive control can be up or down regulated using noninvasive stimulation.

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1:50-2:05 (226)

The “Next” Prepared Reflex Paradigm. NACHSHON MEIRAN and MAAYAN PEREG, *Ben-Gurion University of the Negev*—According to the “prepared reflex” hypothesis, working-memory representations of stimulus-to-response mapping instructions operate reflexively such that responses are activated when an appropriate stimulus is presented. Previous experiments supporting this hypothesis are open to alternative explanations, a limitation that we tried to overcome with a novel “next” paradigm. The paradigm consisted of miniblocks. At the beginning of each miniblock, participants received novel instructions in which two objects were arbitrarily mapped to the right/left keys. In the trials that followed, an object was presented in red color, indicating that the instructed rule should not be applied. Instead, participants were asked to press the right key (or the left key, in other participants) to advance the screen (generating a “next” response). At an unexpected point in time, the objects started to appear in green, indicating that the instructed mapping should now be executed (“go”). To ensure high readiness in the critical “next” phase, only 2 such “go” trials were included and high accuracy and speed were emphasized. Results show quicker “next” responses when the keys used to advance the screen were compatible with the instructed mapping then when they were incompatible with it, and this compatibility effect was most pronounced in the first “next” trial of the mini-block.

Email: Nachshon Meiran, nmeiran@bgu.ac.il

2:10-2:25 (227)

To Control or Not to Control? Using Individual Differences in Working Memory Capacity to Explore Automation and the Resolution of the Control Dilemma. JASON M. WATSON, A. EVE MILLER, CHAD MOFFITT and DAVID L. STRAYER, *University of Utah*, ANN E. LAMBERT, *University of Virginia*—To investigate attentional control, cognitive psychologists often rely on oppositional logic, pitting automatic and controlled processes against one another, measuring speed and accuracy of responding to incongruent stimuli (e.g., RED printed in green ink). Furthermore, individual differences in working memory capacity (WMC) have been shown to predict the differential regulation of habitual responses in favor of novel ones in tasks requiring attentional control like Stroop color naming. Although dual reliance on oppositional logic and individual differences in WMC has contributed considerably to our field’s theoretical knowledge on mechanisms of attentional control, it overlooks the control dilemma. The dilemma is that the exertion of control and the regulation of on/off-task behavior must be balanced by an overarching tendency to automate processing and to conserve limited-capacity cognitive resources. The present study combines oppositional logic with individual differences in WMC to explore automation and resolution of the control dilemma in a Simon task.

Email: Jason Watson, jason.watson@psych.utah.edu

2:30-2:45 (229)

When and How Do Instructions Help Us? Analyzing the Functional Form of Performance Improvement. BAPTIST LIEFOOGHE, MAARTEN DE SCHRYVER and JAN DE HOUWER, *Ghent University*—The presented study investigated when and how instructions help us in relatively simple choice reaction tasks (CRTs). To this end, performance improvement in CRTs for which the S-R mappings are instructed beforehand was compared to performance improvement in CRTs in which S-R mappings had to be derived on the basis of feedback. Performance improvement was measured by fitting exponential functions to RTs, decomposing them into three parameters: the improvement rate, the learning amount, and the baseline performance. In a series of experiments, CRT features such as the task difficulty were manipulated and we investigated how these manipulations modulated the influence of instructions on these three parameters. Overall the results suggest a strong impact of instructions on the improvement rate, and a more modest impact on the learning amount. The results are discussed in line with current proposals on instruction implementation.

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2:50-3:05 (230)

On the Ability to Inhibit Thought and Action: General and Special Theories of an Act of Control. GORDON D. LOGAN, *Vanderbilt University*, TRISHA VAN ZANDT, *The Ohio State University*, FREDERICK VERBRUGGEN, *University of Exeter*, ERIC-JAN WAGENMAKERS, *University of Amsterdam*—The stop signal task measures response inhibition in many domains of psychology and neuroscience. For 30 years, the task been understood using Logan and Cowan’s (1984) race model, in which a stop process races against a go process. The race model has an important limitation: it does not account for choice in the go task. We present general and special race models that account for choice in the stop-signal task. The general model is a race model. Choice depends on a race between the alternative go responses and the stop process. The special model is a race between diffusion processes, characterized by drift rate, threshold, and non-decision time parameters. We apply the models to two data sets to test assumptions about selective influence of capacity limitations on drift rates and strategies on thresholds. We use the model to estimate distributions of SSRT, which previous models could not estimate.

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SYMPOSIUM IV: Exploring the Canine

Mind: Studies of Dog Cognition

Grand Centre, Saturday Afternoon, 1:30-3:40

Organized by William A. Roberts, Western University Canada

1:30-1:35 (231)

Introduction. William A. Roberts, *Western University Canada*

1:35-1:55 (232)

The Mental Age of Dogs. STANLEY COREN, *University of British Columbia*—A continuing interest is the comparison of the intelligence of dogs to that of other animals, however if we could understand how smart dogs are relative to humans this would give us a particular advantage in allowing us to predict the behaviors and competencies of our canine companions. A recent research strategy involves adapting tests designed for children with limited language capacity for use with dogs. Since many of these tests were designed to be scored in terms of human mental age they can give us some of the answers we seek. Currently data suggests that the average dog has a mental age equivalence of a human two-year-old while the most intelligent 20 percent of dogs have a mental age equivalent to a two-and-a-half year old human child.

Email: Stanley Coren, scoren@psych.ubc.ca

2:00-2:20 (233)

When Less is Better Than More. KRISTINA F. PATTISON and THOMAS R. ZENTALL, *University of Kentucky* (read by Thomas R. Zentall)—We have found that dogs are willing to work for two reinforcers of different value: a piece of cheese (A) or a piece of carrot (B). Not surprisingly, when offered a choice between the two foods, the dogs prefer the cheese. Curiously, however, when they are offered a choice between a piece of cheese (A) and a piece of cheese together with a piece of carrot (A+B) they prefer the cheese alone. Thus it appears that rather than judge the sum of the carrot and the cheese together versus the cheese, dogs judge the average of the carrot and the cheese against the cheese alone.

Email: Thomas R. Zentall, zentall@uky.edu

2:25-2:45 (234)

Can Dogs Discriminate Time and Number? KRISTA MACPHERSON and WILLIAM A. ROBERTS, *Western University Canada* (read by William A. Roberts)—Time and number are two fundamental dimensions confronted by most organisms, and research has shown that many species can accurately track time intervals and discriminate between different numbers of stimuli. We report experiments in which dogs learned to respond accurately to a fixed time interval (FI) schedule and to discriminate between short and long time durations. Although dogs failed to discriminate between different numbers of objects presented successively, they readily learned to discriminate between simultaneous presentations of different numbers of patterns and showed clear evidence of Weber's law. That is, they showed both distance and magnitude effects in which numerical discrimination declined linearly as the ratio of the smaller number/larger number increased.

Email: William A. Roberts, roberts@uwo.ca

2:50-3:10 (235)

Individual Difference in Canine Cognition. EVAN L. MACLEAN, ALYXANDRA L. REINHARDT, SUNIL SUCHINDRAN and BRIAN A. HARE, *Duke University*—Research in the last two decades has yielded remarkable insights into canine cognition. Most notably, dogs have been shown to possess a variety of human-like social skills not commonly seen in other nonhuman animals. In contrast, dogs' abilities for reasoning about the physical world appear to be comparatively unremarkable. However, we know little about the underlying structure of canine cognition, the relationships between particular cognitive abilities, and the nature of individual differences. I will present data from a test battery designed to measure social, physical, and domain general cognitive skills in dogs, and a factor analysis of the relationships between these measures. Additionally I will report the associations between these cognitive measures and training outcomes in two working dog populations.

Email: Evan L. MacLean, maclean@duke.edu

3:15-3:35 (236)

Experimenter's Post-Hiding Movements Influence Dogs' Search Behavior for Hidden Objects. SYLVAIN FISET and VICKIE PLOURDE, *Université de Moncton in Edmundston*—Topál, Gergely, Erdőhegyi, Csibra and Miklósi (2009) revealed that domestic dogs commit perseverative search errors in an ostensive-communicative context. In the current study, we replicated Topál et al.'s search paradigm to investigate the influence of the experimenter's post-hiding movements on dogs' search behavior. In Experiment 1, we replicated Topál et al.'s results with dogs and wolves. We also found that dogs, despite communicative cues given by the experimenter, did not commit the perseverative search error when the experimenter remained stationary after the disappearance of the object. In Experiment 2, we demonstrated that the dog's search behavior is also influenced by the experimenter's post-hiding movements in a single visible displacement task. This study suggests that the experimenter's displacement influences dogs' performance in a search task and may partially explain the results observed by Topál et al.

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Explicit Memory II

Dominion Ballroom, Saturday Afternoon, 3:30-5:10

Chaired by Joseph Fitzgerald, Wayne State University

3:30-3:45 (237)

Priming Early and Middle Childhood Memories With Mixed Success. JOSEPH M. FITZGERALD, *Wayne State University*—Priming Early and Middle Childhood Memories with Mixed Success. Joseph M. Fitzgerald, Wayne State University. Recent research has demonstrated priming of autobiographical memories by college students prompted to recall memories from adolescence as a priming task. We explored the nature and limits of this effect. Students aged 18 to 21 were prompted to recall events from either before their 8th birthday or between their 8th and 12th birthdays. Other participants made up stories of events that plausibly could have taken place during one of the target age ranges. Prompts



in the priming task were event descriptions appropriate for the age range. Control participants received no priming. Following a distracter task, participants completed a word-cue autobiographical memory task. There was an effect of priming early childhood memories for specific memories. Participants who made up events for either age range or were primed to recall memories from the 8-12 period showed no effect of priming. The pattern of results suggests that priming of memories from a particular period may be effective but thinking about the period in order to create fictional events does not appear to be. Hypotheses regarding the limitation of priming are discussed.

Email: Joseph Fitzgerald, aa1670@wayne.edu

3:50-4:05 (238)

Prospective Memory Costs Reflect Criterion Shifts, not Capacity Limitations. SHAYNE LOFT, *The University of Western Australia*, ANDREW HEATHCOTE, *The University of Newcastle*, ROGER W. REMINGTON, *The University of Queensland*—Remembering to perform deferred actions when an event is encountered in the future is referred to as event-based prospective memory (PM). Individuals are often slower to respond to ongoing tasks when they have PM tasks. Theories of PM differ in their interpretations of costs; however all assume that the processes underlying costs draw on limited-capacity resources, thereby implying that the PM task has a direct effect on the efficiency of ongoing task processing. In line with this, researchers that have fitted the Diffusion Model to PM data sets have reported a mean rate change. We reevaluate this evidence by fitting the Diffusion and Linear Ballistic Accumulator models to these same data sets, and to new within-subject data better suited to model fitting. Evidence for an effect of PM on the mean rate parameter was weak, which suggests that evidence accrual for the PM and ongoing task do not share a limited-capacity resource. Our model fits support the conclusion that PM tasks predominantly increase the ongoing task response criterion. Increasing the evidence required for ongoing task response selection reduces PM error by decreasing the likelihood that the more routine ongoing task response pre-empts the PM response.

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4:10-4:25 (239)

Part-Set Cuing Interferes With Prospective Memory to Review Loan Terms on Home Loan Disclosure Forms. MARK A. LEOEUF and JESSICA M. CHOPLIN, *DePaul University*, DEBRA POGGRUND STARK, *The John Marshall Law School* (read by Jessica M. Choplin)—Previous research found that presenting a subset of previously studied items again immediately before retrieval inhibits recall performance for the remaining items. This phenomenon is called the part-set cuing effect. Two eye tracking experiments examined whether part-set cuing could disrupt prospective memory. In particular, these experiments investigated whether part-set cuing could cause consumers to forget to check loan terms that they were previously instructed to check on a federally mandated home loan disclosure form (the HUD-1 disclosure form; Housing and Urban Development). Experiment 1 manipulated whether participants were cued prior to reading

through the loan, and Experiment 2 manipulated whether the presentation order of cues was consistent or inconsistent with the order of appearance during study and on the form. Part-set inhibition was observed in both experiments independent of presentation order, such that those cued prior to reading fixated fewer non-cued terms than those not cued. These results suggest that part-set cuing can undermine Congress' intent in mandating these forms by disrupting consumers' prospective memory to review loan terms.

Email: Jessica Choplin, jchoplin@depaul.edu

4:30-4:45 (240)

How General is the Incongruity Advantage in Social Source Memory? RAOUL BELL and AXEL BUCHNER, *Heinrich-Heine-University Duesseldorf*, MEIKE KRONEISEN, *University of Mannheim*, TRANG GIANG, *Heinrich-Heine-University Duesseldorf*—Evolutionary psychology posits that the human mind comprises highly specialized cognitive modules, including a cheater detection module. Given that reciprocal altruism makes huge demands on memory, it has been argued that a module for remembering cheaters could help to protect from social exploitation. Inconsistent with these claims, it has been shown that information that violates positive or negative expectations is remembered best. Remembering expectancy-incongruent information may represent a more adaptive strategy than remembering only cheaters would. In the present study we presented faces whose appearance stimulated strong social expectations together with behavior descriptions that violated or confirmed these expectations, and we assessed memory for the face-behavior associations. To test the claim that the incongruity advantage is due to a module designed to support social exchange we manipulated the emotional and social relevance of the congruent and incongruent behaviors across experiments.

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4:50-5:05 (241)

Context Effects in Associative Memory for Objects on Natural Backgrounds. CHI NGO and MARIANNE E. LLOYD, *Seton Hall University* (read by Marianne E. Lloyd)—Two experiments were conducted to explore the nature of associative memory for objects embedded in natural backgrounds. Previous studies on the context effect (i.e., enhancement in memory when the to-be-remembered items are tested in the same context) has demonstrated reliance on familiarity or recollection depending upon the stimuli and methodology used. In the current study, a robust context effect was found for object recognition. Importantly, the size of the context effect was similar between the speeded and non-speeded recognition conditions, suggesting that context effects for objects on natural backgrounds are based in effects of familiarity. In addition, evidence for familiarity effects in two other associative recognition tasks – associative identification and associative reinstatement (Cohn & Moscovitch, 2007) was obtained and supports the idea that associative memory may be based on familiarity if the items to be remembered are

unitized (e.g., Hayes, Nadel & Ryan, 2007). The results will be discussed in the context of associative memory more generally as well as dual-process models of recognition memory.

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5:10-5:25 (242)

Individualized Measurement of Dual-Retrieval Processes in Neurocognitive Impairment. C.J. BRAINERD, C.F.A. GOMES and VALERIE F. REYNA, *Cornell University*—Recall methods of separating recollective from nonrecollective retrieval provide theory-driven technologies for studying memory deficits and their brain correlates in populations with neurocognitive impairments. These methods are easily applied to the low-burden clinical instruments used to diagnose conditions such as mild cognitive impairment (MCI) and Alzheimer's dementia (AD), yielding individualized profiles for recollective retrieval, reconstructive retrieval, and familiarity judgment. Such profiles were generated for MCI, AD, and healthy control subjects, using samples from the Alzheimer's Disease Neuroimaging Initiative and the Mayo Study of Healthy Aging. Those profiles were better predictors of future disease than genetic markers or spinal fluid markers. When combined with MRI scans, the profiles predicted differences in brain tissue volume in regions that have been linked to recollective and nonrecollective retrieval in fMRI studies. When profiles were compared across diagnostic groups, loss of reconstructive retrieval ability was the hallmark of MCI and AD memory deficits.

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Speech Perception II

Civic Ballroom, Saturday Afternoon, 3:50-5:10

Chaired by Laurie B. Feldman, University at Albany, SUNY & Haskins Laboratories

3:50-4:05 (243)

Reading Skill and Early Morphological Processing. LAURIE B. FELDMAN, *University at Albany, SUNY; Haskins Laboratories*, KIT W. CHO, *University at Albany, SUNY*, PETAR MILIN, *University of Novi Sad; Tübingen University*, FERMÍN MOSCOSO DEL PRADO MARTÍN, *University of California, Santa Barbara*, HARALD BAAYEN, *Tübingen University*—Across a variety of SOAs (34,50,67,84,100), we have observed greater facilitation to decision latencies for prime-target pairs that share morphological structure and semantics (farmer-FARM) than for pairs that share apparent morphological structure but no semantics (corner-CORN) and these form-with-meaning effects on early morphological processing are not carried by the inclusion of a few potentially idiosyncratic pairs (Feldman, Kostić, Gvozdenović, O'Connor, & Martín, 2012; Feldman & Martín, 2009). More novel is that we fail to observe differences when primes are exhaustively (stem+affix; e.g., pastor-PAST) and partially (stem+nonmorpheme e.g., pasta-PAST) decomposable. Finally, we report on how reading skill influences these patterns of morphological facilitation.

Email: Laurie B Feldman, lfeldman@albany.edu

4:10-4:25 (245)

Immediate Effects of Anticipatory Coarticulation in Spoken-Word Recognition. ANNE PIER SALVERDA, DAVE KLEINSCHMIDT and MICHAEL K. TANENHAUS, *University of Rochester*—Participants' eye movements were recorded while they saw a four-picture display and identified the referent of a spoken noun phrase (e.g., "The lemon is the target"). In Experiment 1, the determiner was cross-spliced from a neutral context and the noun was preceded by a prosodic break ("The ... lemon"). Participants began to favor the referent around 200 ms after noun onset. In Experiment 2, the noun phrase was realized as one phonological phrase ("The lemon"). We examined if the formant structure at the onset of the determiner's vowel was influenced by anticipatory coarticulation of the initial sound of the noun. A pattern classifier was trained on the formant values, and predicted the initial sound of the noun well above chance. Participants began to favor the referent around 130 ms after noun onset, significantly earlier than in Experiment 1. The results demonstrate that listeners generate lexical hypotheses based on anticipatory coarticulation.

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4:30-4:45 (246)

Talker Learning Identification: Mixing it Up in the Garden State. JENNIFER S. PARDO, HANNAH GASH and MICHAEL APFELBAUM, *Montclair State University*—A variety of studies have shown that listeners can learn to identify talkers from voice alone in a simple perceptual learning task. These studies have demonstrated the importance of phonological factors in talker identification learning. The current study examined talker identification learning ability in a set of 48 listeners who learned to identify sets of 8 talkers over the course of 5 training sessions. These talkers were all drawn from the same state (New Jersey), but half the talkers resided in the North and half in the South, exhibiting distinct dialects. The results were analyzed to assess the impact of dialect (North versus South New Jersey), dialect discrimination ability, word type (mono versus bisyllabic words), and training set type (mixed versus single dialect regions) on talker identification learning. Overall, listeners were able to learn to identify the talkers, and presenting talkers from mixed regions reduced performance levels and increased variability in training performance.

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4:50-5:05 (247)

Effect of Divided Attention on Lexical Activation and Acoustic Processing. SVEN L. MATTYS, *University of York*—Relative reliance on acoustic and lexical information during speech recognition can shift under cognitive load (CL) (Mattys & Wiget, 2011). This presentation reports two sets of experiments aimed at teasing apart a sublexical locus of CL, a lexical locus, and a post-lexical response bias. In a first set of experiments, phoneme restoration data suggest that CL—a concurrent visual task—attenuates perceptual sensitivity but does not affect lexical activation per se. In a second set of experiments, listeners identified a spoken word masked with white noise at -6 and -12 dB SNR using a forced-choice task. In the critical trials, neither response option corresponded



to the target, but one was acoustically confusable with the target and lower lexical frequency (acoustic foil) whereas the other was less acoustically confusable with the target and higher frequency (lexical foil). CL led to proportionally more acoustic-foil responses whereas increased noise led to proportionally more lexical-foil responses. Taken together, the results suggest that CL (1) does not directly affect lexical activation, (2) operates sublexically, possibly by blurring the boundaries between phoneme categories, (3) is functionally distinct from signal degradation.

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Human Learning and Instruction II

Grand West, Saturday Afternoon, 3:30-5:30

Chaired by Christopher Wolfe, Miami University

3:30-3:45 (248)

BRCA Gist: An Intelligent Tutoring System Grounded in Fuzzy-Trace Theory. CHRISTOPHER R. WOLFE, *Miami University*, VALERIE F. REYNA and PRISCILA G. BRUSTRENCK, *Cornell University*, AUDREY M. WEIL, COLIN L. WIDMER, ELIZABETH M. CEDILLOS and CHRISTOPHER R. FISHER, *Miami University*—Angelina Jolie has brought attention to genetic risk of breast cancer. We tested the efficacy of the BRCA Gist Intelligent Tutoring System to explain such risk in three experiments on the web, in communities, and at two universities. Fuzzy-Trace Theory guided the development of BRCA Gist. Technical information was translated into decision-relevant gist and simple gist principles. Using expectationstextsandLatentSemanticAnalysis, conversational agents (avatars) “understood” and responded to participants’ typed questions. Tutorial dialogues addressed questions such as, “how do genes affect breast cancer risk?” and promoted self-explanation and argumentation. We randomly assigned participants in both laboratory and field experiments to one of three conditions: BRCA Gist, the National Cancer Institute web site, or a control tutorial. The BRCA group was superior at assessing risk, factual knowledge, and gist comprehension of breast cancer and genetic risk, and were appropriately less interested in testing low risk individuals and themselves.

Email: Christopher Wolfe, WolfeCR@MiamiOH.edu

3:50-4:05 (249)

From Specific Examples to General Knowledge in Language Learning. KATHLEEN RASTLE and JAKKE TAMMINEN, *Royal Holloway, University of London*, MATTHEW H. DAVIS, *MRC Cognition & Brain Sciences Unit*—The recovery of general knowledge from individual episodes is at the heart of language acquisition. We investigated this generalisation process in a laboratory model of word learning. Participants learned new affixes (e.g. -nule) embedded in novel words (e.g. sleepnule is a participant in a study about sleep), then were tested immediately or after several days’ delay to determine whether they could generalise their knowledge of the new affixes to untrained contexts (e.g. sailnule). Results of several studies suggest that participants can generalise their knowledge of the new affixes immediately after training, but only when given a task that explicitly requires them to generalise, and that gives them sufficient time to do so.

However, when faced with a speeded lexical processing task, participants show robust generalisation only in the delayed test condition. We discuss these results within a complementary learning systems framework, which asserts that some forms of linguistic generalisation can be achieved on the basis of episodic representations of individual items, but that a process of memory consolidation is required for the development of abstract representations that support generalisation in online language processing.

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4:10-4:25 (250)

Improving Long-Term Knowledge Retention in the Classroom With Personalized Review. ROBERT V. LINDSEY and JEFF D. SHROYER, *University of Colorado*, HAL PASHLER, *University of California, San Diego*, MICHAEL C. MOZER, *University of Colorado* (read by Michael C. Mozer)—Human memory is imperfect; thus, periodic review is required for the long-term preservation of knowledge and skills. However, students at every educational level are challenged by an evergrowing amount of material to review and an ongoing imperative to master new material. We developed a method for efficient, personalized review that combines statistical techniques for inferring individual differences with a psychological theory of memory. The method was integrated into a semester-long middle school foreign language course via retrieval-practice software. In a cumulative exam administered after the semester’s end that compared time-matched review strategies, personalized review yielded a 16.5% boost in course retention over current educational practice (massed study) and a 10.0% improvement over a one-size-fits-all strategy for spaced study.

Email: Michael Mozer, mozer@colorado.edu

4:30-4:45 (251)

Computer-Based Learning: Graphical Integration of Whole and Sectional Neuroanatomy Improves Long-Term Retention. FARAH NAAZ, *Washington University in St. Louis*, JULIA H. CHARIKER and JOHN R. PANI, *University of Louisville* (read by John R. Pani)—There is potential for psychological science to develop uses of computer graphics that improve the effectiveness of illustration in challenging areas of science education. The present paper explores this potential for a basic topic in biology: elementary neuroanatomy in both whole and sectional form (e.g., MRI images). We report a test of the hypothesis that learning from graphically integrated representations of whole and sectional neuroanatomy is especially effective for instances of neuroanatomy that are difficult to learn. Neuroanatomy was taught to two groups of participants using computer graphical models of the human brain. Both groups learned whole anatomy first with a three-dimensional model of the brain. One group then learned sectional anatomy using two-dimensional sectional representations. The second group learned sectional anatomy from a graphical representation of the sampling of sectional morphology from whole anatomy. This group revealed the sectional anatomy by moving a cutting plane through the three-dimensional model. Confirming the hypothesis, the

group with integrated representation recognized more of the difficult instances of sectional anatomy after a retention interval of several weeks.

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4:50-5:05 (252)

Why Does Predicting, Incorrectly, an Upcoming To-be-Learned Response Enhance Learning? Evaluating the Mediator Hypothesis. COURTNEY M. CLARK, VERONICA X. YAN and ROBERT A. BJORK, *University of California, Los Angeles* (read by Robert A. Bjork)—Trying to predict (even when wrong) a to-be-learned target, versus studying the intact pair, enhances recall of cue-target pairs (e.g., Kornell, Hays & Bjork, 2009). One hypothesis as to why guesses enhance learning, rather than create interference, is that guesses become mediators that aid recall of targets. Prior work has found that guesses are not only well remembered, but that target recall is better when guesses remain accessible. We tested the mediator hypothesis more directly by asking learners to either predict the target, or to provide an alternative target in response to seeing a cue-target pair. We argue that alternative responses made in the presence of the target should serve as better mediators than guesses made in the absence of target. The pattern, however, should depend on whether learners are cued by the target or cue at test, and we draw on latent semantic analysis to support such asymmetric predictions.

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5:10-5:25 (253)

Transformation From Psychology Student to Scientist: A Broken Ideology. ROMAN TARABAN and PAIGE SEEGAN, *Texas Tech University*—As a critical element in transforming undergraduates from students to scientists, Boyer (1998) proposed that all should engage in research beginning with freshman year. In an analysis of the undergraduate population at a large public research university only 3% of the enrollments were in independent research, predominantly seniors (77%), with no growth over the last 10 years. Comparing Psychology to Biological Sciences, research enrollments were higher in Psychology (7% vs 5%, respectively), fewer were seniors (64% vs 81%), and GPA was higher (3.42 vs 3.30, out of 4.00). Quality of experience was not evaluated here; however, Taraban and Logue (2012) reported that Biology majors compared to Psychology majors self-reported higher knowledge of lab methods, stronger peer networking, and stronger commitments to science, research, and graduate training. The low level and quality of research participation University-wide, and in Psychology, reflects a broken educational ideology and slow progress toward educating a scientifically-competent workforce.

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Multisensory Integration

Conference B & C, Saturday Afternoon, 3:50-5:30

Chaired by Christine Sutter, RWTH Aachen University

3:50-4:05 (254)

Task Complexity Alters Proprioceptive-Visual Integration. CHRISTINE SUTTER and JOCHEN MÜSSELER, *RWTH Aachen University*—Changes in visual perspective challenge the human information processing system, since discordant information from the moving hand and visual action effect needs to be integrated. In two experiments we examined how motor activity of an irrelevant effector affects multisensory integration in this context. Participants responded to visual stimuli with a pre-defined response hand. They did not see the stimuli and their response hand directly, but received visual feedback with retained or reversed spatial relations on a projection screen in front of them. The non-responding hand was outside the viewing angle, and either inactive or actively performing a separate motor task. In Exp. 1 the active/inactive conditions of the irrelevant effector were presented blockwise (low complexity), in Exp. 2 both conditions randomly varied within a block (high complexity). It is known that in a dual task demands were increased and this is what we found when the irrelevant effector was actively performing a motor task. Changes in perspective did not alter multisensory integration in Exp. 1, but in Exp. 2. We conclude that visual action effects gain more influence in action control when task complexity is increased.

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4:10-4:25 (255)

Aging and Curvature Discrimination From Static and Dynamic Touch. J. FARLEY NORMAN, *Western Kentucky University*, ASTRID M.L. KAPPERS, *Vrije Universiteit*, JACOB R. CHEESEMAN, CECILIA RONNING, KELSEY E. THOMASON, MICHAEL W. BAXTER, AUTUM B. CALLOWAY and DAVORA N. LAMIRANDE, *Western Kentucky University*—Two experiments evaluated the ability of 30 older and younger adults to discriminate the curvature of simple object surfaces from static and dynamic touch. The ages of the older adults ranged from 66 to 85 years, while those of the younger adults ranged from 20 to 29 years. For each participant in both experiments, the minimum curvature magnitude needed to reliably discriminate between convex and concave surfaces was determined. In Experiment 1, participants used static touch to make their judgments of curvature, while dynamic touch was used in Experiment 2. When static touch was used to discriminate curvature, a large effect of age occurred (the thresholds were 0.67 & 1.11/m for the younger and older participants, respectively). However, when participants used dynamic touch, there was no significant difference between the ability of younger and older participants to discriminate curvature (the thresholds were 0.58 & 0.59/m for the younger and older participants, respectively). The results of the current study demonstrate



that while older adults can accurately discriminate surface curvature from dynamic touch, they possess significant impairments for static touch.

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4:30-4:45 (256)

Testing Saccadic Reaction Times to Visual-Auditory Stimuli for Oscillatory Phase Resetting. ADELE DIEDERICH and ANNETTE SCHOMBURG, *Jacobs University Bremen*, 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 visual-auditory stimulus pairs in a focused attention paradigm. An auditory nontarget stimulus was followed by a visual target (LED). Interstimulus intervals (ISI) ranged from zero to 402 ms in increments of 2 ms. Spectral analysis suggests the existence of multiple temporal windows of high and low excitability.

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4:50-5:05 (257)

A Comparison of the Spatial Ventriloquist Effect Induced by Eye Gazes and Flashes. JEAN VROOMEN and JEROEN J. STEKELENBURG, *Tilburg University*—The apparent location of a sound can be biased in the direction of an eye gaze or flash (spatial ventriloquism). Here we examined the extent to which spatial ventriloquism induced by eye gazes and flashes are 'perceptually real' by measuring their 1) aftereffects, 2) the brain response to illusory shifts in sound location (the ventriloquist-MMN), and 3) the extent to which real from illusory sound motion can be discriminated in a 2AFC procedure that excludes response bias. Result show that flashes are real, whereas gaze is fake.

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5:10-5:25 (258)

Causal Relations Affect Perceived Simultaneity. JAMES F. JUOLA and ROB VAN EIJK, *Eindhoven University of Technology*, ARMIN KOHLRAUSCH, *Eindhoven University of Technology; Philips Research Europe*, INGE BRANDT, *Eindhoven University of Technology*—We address the question of how visual predictive information and implied causality affect audio-visual synchrony perception. The research uses audio-visual stimulus pairs that vary in their relative asynchrony, and subjects judge whether the pair appeared to be synchronous or whether the audio or visual component occurred first. Previous research has found systematic shifts in the temporal point of subjective simultaneity for variants of audio-visual stimulus pairs that differ in (1) the amount of visual predictive information, and (2) the apparent causal relation between the auditory and visual components. An

experiment was designed to separate predictability and causality explanations for these shifts. The results showed that changes in the point of subjective simultaneity were completely explained by changes in the implied causal relation in the stimuli, and that predictability explained only negligible additional variance in the data. These results indicate that the observed shifts in subjective simultaneity due to apparent causal relations among auditory-visual stimulus pairs do not reflect a mere change in response strategy, but rather result from early multimodal integration processes in event perception.

Email: James Juola, juola@ku.edu

Judgment and Decision Making II

Grand East, Saturday Afternoon, 3:50-5:30

Chaired by Ben Newell, *University of New South Wales*

3:50-4:05 (259)

Beyond Simple Heuristics: How Hierarchical Bayesian Models Reveal the Complexity of Multi-Attribute Judgment.

BEN R. NEWELL and DON VAN RAVENZWAAIJ, *University of New South Wales*, MICHAEL D. LEE, *University of California, Irvine*—How do people search, stop and decide when making judgments? Several accounts suggest that people use a variety of heuristics or strategies each suited to a particular environment. The simplicity of these accounts is appealing but they tend to belie the complexity of the data observed in experimental analogs of common decision problems. We demonstrate that a novel model, which uses hierarchical latent mixtures and Bayesian inference provides a more complete description of the data from multi-attribute judgment tasks than simple heuristic strategies. The model incorporates frugal and compensatory strategies as special cases of an over-arching framework and naturally captures individual differences in the order in which people search for information, the criteria they use to terminate search, and the interaction between these two sources of variation.

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4:10-4:25 (260)

What's so Special About Moral Judgment? Maybe Not

as Much as You Think. ADAM B. MOORE, *University of Edinburgh* (Associate Member Select-Speaker Award Recipient), ANDREW R.A. CONWAY and YAEL NIV, *Princeton University*—Why is there such variability in moral judgment, not only between people, but within individuals as well? Psychologists have proposed different models to account for this, most of which are of the dual process variety. Instead of this, we propose that subjects make moral judgments as a function of the discounted expected moral value of the actions open to them. This model provides an impressive fit to a large variety of data, predicts moral judgments and response times, and makes novel testable predictions that are upheld. We conclude that simple models of decision making based on action planning are sufficient to explain and predict many of the core effects of the moral psychological literature.

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4:30-4:45 (261)

Validation and Application of a Multinomial Model to Dissect Framing Effects in Truth Judgments. BENJAMIN E. HILBIG, *University of Mannheim*—Recent research has demonstrated a framing effecting in truth judgments such that statistical statements framed negatively are more likely to be judged true than formally equivalent statements frames positively. However, due to the methodology of previous investigations it is largely unclear whether this effect may be due to differences in (a) knowledge or (b) response bias triggered by framing. Therefore, a multinomial processing tree model – based on the two-high-threshold model – is herein proposed to distinguish between these processes. Three model validation experiments support the psychological interpretability of model parameters. Three further model application experiments show that the framing effect constitutes a response bias (individuals more likely guessed “true” when faced with a negatively framed statistical statement) whereas the probability of conclusive knowledge was independent of statement framing. The pattern of results is compatible with theories explaining differences in truth judgments in terms of retrieval fluency.

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4:50-5:05 (262)

Acute Stress Effects on Model-Based versus Model-Free Reinforcement Learning. A. ROSS OTTO (Associate Member Select-Speaker Award Recipient), CANDACE M. RAO, ELIZABETH A. PHELPS and NATHANIEL DAW, *New York University*—Contemporary accounts of reinforcement-learning (RL) posit the operation of separate, competing valuation systems in the control of choice behavior: model-free RL, which learns action preferences in a manner in accord with the “law of effect”, is contrasted with the more flexible model-based RL, which explicitly represents environment structure in order to prospectively evaluate actions. On the basis of previous work demonstrating that working-memory (WM) resources are necessary for implementing model-based choice, and that acute stress deleteriously impacts executive functions including WM, we investigated how acute stress (and its concomitant physiological response) alters expression of model-based and model-free RL in a sequential choice task affording disentanglement of the two choice strategies. To induce a neurophysiological stress response, we administered the Cold Pressor Test shortly before subjects completed the sequential choice task. In line with our predictions we find that cortisol response attenuates model-based, but not model-free contributions to choice behavior.

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5:10-5:25 (263)

Harming is More Probable Than Helping: The Probabilistic Aspect of Intentionality and Valence in the Side-Effect Effect. KUNINORI NAKAMURA, *Seijo University*—How do people judge the intentionality of an action? To answer this question, Knobe (2003) demonstrated that people’s judgment of the intentionality of a side effect depends on the valence of its outcomes. In that study, when the president of a company enacted a new program intended to benefit the company but

that was also harmful to the environment, he was perceived to have intentionally harmed the environment. However, when the program was beneficial to the environment, the president was not perceived to have intentionally helped the environment. This finding is frequently cited as evidence that judgment of the intentionality of an action depends not only on the intention of the actor but also on the valence of the action’s result. However, on the basis of recent findings (e.g., Harris, Corner, & Hahn, 2009; McKenzie & Nelson, 2003), the current study proposes an alternative interpretation of Knobe’s (2003) results by suggesting that peoples’ judgments of intentionality depend on the probability of outcomes resulting from the action rather than the valence of the outcomes. To test this hypothesis, we employed a similar experimental procedure to that of Knobe (2003) but we asked participants to judge both intentionality and the probability of outcomes resulting from the president’s action. The results replicated Knobe’s (2003) finding but in addition showed that a negative event (harming the environment) was considered more probable than a positive event (helping the environment). These results support the proposition that people perceive intentionality of an action not based on its valence but instead on the probability of its outcome.

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Business Meeting

Grand Ballroom Centre, Saturday Afternoon, 5:10–6:00

Chaired by Helene Intraub, University of Delaware

Presentation of the Psychonomic Society 2013 Best Article Awards. COLIN M. MACLEOD, *University of Waterloo*
Business of the Psychonomic Society. HELENE INTRAUB, *University of Delaware*



Metamemory/Metacognition II

Dominion South, Sunday Morning, 8:00-10:00

Chaired by Bennett Schwartz, Florida International University

8:00-8:15 (266)

Contextual Information Influences the Feeling of Knowing in Episodic Memory. BENNETT L. SCHWARTZ, *Florida International University*, MATHIEU PILLOT and ELISABETH BACON, *University of Strasbourg*—The feeling of knowing (FOK) predicts the likelihood of future recognition of currently unrecalled items. According to the accessibility model (Koriat, 1993, 1995), FOKs rely on the quantity and quality of retrieved contextual and partial information. The current study assessed the validity of the accessibility model for episodic memory in an ecologically valid task. Participants studied the names of imaginary animals three times each. We varied the amount of contextual information that accompanied the name and image of animals. There were three conditions, minimum-information (name and image), medium-information (name, image, and country) and maximum-information (name, image, country, diet and weight). FOK for unrecalled items was lower in the minimum-information condition relative to other conditions. However, the minimum-information condition resulted in the best target recall. FOKs were positively correlated with the retrieval of contextual information. This study demonstrated that accessibility of contextual information affected FOKs, consistent with Koriat's model.

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8:20-8:35 (267)

Evaluating the Relationship Between Memory Monitoring and Effective Learning: When Will Accurate Monitoring Help Learning? JOHN DUNLOSKY and SARAH K. TAUBER, *Kent State University*, KEITH W. THIEDE, *Boise State University*, JANET METCALFE, *Columbia University*—Kimball, Smith, and Muntean (2012) conducted multiple experiments to evaluate the hypothesis that accurate monitoring can be used to allocate study in a manner that benefits learning and final performance. Their evidence led them to conclude that highly accurate monitoring had only a minor benefit for learning. We propose a theoretical model that indicates why monitoring within their experimental design could only produce a minor benefit to learning and predicts when monitoring can support large learning gains. We discuss how the model can fit data from previous research (which revealed monitoring can substantially benefit learning) and present new evidence to evaluate predictions from the model. A major conclusion is that high levels of judgment accuracy is important to support effective learning, although some conditions exist in which even excellent accuracy will have a minimal influence on learning.

Email: Sarah Tauber, stauber@kent.edu

8:40-8:55 (268)

Auditory Hindsight Bias is Not Due to Priming. DANIEL M. BERNSTEIN and RAGAV KUMAR, *Kwantlen Polytechnic University*, DANIEL J. LEVITIN, *McGill University*—Hindsight bias (HB) is the tendency to overestimate one's prior

ability to predict known event outcomes. In two experiments, we separated auditory HB from priming. During a priming phase, participants heard words zero, one, three, or six times. Then, HB participants heard a clear followed by a distorted version of the words, while non-HB participants heard only the distorted version; all participants then estimated how many of their peers could identify the distorted version of the word, assuming said peers had not heard the clear version. We defined auditory HB as increased peer identification estimates after hearing the clear version of the words immediately before the distorted version, and priming as increased peer identification estimates based on how many times participants heard the words during the priming phase. HB participants showed clear HB but no priming, while non-HB participants showed clear priming and no HB. Auditory hindsight bias is, therefore, not due to priming.

Email: Daniel Bernstein, daniel.bernstein@kwantlen.ca

9:00-9:15 (269)

Beyond Fluency: Why is Confidence in Problem Solutions Inversely Related to Solving Time? RAKEFET ACKERMAN, *Technion-Israel Institute of Technology*—Several studies have found negative time-confidence correlations in problem-solving tasks. This was traditionally explained by the attribution of fluency to confidence judgments, as was found to be the case with metacognitive judgments for memorization and knowledge questions. However, as lengthy problem solving is effortful and goal-directed, we would expect solvers to gain confidence as they invest more time. According to the proposed Diminishing Criterion Model (DCM), as people invest longer in a problem, their confidence in their solution indeed increases, reflecting their goal-directed efforts. Nevertheless, the process ends with a negative time-confidence correlation because people compromise on their stopping criterion, finding lower confidence levels satisfactory after lengthy investment in solving a problem. The hypotheses derived from the DCM were supported under several conditions. Even when participants were allowed to submit a "don't know" response, they still provided low-confidence solutions after lengthy thinking, suggesting that they found them satisfactory. The study emphasizes the top-down goal-directed nature of effort investment in complex tasks over the bottom-up fluency explanation for confidence.

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9:20-9:35 (270)

True Psychological Underconfidence or Scaling Artifact? The Recalibration Hypothesis and the Underconfidence-With-Practice Effect. KATARZYNA ZAWADZKA and PHILIP HIGHAM, *University of Southampton* (read by Philip Higham)—In studies with multiple study-recall cycles using the same items, recall increases to a greater extent over cycles than judgments-of-learning (JOLs), producing the so-called underconfidence-with-practice (UWP) effect on later cycles. We have shown recently that this effect is unique to percentage likelihood scales; if binary tasks are used instead (e.g., yes/no JOLs), the effect is eliminated (Hanczakowski, Zawadzka, Pasek, & Higham, in press). Here, we present new data suggesting that this dissociation, and the UWP effect

more generally, may be partly explained by the recalibration hypothesis, which assumes that JOLs are malleable, context specific, and sensitive to the psychological range of stimuli being rated. If so, a central premise in metacognitive research is undermined: that bias measures (e.g., Yates, 1994), derived directly by comparing mean recall and mean JOLs, accurately index psychological realism. Implications for recalibration in other areas of metacognitive research are discussed.

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9:40-9:55 (271)

Learnin' 'Bout my Generation: The Effects of Generation on Encoding, Recall, and Metamemory. GLEN E. BODNER and A. NICOLE BURNETT, *University of Calgary*—We examined how the effect of a generation manipulation shifts across two study-test blocks. Having differential recall for generate versus read targets on Block 1 led participants to modify their encoding strategies for Block 2 in ways that eliminated their differential recall on Test 2. However, recall also increased across tests for groups who studied and recalled only one target type, and differential recall on Test 2 was also eliminated for some groups who were not tested on both target types on Test 1. Thus experiencing the generation effect on Test 1 is not critical to its elimination on Test 2. Participants' strategy reports and metamemory judgments were used to try to elucidate how and when participants modify their encoding strategies in an effort to improve future memory performance. We conclude that shifts in study strategies in this paradigm are more ubiquitous and more varied than suggested by previous research.

Email: Glen Bodner, bodner@ucalgary.ca

Judgment and Decision Making III

Grand West, Sunday Morning, 8:00-9:40

Chaired by Mario Fific, *Grand Valley State University*

8:00-8:15 (272)

Stopping Rule Selection (SRS) Theory Applied to Deferred Decision Making. MARIO FIFIC, *Grand Valley State University*, MARCUS BUCKMANN, *Max Planck Institute for Human Development*—The critical step facing every decision maker is when to stop collecting evidence and proceed with the decision act. This is known as the stopping rule. Over the years, several unconnected explanations have been proposed that suggest nonoptimal approaches can account for some of the observable violations of the optimal stopping rule. The current research proposes a unifying explanation for these violations based on a new stopping rule selection (SRS) theory. The main innovation here is the assumption that a decision maker draws from a large set of different kinds of stopping rules and is not limited to using a single one. The SRS theory hypothesizes that there is a storage area for stopping rules—the so-called decision operative space (DOS)—and a retrieval mechanism that is used to select stopping rules from the DOS. The SRS theory has shown good fit to challenging published data and the new data.

Email: Mario Fific, fificm@gvsu.edu

8:20-8:35 (273)

Evidence Supporting Theory of Shannon Capacity in Human Decision-Making. LAURENCE T. MALONEY, JAMES TEE and HANG ZHANG, *New York University*—Sims, Jacobs & Knill (2012) employed Shannon's theory to analyze the performance of human visual working memory in recall tasks. A crucial element of Shannon's theory is the concept of quantization, where a continuous quantity is divided into a discrete (or finite) number of small parts (or steps) (Gray & Neuhoff, 1998). If the human brain does indeed have finite Shannon capacity, we should also find evidence of quantization in decision-making tasks. We designed a conjunction probability gambling task to test this hypothesis. We found that experiment data is a better fit to a novel quantized Prelec model compared to the standard continuous version. 29/36 naïve subjects showed best fit at 4 bits of precision, implying that the brain may be using a finite precision multiplier to perform the conjunction computation. Our discovery of quantization in a decision-making task supports the theory of Shannon capacity in human decision-making.

Email: Laurence Maloney, jst344@nyu.edu

8:40-8:55 (274)

Testing the Sampling Model of Frequency and Probability Distortion in a Visual Numerosity task. HANG ZHANG and LAURENCE T. MALONEY, *New York University*—Two opposite patterns have been reported in human judgment or use of frequency/probability information: (1) overestimation of small probability and underestimation of large probability; (2) underestimation of small probability and overestimation of large probability. Both patterns can be expressed as linear transformations of the log odds of frequency/probability (Zhang & Maloney, 2012, *Frontiers in Neuroscience*). They differ in the slope of the transformation, γ . Zhang & Maloney (2012, *Psychonomics*) developed a model to explain how γ may change within and across human individuals as the result of a sampling process. Assuming one single slope γ_0 for the same individual, the model attributes the observed different γ 's to the binomial variation in samples of limited sizes N s and the individual's representational bound in log odds, Δ . Here we present a new test of the model in a visual numerosity task, where we manipulated N s and measured Δ . The observed variations of γ within and across human individuals were consistent with model predictions.

Email: Hang Zhang, hang.zhang@nyu.edu

9:00-9:15 (275)

Experimental Tests of the Probability Weighting Function. RICHARD A. CHECHILE and DANIEL H. BARCH, *Tufts University*—In cumulative prospect theory, the outcome probabilities for a binary gamble are transformed to a probability weighting function $\Omega(p)$, so the utility of the gamble is $U(G) = \Omega(p)u(V1) + (1 - \Omega(p))u(V2)$, where $u(V1)$ and $u(V2)$ are outcome utilities. Many proposals for the probability weighting function have been advanced in the literature of psychology and economics, but heretofore it has been difficult to reach a consensus. In this paper we provide an experimental method for finding the logarithmic derivative



function (LD) for $\Omega(p)$. The LD function is very sensitive to the curvature of the weighting function, so incorrect models are easily detectable. The experimental LD data is only consistent with two functions.

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

9:20-9:35 (276)

To Agree or Not to Agree: Evidence for Confirmation Biases. MITCHELL RABINOWITZ and ANDREW LANDERS, *Fordham University*—The current study was designed to assess how people view information that was either consistent or inconsistent with their view and in addition, to assess their awareness of other people's views of the same information. The participants were a national sample of adults recruited from Mechanical Turk. Participants were asked to rate statements about parenting style in terms of whether they thought it was true, their perception would be the percent of the general population that they thought would agree with the statement, and whether the statement was a fact or a belief. The results indicated a substantial confirmation bias, if a person agreed with a statement they were pretty accurate in terms of predicting other's level of agreement. However, if they disagreed, they predicted that more people would disagree than did. This effect increased if they strongly disagreed with the statement. Also, if they strongly agreed with a statement, they overestimated the number of people who would agree. Email: Mitchell Rabinowitz, mrabinowitz@fordham.edu

Selective Attention III

Grand Centre, Sunday Morning, 8:00-10:00

Chaired by Jane Raymond, *University of Birmingham*

8:00-8:15 (277)

Mechanisms of Cognitive Enhancement by Incentive: Human Electrophysiological Evidence. JANE E. RAYMOND and RISA SAWAKI, *University of Birmingham*, STEVEN J. LUCK, *University of California, Davis*—How do incentive cues (stimuli that predict behaviourally contingent rewards) produce enhanced performance on simple visual attention tasks? We monitored electroencephalography (EEG) as adults performed a series of trials comprised of a briefly presented incentive cue, a 1500 ms blank preparation interval, and then a speeded visual discrimination task that could yield a high or low behaviourally contingent reward depending on the incentive's cue's color. For high versus low incentives, we found that (1) response times on the search task were faster; (2) attentional suppression of incentive cue processing (as indexed by the Pd of the ERP) was evident; (3) visual alertness (indexed by alpha suppression) during the preparation interval was greater; and (4) efficiency of covert attention orienting (indexed by the N2pc) in the search task component was greater. Cues predicting rewards can engage rapid processing suppression when cognitive resources are needed elsewhere to gain rewards, rather than slavishly attracting attention. Email: Jane Raymond, j.raymond@bham.ac.uk

8:20-8:35 (278)

Inhibition Drives Early Feature-Based Attention. JEFF MOHER, *Brown University*, BALAJI M. LAKSHMANAN, *Kennedy Krieger Institute*, HOWARD E. EGETH, *Johns Hopkins University*, JOSHUA B. EWEN, *Kennedy Krieger Institute* (read by Howard E. Egeth)—Attention can modulate visual input according to task-relevant features, even as early as ~100 ms after stimulus presentation. In the present study, ERP and behavioral data suggest that inhibition of distractor features, rather than activation of target features, is the primary driver of early feature-based selection in human observers. Additionally, feature-based inhibitory attentional sets are robust and transfer to novel task contexts. This discovery of inhibition consistent with task goals suggests that inhibition plays a much larger role at an earlier stage of target selection than previously recognized, and highlights the importance of understanding the role of inhibition (in addition to activation) in attention.

Email: Howard Egeth, egeth@jhu.edu

8:40-8:55 (279)

A Convergent Gradient-Field Model of Attention. BRAD WYBLE, *The Pennsylvania State University*, MINGXUAN TAN, *Syracuse University*, MAXWELL BAY, *University of California, Los Angeles*—Visual attention is frequently described as a spotlight that focuses on one location to the exclusion of others, and there are hundreds of experiments that support this general idea. However, like Newtonian mechanics, a description of a system that is sufficient at one scale, can fail at a finer grain of analysis. For example, there is increasing evidence that attention can be divided across multiple locations. We propose a neural model of spatial attention with the general characteristics of a spotlight, that can also exhibit multiple, stable hotspots of attention when cues appear simultaneously. This model makes predictions about simultaneous cueing effects, and also provides an explanation of the N2pc EEG component. The model raises important questions about the role of the attentional spotlight in vision. We suggest that the spotlight may play a role in the temporal segmentation of visual input.

Email: Brad Wyble, bwyble@gmail.com

9:00-9:15 (280)

Seeing Visual Relations. *STEVEN L. FRANCONERI, AUDREY LUSTIG, LINSEY SMITH, LAURA STOUGHTON and LEI YUAN, *Northwestern University*, PRITI SHAH, *University of Michigan*, DAVID UTTAL, *Northwestern University*—Some visual tasks, such as identifying previously seen objects, faces, or scenes, can be performed easily and immediately. But when visual tasks require extracting novel information from an unfamiliar image, we often find it difficult and sluggish even for relatively simple images. Here we examine how people extract relations from bar graphs, which are visually simple in many ways but also contain complex relational information. We will describe a model where many types of relational extraction must unfold slowly through a sequence of attentional shifts over time, producing a serial stream of relational information similar to a linguistic code. We will describe eye-tracking data suggesting that (a)

relational extraction does involve serial inspection of a single value at a time, (b) that the order of this serial stream matters, such that seeing that bar A is larger than bar B is different from seeing that bar B is smaller than bar A, (c) that guiding attention through a graph can control the types of visual representation (and subsequent cognitive conclusions) that an observer constructs, (d) that elementary-school children use different patterns of attentional shifts compared to older populations. We will discuss how these patterns reveal new insights into relational processing across perception and cognition, and also suggest concrete steps to improving how graph comprehension is taught.

Email: Steven Franconeri, franconeri@northwestern.edu

9:20-9:35 (281)

A Fresh Look at the Emotional Stroop Effect. AMI EIDELS, ELOISE FALLON and RACHEL ROSS, *The University of Newcastle*, DANIEL ALGOM, *Tel Aviv University*—The emotional Stroop effect (ESE) is the difference in colour-classification latency of coloured emotion and neutral words. The presence of ESE shows that participants fail to ignore the emotional content of the task-irrelevant words. The current study examines the source of the ESE by employing a novel task in which participants gave routine colour responses only to emotion words, but gave a constant colour-irrelevant response to neutral words. The selective responding forces deeper processing of the meaning of the carrier words. Our results showed a larger ESE in the new task, suggesting that emotion processing in the standard task may not be complete. Our analysis was augmented by (1) individual depression scores and (2) calculation of fast and slow effects, the latter tapping carry-over effects from previous trials.

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9:40-9:55 (282)

Now or Later? Attentional Processing and Temporal Decision Making. ANA M. FRANCO-WATKINS, *Auburn University*—Many decisions involve making choices between immediate and future prospects. The general tendency to discount future gains in lieu of smaller immediate gains is known as temporal discounting. Although the basic temporal decision making paradigm has been associated with real-world problematic behaviors, it does not adequately model situations where often there are immediate and delayed costs (as well as rewards); and the rewards and costs of future outcomes are probabilistic rather than certain. The current work builds upon and extends the standard paradigm, to include the parameters involved in decision making (e.g., time, uncertainty, gains, and losses) and used eye-tracking methodology to examine attentional processing to different elements of choice options during the decision process. Accounting for some of these complexities allows for a better theoretical understanding of the mechanisms and processes involved in temporal decision making.

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Action and Perception II

Dominion North, Sunday Morning, 8:00-10:00

Chaired by Robert Cook, Tufts University

8:00-8:15 (283)

Discrimination of Complex Human Actions by Pigeons and Humans. ROBERT G. COOK and MUHAMMAD A. QADRI, *Tufts University*—Recognizing and categorizing different behaviors is a critical function for all animals. The current experiments examined if and how pigeons categorized complex, non-repetitive actions of digital human actors. Pigeons were tested in a go/no-go procedure to discriminate among multiple versions of “martial arts” and “Indian dance” actions or poses presented in 20-s sequences. Humans were tested in a choice version of the task. The experiments revealed for both species: 1.) a dynamic advantage for action over pose presentations, 2.) that action and pose information are mediated by different visual features, and 3.) the cues involved appeared to be derived from the global configuration of the actor’s movements. The results suggest that both species learned to recognize these complex actions using a combination of both motion and static cues. That pigeons can discriminate complex human movements suggests that embodied species-specific action networks are not a necessary condition for the recognition of behavior.

Email: Robert Cook, Robert.Cook@tufts.edu

8:20-8:35 (284)

The Dynamic Relationship Between Fear and Estimates of Virtual Heights. MICHAEL N. GEUSS, *University of Utah*, FRANCOIS D. DU TOIT, *Max Planck Institute for Biological Cybernetics*, JEANINE K. STEFANUCCI, *University of Utah* (read by Jeanine K. Stefanucci)—Previous research has demonstrated that fear increases height estimates (Jackson, 2009; Stefanucci & Proffitt, 2009). Given that the intensity of height fear dissipates with time (Emmelkamp et al., 2002), we assessed whether height estimates also changed according to fear levels within and across trials. Participants estimated multiple virtual heights of varying depths by performing a visual matching task. Objective (electrodermal) and subjective (self-report) measures of emotion were employed. Across trials, we assessed whether overestimation of height was attenuated as fear habituated. Within trials, we tested whether the emotional reaction to the displayed height influenced the process of estimation by recording adjustments for the matching task over time. Height estimates decreased across trials, but the rate of decline in estimates was moderated by individuals’ subjective and objective levels of fear. Lower levels of fear were associated with a greater decline in height estimates across trials and different adjustment processes within trials.

Email: Jeanine Stefanucci, jeanine.stefanucci@psych.utah.edu

8:40-8:55 (285)

The Importance of Being First: Serial Order Effects in the Interaction Between Action Plans and Ongoing Actions. LISA R. FOURNIER, JONATHAN M. GALLIMORE and KEVIN R. FEISZLI, *Washington State University*, GORDON D. LOGAN, *Vanderbilt University*—When planning actions,



we must hold some elements of the sequence in working memory (WM) while we execute others. Research shows that executing an action can be delayed if it partly overlaps (vs. does not overlap) with another action plan maintained in WM (overlap cost). However, it is not known whether all action features maintained in WM interfere equally with current actions. We examined whether serial position of action features maintained in WM influence current actions. Two visual events occurred in a sequence, and participants planned and maintained an action sequence to the first event (Action A) in WM while executing a speeded response to the second event (Action B). Results showed delayed execution of Action B (overlap cost) when it matched the first feature, but not the last feature, in the Action A sequence. This result suggests that serial order is represented in the action plan prior to response execution, consistent with models that assume serial order is represented by a primacy gradient of parallel, feature activation prior to action execution.

Email: Lisa Fournier, lfournier@wsu.edu

9:00-9:15 (286)

Visual Perception Near the Hands: The Case of Object Files. DAVOOD GOZLI, JULIE ARDON, DAVID CHAN and JAY PRATT, *University of Toronto* (read by Jay Pratt)—Recently, we have provided evidence across a variety of tasks (spatial/temporal gap, object substitution masking, rapid object identification) that having the hands near visual stimuli (proximal) facilitates magnocellular processing and having the hands far from visual stimuli (distal) stimulates parvocellular processing. Here we test if this visual pathway distinction affects how objects are represented, with the hypothesis that distal hands should promote feature integration (i.e., a bias toward object-based processing) while proximal hands should suppress feature integration (i.e., a bias toward feature-based processing). The first experiment, using a partial repetition cost task, showed greater object binding with distal hands than proximal hands. The second experiment involved recognition of objects with or without spatiotemporal continuity, and also showed stronger feature integration with distal hands than proximal hands. Together, these two experiments provide empirical support for the hypothesis that object-based processing is facilitated with distal hand postures that enhance parvocellular activity.

Email: Jay Pratt, pratt@psych.utoronto.ca

9:20-9:35 (287)

What is Selected First, the Hand Used for Reaching or the Target That is Reached? OLIVER HERBORT, *Ludwig-Maximilians-Universität Würzburg*, DAVID A. ROSENBAUM, *The Pennsylvania State University*—In many situations one has to select among different objects for interaction. Additionally, one has to choose how to interact with them. This raises the question of which sorts of decisions normally precede which others. Does one first select the object and then a suitable action? Or does one first select an action and then a suitable object? We addressed this question by asking participants to aim for either of two target objects with either hand based on whichever combination seemed easiest. The choices made in this free condition were compared to choices made when

either object or target selection were constrained. A model assuming similar selection processes in the free condition and in the action-constrained condition (in which action selection necessarily preceded object choice) provided the best account for the data. This result accords with the hypothesis that hand was generally chosen first in the free choice condition.

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9:40-9:55 (288)

Kinematics Trump Dynamics for Throwing Balls Varying in Weight to Targets varying in Distance. JOHN J. RIESER, NICHOLAS WEAVER, AYSU ERDEMIR, NGOC-THOA KHUU, DAVID JOHNSON, LIONEL POMERANZ and SARA BECK, *Vanderbilt University*—The flight distance of a thrown ball depends on its speed at the instant of release. This study shows accuracy depends more directly on the throw's kinematics than on the underlying dynamics. To throw a constant weight ball to further away targets, one increases the ball's release speed. To throw balls that vary in weight to fixed targets, one holds the ball's release speed constant and increases the force for heavier balls. We hypothesized that the throwing system is tuned to actively control hand speed, not force. Adults used an underhand toss to throw a ball to land on a small ground target. In one condition three weight-varying balls were tossed a constant distance; in the other condition a constant weight ball was tossed to three distances. Weights & distances were selected so the momenta for optimal throws were matched in pair-wise fashion for the 3 weights & distances. Results show the constant & variable errors increased across the 3 distances, and were constant across the 3 weights. In order to toss a ball accurately under conditions like these, people actively control the kinematics of the throw. They do not actively control the dynamics.

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Letter and Word Processing II

Grand East, Sunday Morning, 8:00-10:00

Chaired by Rebecca Treiman, Washington University in St. Louis

8:00-8:15 (289)

Influences on Spelling: Evidence From Homophones. REBECCA TREIMAN, *Washington University in St. Louis*, MARK S. SEIDENBERG, *University of Wisconsin*, BRETT KESSLER, *Washington University in St. Louis*—In three experiments, we used homophones as a test case to examine the influences of linguistic and performance factors on spelling in English. We introduced university students to novel meanings of phonological forms, for example presenting /fid/ as a rare word meaning “an upholstered settee for two persons.” If people tend to assign a unique spelling to each morpheme, they should avoid the spelling <feed> for the novel morpheme because this spelling is already associated with a meaning. Contrary to this prediction, participants in spelling production tasks were more likely to use known spellings such as <feed> for homophone items than control items. Participants did tend to choose novel spellings for homophones in a two-choice recognition task, and most also expressed the belief

that the different meanings of a homophone should be spelled differently. The results suggest that a major influence on spelling production is the lesser cognitive resources required to use a familiar orthographic form compared to those needed for selecting different sound-to-letter correspondences and assembling a novel spelling.

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8:20-8:35 (290)

Letter-Position Sensitivity is Modulated by the Linguistic Environment: Evidence From an Elementary Learning Model. ITAMAR LERNER, *Rutgers University; Hebrew University*, BLAIR ARMSTRONG, *Basque Center for Cognition, Brain and Language*, RAM FROST, *Hebrew University; Haskins Laboratories; Basque Center for Cognition, Brain and Language* (read by Ram Frost)—Transposed-Letter (TL) effects in word recognition are commonly taken to reflect an inherent insensitivity to letter position. Consequently, recent computational models of reading have introduced letter positional variability as a hardwired property of their mechanisms. These models, however, cannot explain important cross-linguistic differences in sensitivity to position, such as the lack of TL effects in Hebrew or Arabic. Here we demonstrate that relative insensitivity to letter position can result purely from different statistical properties of the linguistic environment during learning. We instantiated a basic feed-forward connectionist model that learned to map separate representations of word inputs onto target semantic outputs, abstractly capturing reading-skills acquisition. The model was trained on either Hebrew or English words, and then probed with transposed-letter pseudo-words. The results show that the characteristics of the languages' orthographies lead to differential emergent sensitivity to letter position, without recourse to unnecessary domain-specific assumptions. Implications to reading are discussed.

Email: Ram Frost, frost@mscc.huji.ac.il

8:40-8:55 (291)

Accounting for Variance in Single-Word ERPs. ARNAUD REY, SYLVAIN MADEC, JONATHAN GRAINGER and PIERRE COURRIEU, *CNRS; Aix-Marseille University*—Event-related potentials (ERPs) allow us to track the time-course of word processing from the visual presentation of the stimulus to the initiation of the response. In the present study, we recorded ERPs for 48 participants while they repeatedly (i.e., 4 times) performed a single-word naming task on a list of 200 disyllabic words. After conducting a sequence of ERP treatments (e.g., ICA and BSS-CCA processing), mean ERPs for each word were computed over the four repetitions and over participants in order to obtain item-level ERPs. Intra-class correlation statistics (ICC, see Courrieu et al., 2011) were then calculated on each time-point to determine the amount of reliable variance that is present in the signal during the first 400 milliseconds. The results reveal a progressive and dynamical increase of the ICC across the scalp that provides new insights for our understanding of word recognition processes.

Email: Arnaud Rey, arnaud.rey@univ-amu.fr

9:00-9:15 (292)

Masked Affix Priming and Morpheme Position Coding. DAVIDE CREPALDI, *University of Milano Bicocca*, KATHLEEN RASTLE and COLIN J. DAVIS, *Royal Holloway, University of London*—Previous studies have shown that suffixes are identified as such only when they occur after a stem (Crepaldi et al., 2010). This evidence emerged in a lexical decision task where the critical stimuli were presented overtly to participants; therefore, we do not know whether suffix “position locking” is a task-specific, strategic effect, or rather arises because morphological coding reflects statistical regularities in morpheme distribution within words (see Crepaldi et al., 2013). Here we show that this latter hypothesis is correct by providing evidence for suffix position-locked coding in masked priming. We found that nonword primes yield time savings in the identification of words with a same suffix (flagly-YEARLY), both against a morphological (fatefu-YEARLY) and an unrelated baseline (fatefu-YEARLY). However, this effect disappeared when (related and control) prime morphemes were flipped so that the shared suffix was in different positions in primes and targets (lyfate-YEARLY). Email: Davide Crepaldi, davide.crepaldi1@unimib.it

9:20-9:35 (293)

Crowd-Sourcing Lexical Decision: A Snapshot of Language. EMMANUEL KEULEERS, PAWEŁ MANDERA and MARC BRYSSBAERT, *Ghent University*—Psycholinguistics has seen a rapid increase of crowd-sourcing as a way to collect large amounts of behavioral data. We will present the results of a massive lexical decision experiment. In the experiment, which is set up as an on-line vocabulary game, Dutch speakers can get a percentage score reflecting their estimated vocabulary size by indicating which of 100 presented stimuli they know as words. Within a matter of weeks, we were able to collect accuracy and reaction time data for over 50,000 Dutch words and associated profile data (age, gender, linguistic background) from hundreds of thousands of participants. With over 1% of the total Dutch-speaking population participating, the experiment is a first-of-its kind snapshot of a language. In addition to discussing the experiment's implementation and results we will address its potential uses for scientific research and everyday life.

Email: Emmanuel Keuleers, emmanuel.keuleers@ugent.be

9:40-9:55 (294)

Inhibitory and Facilitative Effects of Lexical Neighborhood Size on Reading. WONIL CHOI, *University of South Carolina*, PETER C. GORDON, *University of North Carolina at Chapel Hill* (read by Peter C. Gordon)—The size of a word's orthographic neighborhood robustly affects performance in lexical-decision tasks, with faster responses for words with many, rather than few, orthographic neighbors. Two eye-tracking experiments showed the reverse pattern in gaze duration when reading words in sentences even though data from the English Lexicon Project on the seven-letter (Experiment 1) and five-letter (Experiment 2) target words showed that having many neighbors facilitated lexical-decision performance for these stimuli. Skipping rates during reading for the five-letter words were significantly



higher for words with many, rather than few, neighbors. Thus, orthographic neighbors facilitated word recognition as measured by skipping but inhibited word recognition as measured by gaze duration. The results support a multiple read-out model in which global lexical activity generated from parafoveal preview facilitates skipping (and lexical decisions) but where recognition of the specific word that is fixated is made more difficult by confusable orthographic patterns.
Email: Peter Gordon, pcg@email.unc.edu

Cognitive Skill Acquisition

Conference B & C, Sunday Morning, 8:00-9:40

Chaired by Craig Speelman, Edith Cowan University

8:00-8:15 (295)

How Robust are Skills in the Face of Context Change? CRAIG P. SPEELMAN and LOIS JOHNSON, *Edith Cowan University*—The present study examined a previously reported disruption in learning curves associated with transfer. On each trial a multiplication problem from the 6 times table was presented. When subjects gave a response they were asked to use the number in a subsequent addition or subtraction problem. Both the training and transfer phases consisted of 12 blocks of trials, with six trials per block. The same multiplication problems were presented in both phases, while participants receiving addition problems in training then received subtraction questions in transfer and vice versa. Only RTs for the multiplication problems were analysed. There was a significant disruption in performance on these problems in the first block of the transfer phase. Analysis of trial-by-trial data indicated that in the two trials following the task change, performance was significantly slower than the first trial of the transfer phase. Performance in the remainder of the block quickly returned to levels similar to those prior to the disruption, indicating the change of task had only a short-lived effect on performance of the multiplication problems. The robustness of skills in the face of changes in performance context will be discussed.

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8:20-8:35 (296)

The Promise and Reality of Transfer From Video Games. SCOTT WATTER, JULIANA LOUREIRO-KENT and JAMES W. KARLE, *McMaster University*—Research on the effects of video games on cognition has revealed at least two general findings: 1) expert gamers show superior performance on a wide range of perceptual and attentional tasks versus non-experts, and 2) moderate video game training with non-experts shows very limited effects in comparison. This suggests much of the expert gamer advantage is likely an interaction of experience with individual differences, and leaves open the practical question of how useful video games might be as a cognitive training tool for a general population. We collaborated with a video game studio to produce several real (“fun”) games, with features designed to maximally train basic attentional and perceptual abilities, and assessed transfer to standard cognitive tasks from 10 hours’ gameplay in non-experts. We present findings from several games, and discuss aspects of cognition that might be more or less susceptible to

training and transfer, and the practical effect sizes involved. (Co-author James Karle was an employee of the video game company with which we worked to produce our training games.)

Email: Scott Watter, watter@mcmaster.ca

8:40-9:55 (297)

Obtaining Transfer From a Computer Memory Game to an Incidental Learning Task. MICHAEL S. HUMPHREYS, *The University of Queensland*, SCOTT WATTER and JAMES W. KARLE and JULIANA LOUREIRO-KENT, *McMaster University*—A computer memory game was designed in which a player’s performance could be improved by deliberately forming and then using bindings between game elements. In the control condition a player’s performance could be improved by remembering individual elements. In two experiments playing the binding game transferred to performance on an incidental binding task but not to deliberate binding tasks. This may have occurred because our training for forming or using bindings occurred in the presence of competition. It also has implications about where we look for generalized transfer. (Co-author James Karle was an employee of the video game company with which we worked to produce our training games.)

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9:00-9:15 (298)

Keeping Playing Fields Level: The Case FOR Performance Enhancing Drugs. LEWIS M. BARKER, *Auburn University*—Fairness requires that athletes are guaranteed a “level playing field” on which to perform. A number of quasi-governmental regulatory agencies have mandated that Performance Enhancing Drugs (PEDs) represent the greatest threat to “fairness” in sports, and that banning such drugs has the effect of leveling the playing field. However, it can be argued that totally unregulated genetic and cultural disparities differentiate athletes to a far greater extent than PEDS. Perhaps the use of PEDs should be evaluated by a mantra other than “the war on drugs” that indiscriminately penalizes and criminalizes “illicit” drug use.

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9:20-9:35 (299)

The Executive Power of Music. L. ROBERT SLEVC, NICHOLAS DAVEY, MARTIN BUSCHKUEHL and SUSANNE M. JAEGGI, *University of Maryland*—Does musical training confer advantages beyond the ability to create music? Previous work suggests it can: musicians have advantages in a variety of abilities, including auditory working memory and executive functioning (EF). However it is not yet clear if these advantages are limited to auditory processing tasks and/or to specific components of EF. This study investigated the existence and generality of a “musician advantage” in EFs by testing matched groups of 48 musicians and 48 non-musicians on three different components of EF – inhibition, updating, and switching – in both auditory and visual domains. Musicians outperformed non-musicians in both auditory and visual updating tasks and, to some extent, in inhibition tasks, but groups did not differ in switching performance. Thus cognitive benefits of musical training

are not limited to auditory processing, but are limited to particular aspects of EF. This supports process-specific (but modality-general) transfer from musical experience to non-musical cognitive abilities.

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Explicit Memory III

Dominion South, Sunday Morning, 10:20-12:00

Chaired by Peter F. Delaney, University of North Carolina at Greensboro

10:20-10:35 (300)

Primacy and Negative Recency Effects in Incidental Learning and the Story Mnemonic. PETER F. DELANEY, *University of North Carolina at Greensboro*, PETER P.J.L. VERKOEIJEN, *Erasmus University Rotterdam*, NAMRATA R. GODBOLE, *University of North Carolina at Greensboro*—The “standard” serial position function in free recall is one of the most-recognized discoveries of cognitive psychology: a u-shaped curve with better memory for items at the beginning (primacy) and end (recency) of a list. Primacy is usually explained via rehearsal producing recent and frequent strengthening. Consequently, in incidental learning or when the story mnemonic is used, there is little or no primacy effect on an immediate test. However, increasing the retention interval produces a shift from recency to primacy: the R2P or recency-to-primacy shift. In the present studies, multi-day retention intervals of spaced repetitions produced large R2P shifts in incidental learning and with the story mnemonic, in both cases with pronounced negative recency effects. With incidental learning, there was even absolute recovery of primacy items (anti-forgetting). These and related results at other time scales may have implications for our understanding of directed forgetting, spacing effects, testing effects, and forgetting over time.

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10:40-10:55 (301)

Retrieval-Induced Forgetting: Strength Independence and Competitor Interference. MICHAEL F. VERDE, *University of Plymouth*—The argument that active inhibition plays a central role in forgetting is supported by findings that seem to be incompatible with mechanisms of competitor interference. One key finding is that two forms of practice, additional study and retrieval from memory, both facilitate later recall of a practiced item. However, only retrieval practice causes forgetting of related items. This suggests that the “strength” of a memory is independent of its ability to interfere with other memories. It will be shown that this pattern of “strength independence” can be predicted by a competitor interference model like SAM-REM when one considers that a memory representation can be strengthened in different ways, some of which are more likely to produce interference. Data consistent with the predictions of the model show that it is possible to produce the well-known effect of “retrieval-induced forgetting” in the absence of retrieval. The implication is that many findings thought to be uniquely explained by inhibition are in fact consistent with competitor interference.

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11:00-11:15 (302)

Improving Memory Integration Through Repeated Study and Test. AYANNA K. THOMAS and CHARLES PARSOW, *Tufts University*, JOHN B. BULEVICH, *Richard Stockton College of New Jersey*—Internal and external context dependency is a limitation of episodic memory. Because of this limitation, learners will often experience feelings of mastery, but demonstrate failures in retrieval because of changes in contextual cues. These failures suggest that learners have not integrated new information in such a way as to broaden the scope of useful retrieval cues. In the present study, we hypothesized that repeated testing could reduce negative consequences of contextual dependency, and improve memory integration. In three experiments, participants studied related and unrelated triads (e.g., wave – tide – beach). After initial study, three groups diverged into different study-testing schedules. A final test occurred 48 hours later. We compared memory among three groups (SSST, STST, ST_T), and found that the STST schedule resulted in the best memory integration. This schedule was also the most effective at reducing the negative consequences of context dependency.

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11:20-11:35 (303)

Modeling Interference Effects in Item and Associative Recognition. SIMON DENNIS and ADAM OSTH, *The Ohio State University*—A current controversy in episodic recognition memory concerns the source of interference at retrieval, with some models positing that interference results from confusions among the studied content of the learning episode (item-noise) and other models positing that it results from the confusions among the prior contexts that the content has been experienced in (context-noise). We present a model that is comprehensive of these sources of interference by modeling the similarity among the stored representations rather than the representations themselves. The model was fit to data from item and associative recognition paradigms where both the length and strength of the studied items was manipulated. The model was successful in its ability to predict null effects of list length and list strength along with the mirror effects for word frequency, concreteness, and strength. Resulting parameter values indicated a very small contribution of item-noise along with a substantially larger contribution of context-noise.

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11:40-11:55 (304)

Characteristic Functions of Short-Term Memory Tasks: Implications for Theory and Applied Research. MATTHEW J. DUNCAN, *Defence R&D Canada*—Computational models of STM often assume an explicit functional relationship defining the confusability between items in memory. This functional relationship defines a characteristic function, because it represents a core characteristic of the model, which determines its ability to capture human behaviour. Characteristic functions play an important role in applied research by simplifying how cognitive processes are implemented in simulations. Consequently, empirical



validation of characteristic functions is of paramount interest to applied research. Confusion matrices were constructed from data of several STM tasks and fit with a theory neutral model to empirically determine the shape of STM characteristic functions. The results showed that STM tasks which rely on relational information (e.g., serial recall) were well described by an exponential function. Conversely, characteristic functions of tasks which rely on item information (e.g., item recognition) were well described by a power function. These results have implications for both STM theorizing and applied research

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Perceptual Processes

Conference B & C, Sunday Morning, 10:00-12:00

Chaired by Nurit Gronau, *The Open University of Israel*

10:00-10:15 (305)

Contextual Associations Facilitate Long-Term Memory of Visual Details in Barely Seen Images. NURIT GRONAU and MEYTA SHACHAR, *The Open University of Israel*—What do we remember following an extremely brief snapshot? Typically, the ‘gist’ of a scene is grasped while relatively little visual detail is perceived and retained in long-term memory. Here, we investigated whether contextual associations among objects may enhance memory of visual details when stimuli are merely glimpsed. Participants viewed pairs of contextually related and unrelated objects (e.g., a kettle and a mug; a shovel and a vase, respectively), presented for 24 ms (masked). Subsequently, participants performed a memory-recognition test on one of two objects within each pair, dissociating old items from new items of the same basic category. Improved detail memory for item exemplars was obtained for objects belonging to contextually related than to unrelated pairs, across various recognition conditions. Our findings suggest that during a very brief glance, contextually associated stimuli are ‘bound’ within a unified representation, allowing enhanced encoding of their gist as well as their specific visual features.

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10:20-10:35 (306)

Memory Representations Are Not Created Equal: Incidental Encoding During Object Search Outperforms Intentional Object Memorization. MELISSA L. VO, *Harvard Medical School*, DEJAN DRASCHKOW, *Ludwig-Maximilians University Munich*, RAYMOND FARMER, *Union College*, JEREMY M. WOLFE, *Harvard Medical School*—This study directly compared recall memory for objects that were incidentally encoded during scene search to recall memory for intentionally memorized objects in scenes. Observers searched for ten objects in each of five scenes. For the other five scenes, observers were given 15 seconds to memorize each scene and its objects for later recall (task order and scene assignments were counterbalanced). Recall memory was assessed by asking participants to redraw each of the 10 scenes and their objects. Interestingly, even though participants in the search condition were not explicitly asked to memorize objects, they reproduced twice as many objects (28%) compared to the memory condition (15%). Recall memory for searched objects

remained superior even when we replicated with 20 seconds memorization time and explicitly marked relevant target objects (searched: 40%, memorized: 19%). This implies that active search produces stronger memory representations than the general request to memorize the same objects.

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10:40-10:55 (307)

Does the Way You Interact With an Object Affect How You Search for it? Investigating the Role of Target Function on Search Strategies. MONICA S. CASTELHANO and RICHELLE WITHERSPOON, *Queen's University*—Research has shown that how one interacts with an object can affect how one perceives it (e.g., Triesch et al., 2003). This is not surprising given that visual perception is often conducted in the service of a goal, such as an action (Gibson, 1979). Here we investigated whether the way an object is used affects visual search strategies and the use of scene context. In Experiment 1, two groups were shown a set of invented objects. One group studied their function (Function group) and the other their visual features (Feature group). When searching for these objects in a scene, the Function group had shorter target latencies and a fewer number of fixations to the studied objects compared to novel objects, but there was no difference between the object types for the Feature group. In Experiment 2 we investigated whether scene location was important, and found that objects placed in function-congruent areas were located more efficiently than those in function-incongruent areas. Because participants did not previously view these objects in a scene context, improvements could not be due to experience. We suggest that the way we interact with an object can positively influence search strategies and optimize the use of scene context.

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11:00-11:15 (308)

Facial Attractiveness and Averageness: Individual Differences in Perceived Attractiveness Reflect Degree of Access to Right Hemisphere Processing. STEPHEN D. CHRISTMAN and JESSICA BAKER, *University of Toledo*—The attractiveness of faces is determined in part by how “average” they are: faces that are closer to average (e.g., closer to the “prototypical” human face) are perceived as being more attractive (Langlois & Roggman, 1990). In turn, the left hemisphere of the brain is specialized for processing patterns in terms of abstract prototypes while the right hemisphere is specialized for processing specific exemplars (Marsolek, 1995). Also, inconsistent handedness is associated with increased access to right hemisphere processing (Prichard, Propper, & Christman, 2013). Accordingly, inconsistent-versus consistent-handers were asked to rate the attractiveness of faces varying in averageness. Inconsistent handedness was associated with decreased sensitivity to averageness-based facial attractiveness, with highly average faces been rated as less attractive and low average faces rated as more attractive, relative to ratings from consistent-handers. Results

suggest that perception of averageness-based attractiveness is localized to the left hemisphere and varies systematically among individuals.

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11:20-11:35 (309)

Recognizing Old and Conjunction Faces: Factors Influencing Confidence and Accuracy. MARK T. REINITZ, *University of Puget Sound*, JULIE ANNE SEGUIN, *Victoria University of Wellington*, GEOFFREY R. LOFTUS, *University of Washington*—We investigated factors that give rise to confidence and “old” recognition responses for conjunction faces (constructed from features of previously studied faces) and old faces. Subjects studied photos of faces and received a recognition test containing old and new faces as well as two types of conjunction faces (internal features of one face were combined with the external features of another, or hair, nose, and mouth of one face were combined with remaining features of another). Subjects indicated whether test faces were old or new, rated their confidence, and indicated whether their recognition responses were based on recognizing a facial feature or on general familiarity. There was an approximately equal mix of feature and familiarity responses for all face types. A state-trace analysis supported a simple model in which face type and feature/familiarity separately influence a single underlying dimension (memory strength) which in turn determines both confidence and “old” responses.

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11:40-11:55 (310)

Ethnicity-Specific Social Contexts and the Dual-Process Memory of Own and Other Race Faces. GUOMEI ZHOU and XINGE LIU, *Sun Yat-Sen University*—The present study investigated how the context where face appeared during encoding affected face recognition. Specifically, Chinese participants were instructed to learn the faces of Chinese and Caucasian targets which were presented in either neutral (e.g., forest), Chinese (e.g., Great Wall), or western contexts (e.g., White House). Later, participants completed a Remember, Know, and New judgment for these faces. Results revealed that the contexts modulated the False Alarms (FAs) of recollection and familiarity in face recognition. Compared with neutral contexts, Chinese contexts decreased the FAs of familiarity for Chinese faces, and had no influence on their FAs of recollection. So did Western contexts for Caucasian faces. Western contexts decreased FAs of both recollection and familiarity for Chinese faces; Chinese contexts decreased FAs of the familiarity of Western faces and increased their recollection. The findings are interpreted in light of recent models of face recognition for own and other-race faces.

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Working Memory III

Grand Centre, Sunday Morning, 10:20-12:00

Chaired by Robert West, Iowa State University

10:20-10:35 (311)

ERP Slow Wave Activity and the Focus of Attention. ROBERT WEST, *Iowa State University*, KIRA BAILEY, *University of Missouri*, GREGORY MLYNARCZYK and STEPHEN ANDERSON, *Iowa State University*—The N-back task has been used extensively to examine the cognitive processes and functional neuroanatomy underpinning working memory. In contrast, fewer studies have used ERPs to examine the neural correlates of information processing in this task. In three experiments we used ERPs in combination with the N-back task to examine slow wave activity measured in the response-to-stimulus interval (RSI). Across all three experiments this slow wave activity distinguished 1-back trials from 3-back trials, and 2-back trials in Experiment 3. In Experiment 2 the slow wave activity distinguished 1-back hits from 3-back hits and misses that did not differ. Experiment 3 revealed that this slow wave activity was not sensitive to proactive interference. Together the results of the three experiments lead to the conclusion that slow wave activity observed in the RSI is related to maintenance within, rather than outside of, the focus of attention.

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10:40-10:55 (312)

Updating Information in Visual Working Memory: A Behavioral and ERP Study. YOAV KESSLER, RACHEL RAC, CARMEL LICHTSTEIN, HADAR MARKUS and ALMOG SIMCHON, *Ben-Gurion University of the Negev*, MORRIS MOSCOVITCH, *Rotman Research Institute; Baycrest Centre; University of Toronto*—A change detection paradigm was employed, in which two memory arrays were presented, followed by a test array. The second array was either identical to the first, or different in some or all of the items. The participants were required to remember the first array and update their memory with the second array. Theories assuming a discrete item representation entail that each item would be updated separately (“local updating”). Theories assuming a holistic representation predict that the entire content of working memory would be updated as a whole (“global updating”). Performance for items that were updated was worse than for items that were not updated, as predicted by local updating. ERP delay activity was sensitive to the number of changed items over frontal electrodes. Parietal-occipital electrodes, however, showed a difference between updating and a full repetition, but no effect for the number of updated items, supporting global updating.

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11:00-11:15 (313)

Selection of Multiple Cued Items Is Possible During Visual Short-Term Memory Maintenance. MICHI MATSUKURA and SHAUN P. VECERA, *University of Iowa*—Recent neuroimaging studies suggest that maintenance of a selected object feature held in visual short-term/working memory (VSTM/VWM) is supported by the same neural mechanisms



that encode the sensory information. If VSTM operates by retaining “reasonable copies” of scenes constructed during sensory processing (Serences et al., 2009), then attention may be able to select multiple items represented in VSTM as observed during sensory processing. However, empirical reports of the studies that examined this possibility are inconsistent. In the present study, we investigated (1) whether multiple items can be selected during VSTM maintenance and (2) why the previous study failed to observe a significant cueing benefit of multiple items, in a well-controlled setting. The results indicate that, despite severe architectural limitations of VSTM, attention can indeed select multiple cued items represented in VSTM when observers are asked to recognize these items in the way these items are cued (attended) to remember.

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11:20-11:35 (314)

Eye Movements Delay Passive Spatial Working Memory Tasks. MATTHEW S. PETERSON, ERIC J. BLUMBERG and SURPREET SACHDEVA, *George Mason University*—Irwin (1998) with Brockmole (2000, 2004) demonstrated that eye movements interfere with spatial mental tasks. Lexical processing and object identification are unaffected, whereas active spatial tasks, such as mental rotation and orientation judgments, are slowed as a function of saccade distance. Here we investigate whether saccades also interfere with passive spatial tasks, which do not require mental transformations. Subjects memorized a spatial array (1500ms), followed by a saccade target display (near or far). After 150ms, a judgment/go display was presented, which served as the saccade go signal, and subjects had to respond as to whether the display was identical or not (one dot could be displaced). Response times to the spatial task were longer when making long saccades: therefore the judgment was delayed by performing the saccade. In a separate experiment, when subjects were asked to encode the dots as a configuration, saccades had no effect on response times.

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11:40-11:55 (315)

Discrete-Slots Models of Visual Working-Memory Response Times. CHRIS DONKIN, *University of New South Wales*, ROBERT NOSOFSKY, RICHARD SHIFFRIN and JASON GOLD, *Indiana University*—Much recent research has aimed to establish whether visual working memory (WM) is better characterized by a limited number of discrete all-or-none slots, or by a continuous sharing of memory resources. To date, however, researchers have not considered the response-time (RT) predictions of discrete-slots vs. shared-resources models. To complement the past research in this field, we formalize a family of mixed-state, discrete-slots models for explaining choice and RTs in tasks of visual WM change detection. We also formalize an analogous set of continuous shared-resources models. The model classes are tested on individual subjects both with qualitative contrasts and quantitative fits to RT-distribution data. The discrete-slots models provide much better qualitative and quantitative

accounts of the RT and choice data than do the shared-resources models, although there is some evidence for slots plus resources when memory set size is very small.

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Concepts and Categories II

Dominion North, Sunday Morning, 10:20-12:00

Chaired by Ken McRae, *University of Western Ontario*

10:20-10:35 (316)

Abnormal Semantic Memory Structure in a Case of Developmental Amnesia. DEVIN DUKE and KEN MCRAE, *University of Western Ontario*, BEN BOWLES, *Stanford University*, ASAF GILBOA, *Rotman Research Institute*, SHAYNA R. ROSENBAUM, *York University*, STEFAN KOHLER, *University of Western Ontario* (read by Ken McRae)—Developmental Amnesia is considered to be a compelling source of evidence for independent development of episodic and semantic memory, with hippocampal integrity necessary for episodic memories only. It has been demonstrated that some aspects of semantics can be learned without an intact hippocampus, but no research has directly addressed semantic relations. Given that re-organization processes known to support episodic memory may also play a role in general knowledge integration, it seems likely that semantic representations differ in structure when acquired with an episodic memory impairment. We tested a developmental amnesic (HC) using concrete concepts. Unlike typical neuropsychological tests, our tasks required comparisons among similar concepts in terms of their typicality, and also familiarity. We also used a semantic feature production task. HC's typicality ratings and feature type profiles differ from those of controls. These findings suggest that the hippocampus may play a pivotal role in semantic memory development.

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10:40-10:55 (317)

Feeling Outnumbered: Group Membership Affects Numerosity Perception. SARA CORDES, LIANE YOUNG and ELIZABETH HELLER, *Boston College*—Group bias is well established, but how this bias might influence the direct perception of objective quantitative variables, such as numerical estimates of group size, is unknown. Using a psychophysical task, we asked adult participants to estimate the number of individuals presented belonging to their own group (ingroup) or to an outgroup. Data reveal that estimates differed depending on group membership, such that the number of ingroup members was underestimated relative to estimates of outgroups of comparable size, especially when the ingroup was outnumbered by a large amount. This ingroup underestimation held under varying levels of outgroup threat and even under minimal group circumstances. Thus, group membership, independent of the nature of the relationship between groups, can bias the direct perception of objective quantitative variables, leading to robust differences in numeric estimates.

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11:00-11:15 (318)

A Coincidence Detection Theory of Situational Irony Understanding. GREG BRYANT and CLARK BARRETT, *University of California, Los Angeles*—People struggle to clearly define irony, and current theories fail to explain the cognitive origins of the concept. We propose a strict definition of situational irony as a series of events where an agent's action causes an outcome specifically intended to be avoided by that agent. A causal inference system designed to minimize misses in identifying such scenarios will be predisposed towards false positives, and thus often include cases that appear to have causal structure but are actually coincidental. Using written vignettes depicting events with either causal, coincidental, or unrelated connections between outcomes and actors' intentions, we found a predicted effect of coincidence on people's judgments of irony. In a second experiment, judgments of irony were directly related to the degree of coincidence in the relationship between intentions, events, and outcomes, with low probability coincidences being judged as more ironic than higher probability coincidences. Taken together, these results support a coincidence detection theory that classifies the irony concept as the product of a causal inference system biased towards false alarms in scenarios where event outcomes are directly opposed to actors' intentions.

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11:20-11:35 (319)

Benefits of Category Learning With Interleaved and Active, or Blocked and Passive, Presentations. PAULO F. CARVALHO and ROBERT L. GOLDSTONE, *Indiana University* (read by Robert L. Goldstone)—Apparently conflicting research on how information should be presented during inductive category learning has identified both interleaving of categories and blocking by category as beneficial for learning. One possible reconciliation takes into account the category similarity structure. The current work explores a second moderating factor: active/passive learning. One group of participants studied categories actively (by studying the objects without correct category assignment and actively figuring out what the category is), either interleaved or blocked. Another group studied the same categories passively (objects and correct category assignment were simultaneously provided). Results from a subsequent generalization task show that active learning benefits from interleaved presentation while passive learning benefits from blocked presentation. One account of these results is that interleaving and blocking promote different patterns of attention to stimulus components. Passive learning promotes attending to commonalities within categories, while active learning promotes attending to differences between categories. When the presentation order and activity/passivity of learning emphasize the same components, learning is facilitated.

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11:40-11:55 (320)

Visual Expertise in Matching Fingerprints. JASON M. TANGEN, RUBEN E. LAUKKONEN and JESSICA L. BAIRD, *The University of Queensland*, DUNCAN J. MCCARTHY, *Queensland Police Service*—We are interested in the nature

of visual expertise and factors that distinguish experts from novices. A fascinating group of experts are fingerprint examiners with decades of experience with a highly structured set of impressions that vary across individuals and instances. In a series of experiments, we compared the matching performance of experts and novices while manipulating cognitive load using visual and verbal working memory tasks, and measured their pupil dilation. By occupying their working memory resources, we can assess the role of nonanalytic processing in their identification performance. Even though examiners believe that a slow, careful, and highly analytic approach is critical for matching prints, our results from these experiments and others suggest otherwise. Like experts in other visual domains (e.g., radiologists, cytologists, face recognition), the experiential knowledge based on the hundreds of thousands of prior instances serves as a rich source of analogies to permit efficient problem solving.

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Psycholinguistics II

Grand East, Sunday Morning, 10:20-12:00

Chaired by James Magnuson, *University of Connecticut & Haskins Laboratories*

10:20-10:35 (321)

Contra the Qualitatively Different Representation Hypothesis (QDRH), Concrete Concepts Activate Associates Faster than Abstract Concepts. CHRISTOPHER R. BROZDOWSKI and JONATHAN GORDILS, *University of Connecticut*, JAMES S. MAGNUSON, *University of Connecticut; Haskins Laboratories* (read by James S. Magnuson)—Based on neuropsychological evidence, Crutch & Warrington (2005) proposed the QDRH: abstract concepts are organized in associative networks; concrete items are organized by semantic similarity. Duñabeitia et al. (2009) predicted spoken abstract words should therefore activate associates faster than concrete words. Their subjects looked faster to pictures of associates of 'abstract' than concrete words. However, many "abstract" items had low imageability but were concrete, and their "find closest match" procedure is subject to strategies. We avoided these issues by using phonological mediation (Yee & Sedivy, 2006). Subjects heard words (FIST), activating phonological competitors both concrete (FISH) and abstract (FIT). Displays included targets, associates of concrete (OCEAN) and abstract (CLOTHES) competitors, and unrelated items. Subjects fixated associates of concrete (but not abstract) competitors reliably more than unrelated items. To address complications of pictures, a second experiment used printed words, allowing use of abstract targets and associates. Results converged with Experiment 1.

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10:40-10:55 (322)

Appearance and Reality in Real-Time Referential Processing. MINDAUGAS MOZURAITIS, CRAIG CHAMBERS and MEREDYTH DANEMAN, *University of Toronto* (read by Craig Chambers)—Successful communication requires sensitivity to shared vs. privileged knowledge, which is inferred from various information sources including



interlocutors' perspective differences. Previous eyetracking work has shown listeners can take into account a speaker's lack of knowledge about the EXISTENCE of hidden objects early in online processing. Here, we investigate listeners' ability to manage knowledge about the IDENTITY of visually misleading objects as a target noun (e.g. "yogourt") is heard in an unfolding sentence. When the identity of a misleading competitor sharing onset sounds with the target (e.g., a yo-yo that looks like a baseball) had been revealed previously, listeners' momentary consideration of the competitor was the same as when a perceptually apparent competitor ("obvious" yo-yo) was used and, as expected, was greater than when there was no pre-familiarization. A subsequent referential communication task using these materials showed listeners have difficulty differentiating their own privileged knowledge of object identity from the speaker's knowledge during the early moments of noun processing. Thus, perspective differences arising from knowledge of object identity seem especially difficult to integrate on-line.

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11:00-11:15 (323)

Alpha and Beta Power Decrease as a Neural Correlate of Semantic and Phonological Processing in a Language Task. FRANK OPPERMAN, *Radboud University Nijmegen*, ANETA KIELAR, LILIA PANAMSKY and JED A. MELTZER, *Rotman Research Institute, Toronto*—Oscillatory power decreases in the alpha and beta bands reflect cortical activation. In a magnetoencephalographic study, we examined semantic and phonological priming in a language production task. Participants repeated sentences after a delay period. During the retention interval, an auditory prime word was presented that could be semantically or phonologically related or unrelated to a noun of the sentence. Primes were followed by a strong decrease of alpha and beta power in widely distributed brain networks. Related prime words yielded a stronger decrease compared with unrelated words in specific brain networks. Semantic primes showed decrease in left middle and inferior temporal, phonological primes in more widespread areas including left middle and superior temporal, inferior frontal, precentral and supplementary motor cortex. The results show that decreases in alpha and beta power can be used to map linguistic activation at high spatiotemporal resolution.

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11:20-11:35 (324)

Perceptual Simulation of Native and Non-Native Speech During Silent Reading. KIEL CHRISTIANSON and PEIYUN ZHOU, *University of Illinois at Urbana-Champaign*—Three eye-tracking experiments investigated the effects of perceptually simulating native and non-native speech during silent reading on reading speed and reading comprehension. Social attractiveness surveys were used to evaluate readers' attitudes toward the native and non-native speech to which participants were habituated prior to reading. Perceptual simulation was triggered by showing pictures of these "speakers" in Experiment 1 and by playing a recording of each "speaker" saying her name prior to the participant

reading each sentence in Experiment 2. In Experiment 3 participants read the same materials without being encouraged to perceptually simulate. Readers read slower and were more likely to make errors when they perceptually simulated nonnative speech compared to native speech. However, perceptual simulation of either native or nonnative speech in Experiment 1 and 2 yielded higher accuracy and no overall difference in reading rate compared to Experiment 3, in which perceptual simulation was not triggered. The results indicate that perceptual simulation facilitated deeper sentence processing and improved comprehension.

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11:40-11:55 (325)

The Development of Inflectional Morphology From Form Versus Meaning. ANNA M. WOOLLAMS, JOANNA V. MOY and SARAH KEEBLE, *University of Manchester*, GRZEGORZ KRAJEWSKI, *University of Warsaw*, ANNA THEAKSTON, *University of Manchester*—Current theoretical perspectives on language processing differ considerably in their accounts of inflectional morphology. Most empirical data has been acquired using the inflection from stem task, however this is only analogous to more naturalistic speech production if stem retrieval is mandatory. Yet work with adults reveals quite different results when inflection proceeds instead from meaning, a task difference that has been simulated by connectionist models. What remains unknown is the extent to which these task differences are seen across early development. For the first time, we consider the impact of task type upon inflectional development of 908 children aged between 2 and 4 years. We then present a revised version of a connectionist model of inflection, trained in a manner consistent with child directed speech in order to capture the children's performance. This work represents a clear step toward more ecologically and developmentally valid approaches to inflection.

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Judgment and Decision Making IV Grand West, Sunday Morning, 10:00-12:00

Chaired by Timothy J. Pleskac, *Michigan State University*

10:00-10:15 (326)

Ecologically Rational Choice and the Structure of the Environment. TIMOTHY J. PLESKAC, *Michigan State University*, RALPH HERTWIG, *Max Planck Institute for Human Development*—In life risk is reward. This maxim reflects the economic constraints of our world. Yet, economic and psychological theories of risky choice have largely ignored this relationship. In fact, a basic tenet of many of these theories is that probabilities and payoffs are independent factors that determine the value of an alternative. An ecological analysis of life's gambles—ranging from gambles in roulette to bargaining to artificial insemination of cows—show that payoffs and probabilities are often intimately tied. In some cases, the constraints of the market result in these two core ingredients of choice being related via a power function. Decision makers are keenly aware of this relationship and exploit it in the form of a heuristic—the risk-is-reward heuristic—to infer the probability of a payoff during decisions under uncertainty.

We demonstrate how this inferential process can help explain observed ambiguity aversion. This ecological relationship between payoffs and probabilities can also help explain the shape of the utility and probability weighting functions. These findings indicate that theories of risky decision making need to model not only the decision process, but also the environment to which the process is adapting.

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10:20-10:35 (327)

Decision-Network Context: Dynamics and Learning in Preference Formation. PETKO KUSEV, *Kingston University London*, BRADLEY LOVE, *University College London*, PAUL VAN SCHAIK, *Teesside University*—Recently, there has been a debate in decision-making about whether people integrate attributes such as money and probabilities into subjective values or they employ somewhat different psychological processing, without integration of attributes and decision trade-offs. In the latter decision-making is accounted for by experience with sequential events, simple binary comparisons and a threshold mechanism. Despite all the differences offered in these theories of utility formation and decisions from experience/descriptions, they share common assumption - decision makers have stable and coherent preferences, informed by consistent use of psychological processing (computational or sampling) that guide their choices between alternatives varying in risk and reward. In this research we pursued the opposite idea: people do not have underlying preferences for risk; decision-makers gate strategy selection from current context (decision-network context) and learn to select decision strategies that are most successful (effort and reward) for a given context.

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10:40-10:55 (328)

Pillars of Judgment: How Memory Abilities Affect Rule- and Exemplar-Based Judgments. JANINA A. HOFFMANN, BETTINA VON HELVERSEN and JÖRG RIESKAMP, *University of Basel*—Making accurate judgments, such as correctly diagnosing a patient, is an essential skill across many domains. However, little is known about the basic cognitive skills required for accurate judgments. We argue that the cognitive processes underlying human judgment can differ substantially. People often rely on two kinds of strategies: rule-based and exemplar-based strategies. We investigate if these judgment processes differ in the cognitive abilities they require. Specifically, high working memory capacity may benefit rule-based judgments, whereas long-term memory may be crucial for exemplar-based judgments. To investigate this hypothesis, 279 participants performed two judgment tasks that were either best solved by a rule-based or an exemplar-based strategy. Additionally, we measured working memory capacity, episodic memory, and implicit memory with three tests each. Consistent with our hypothesis structural equation modeling showed that working memory capacity predicted judgment accuracy in the rule-based task, whereas episodic memory predicted judgment accuracy in

the exemplar-based task. In sum, different memory abilities are essential for successfully adopting different judgment strategies.

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11:00-11:15 (329)

Improved Classification of Mammograms Following Idealized Training. BRADLEY C. LOVE and ADAM HORNSBY, *University College London*—Some decisions, such as predicting the winner of a baseball game, are challenging in part because outcomes are probabilistic. When making such decisions, one view is that people stochastically and selectively retrieve a small set of relevant memories that provides evidence for competing options. Optimal performance at test is impossible when retrieving information in this fashion, no matter how extensive training is, because limited retrieval introduces noise into the decision process that cannot be overcome. One implication is that people should be more accurate in predicting outcomes when trained on idealized rather than on the actual distributions of items. Giguère & Love (2013) found support for this view in a series of studies involving simple stimuli. Here, these investigations are extended to high-dimensional, real-world stimuli. Idealized training on unambiguous cases improved people's ability to classify novel images as tumorous or non-tumorous. Surprisingly, this test advantage held for borderline cases that were not experienced during idealized training. These results have practical implications for how to best train people, and speak to basic theoretical issues concerning the nature of human expertise and rationality.

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11:20-11:35 (330)

Using Explanation Structure as an Indicator of Competence in Forecasting. WINSTON R. SIECK, *Global Cognition*, EDGAR C. MERKLE, *University of Missouri*—The two studies reported here examined the relationship between general aspects of explanations and cognitive competence using data from the Aggregative Contingency Estimation System study of wisdom of crowd approaches to forecasting world events. Specifically, we examined relations between forecaster competence and measures of five aspects of written explanations of forecasts, including causal-interconnectedness, source sensitivity, qualification, universalism, and temporal awareness. The measures were computed based on the prevalence of lexical indicators in an automated text analysis of participants' explanations of forecasts across a wide range of problem topics. Consistent with theory and practice regarding the importance of explanatory depth, more densely causally interconnected explanations were strongly associated with forecaster accuracy. Our results from both studies also showed accuracy relations for lexical indicators of uncertainty qualification and temporal awareness. Implications for dual-process theories of reasoning and decision making, as well as for potential educational interventions designed to increase cognitive competence are discussed.

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11:40-11:55 (331)

Intuitive Judgments of Social Statistics: How Exhaustive Does Sampling Need to Be? THORSTEN PACHUR and RALPH HERTWIG, *Max Planck Institute for Human Development*, JÖRG RIESKAMP, *University of Basel*—One way to make inferences about social statistics—such as the frequencies of health risks in the population—is to probe how many members of one’s social network suffer from them. How are such instance-based inferences cognitively implemented? Noncompensatory strategies based on lexicographic and limited search have been extensively examined in the context of cue-based inference. Their role in instance-based inference, by contrast, has received scant attention. We propose and test the social-circle heuristic as a model of noncompensatory and lexicographic instance-based inference. Two empirical studies show that the heuristic accurately predicts the judgments of a substantial portion of participants. A response time analysis also supports lexicographic search: The earlier the heuristic predicts search to be terminated, the faster participants classified as using the social-circle heuristic respond. Using computer simulations to systematically investigate the heuristic’s normative implications, we find that despite its limited search, the heuristic can approximate the accuracy of a compensatory strategy in skewed and in spatially clustered environments—both common properties in distributions of real-world social environments.

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POSTER SESSION I

Thursday Evening

Sheraton Centre Toronto Hotel, Sheraton Hall

Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION I •

(1001)

Semantic Consistency in Boundary Extension. DANIEL C. LACOMBE JR., *Florida Atlantic University*, CHRISTOPHER A. DICKINSON, *Appalachian State University*—Intraub's (2010) multi-source model of scene perception posits that contextual knowledge is incorporated into our understanding of a continuous world. In two experiments, we asked if semantic information influences boundary extension (BE) by showing participants images depicting either a semantically consistent or inconsistent object-background relationship and testing memory for views' spatial expanse. In Experiment 1, view memory (rate identical test picture as same view, more close-up, or more wide-angle) was tested after each 250-ms image and 250-ms masked retention interval; in Experiment 2 it was tested after a 10-image sequence (15 s each) and test instructions. Across conditions and experiments, participants tended to rate test views as more close-up than stimuli (BE). We found no difference in BE in Experiment 1 but found more BE for semantically consistent scenes in Experiment 2. BE may be context independent early in scene perception, but semantic inconsistency may interfere with spatial computation later. Email: Christopher Dickinson, dickinsonca@appstate.edu

(1002)

Perceptual Evidence Accumulation in Moving Window Paradigm. MAXIM A. BUSHMAKIN and THOMAS W. JAMES, *Indiana University* (Sponsored by Robert M. Nosofsky)—The ability to identify and categorize objects is essential for successful interactions with one's environment. Different features of an object contribute differently to the visual identification of that object. This visual information is accumulated through time until an appropriate response is executed. The current work examined these ideas with a Drift Diffusion (Ratcliff, 1978) and Linear Ballistic Accumulators (Brown & Heathcote, 2008), analyzing subject performance in a same-different task on the upright and inverted face and non-face objects with a moving window paradigm, where subjects were allowed to see only a limited amount of information per unit of time. We hypothesized that lower performance with upside down faces would be due either to a lower rate of perceptual evidence accumulation or a higher decisional threshold. The modeling results showed that the large inversion effects found with faces were mainly mediated by the rate of perceptual evidence accumulation. Email: Maxim Bushmakin, mbushmak@indiana.edu

(1003)

Foreshortening Increases Apparent Angles. MARTA WNUCZKO, JOHN M. KENNEDY and MATTHIAS NIEMEIER, *University of Toronto*—In the distance, foreshortened depths may be underestimated. If so, angles

will be misperceived. In particular, acute angles in stimuli on the ground or on a wall will appear larger than true. Similarly acute angles of stimuli slanted to the ground plain will appear larger than true. The overestimation of acute angles will grow as the optical slants of the stimuli increase. The hypotheses were tested in six experiments. The acute angles were formed by a z-line and a line oblique to the z-line. Experiments 1 and 2 used line stimuli on the ground and on a wall. In Experiments 3 (ground stimuli) and 4 (wall stimuli), optical slant was varied. Observers estimated the geographical slant of textured surfaces at a high eye-height in Experiment 5, and at a low eye-height in Experiment 6. The hypotheses were supported. Acute angles were increasingly overestimated as foreshortening and optical slant increased.

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(1004)

Dissociable Forms of Edge-Based Masking: An Examination of Object Trimming and Object Binding. TODD A. KAHAN and JEFFREY R. LATHROP, *Bates College*—Kahan and Enns (2010; 2013) have identified two forms of edge-based masking. When dots flank a target's edge, competition between edges results in the flanked object being perceptually altered by the dots, an effect referred to as object trimming. However, Kahan and Enns have shown that edge-based interactions can also be cooperative, an effect referred to as object binding. Here we dissociate these two masking effects. Though object trimming ought to be robust in both visual fields, object binding may be larger in the left visual field, relative to the right visual field, since the right hemisphere has a stronger bias towards holistic perception. Results confirm this prediction. Object trimming was robust in both visual fields but object binding was only found when targets and dots were displayed in the left visual field. These data provide evidence that object trimming and object binding are dissociable forms of edge-based masking. Email: Todd Kahan, tkahan@bates.edu

(1005)

Detection of Acoustic Time-to-Arrival in Cluttered Environments. MICHAEL S. GORDON, DANIEL KOBYLARZ and DARLENE EDEWAARD, *William Paterson University*—Time-to-Arrival (TTA) detection is the determination of when an approaching object will reach one's position. Detection of TTA is critical to facilitate prospective actions and maintain one's safety in a dynamic environment. The current research was designed to investigate how the spatial and spectral properties of sounds might support effective TTA determinations. Previous research has suggested that these acoustic properties are critical for object and speech perception. A series of experiments were conducted to manipulate the approach angle and competing background sounds during TTA determinations. Participants were found to be more accurate in TTA judgments for sounds approaching with rapidly changing spectra (e.g., sudden and punctuated

frequency shifts) and at certain velocities. Conclusions from this research suggest that despite the potential importance of TTA to avoid collisions, cluttered acoustic environments produce significant energetic masking that can inhibit TTA judgments.

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(1006)

Evidence for Higher Order Schema-Based Cognitive Effects in Auditory Cortex. ANJA ROYE, BERNHARD ROSS and CLAUDE ALAIN, *The Rotman Research Institute at Baycrest* (Sponsored by Frank Oppermann)—Anecdotal reports and also empirical observations suggest a preferential processing of personally significant sounds. For sounds of emotional significance it has been shown that processing can be enhanced even within sensory cortices. The present magnetoencephalographic (MEG) study investigated the processing of sounds that gained significance within the individual past and, hence, are differentiated only based on individual memory representations. Therefore, participants were presented with task-irrelevant sequences of acoustically variable sounds, one of these being a self-chosen sound associated with personal significance (the own SMS ring). Source waveforms within left and right auditory cortices were constructed based on dipole modeling of average sensory evoked responses (N1m). The data clearly show differential activity between the personally significant and a non-significant sound (the SMS tone of another yoked participant) at 250 to 550 ms. This differential activation indicates that incoming acoustic data quickly activate long-term representations, which may be contingent upon schema-driven, top-down guided significance detection in related cortical and subcortical brain areas.

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(1007)

An ERP Study of Joint Effects of Exposure Frequency and Expression Variation on Face Learning and Generalization. GARY C.-W. SHYI and JULIA W.-J. LIN, *National Chung Cheng University*—We recently showed that a relatively large number of exposures coupled with sufficient number of variation in expression can help create reliable representation for face learning and generalization. Here we examined neural mechanisms underlying the joint influence of exposure frequency and expression variation by recording and analyzing ERP components for faces that were learned with different number of exposures, while being subject to variation of a single expression or multiple expressions. During learning, ERPs for single expressions tended to exhibit more negatively going potentials at TP7 and TP8, and more positively going potentials at P7 and P8, than those for multiple expressions. In contrast, ERPs during recognition manifested mostly as a general difference between images of those that were shown during learning (i.e., old targets) and those that were not shown before (i.e., new targets). The behavioral results of recognition and the ERP findings also exhibited an intriguing pattern of dissociation: While participants behaviorally could generalize from images encountered during learning to

those encountered during recognition test, the neural signals underlying learned versus generalized faces were not at all identical.

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(1008)

A Persistent Low-Prevalence Effect in Face Matching. MEGAN H. PAPESH, *Louisiana State University*, STEPHEN D. GOLDINGER, *Arizona State University*—The ability to quickly and accurately match faces to photographs bears critically on many domains, from controlling purchase of age-restricted goods to security contexts. Despite the ubiquity of face matching, research has shown that it is surprisingly error-prone, with error rates often exceeding 20%. In 4 experiments, we presented observers with highly variable photographs of faces, and examined whether matching performance is affected by the prevalence of identity mismatches, comparing conditions of low (10%) to high (50%) prevalence. Like the low-prevalence effect in visual search, we observed inflated miss rates under low-prevalence conditions. This error rate persisted even when participants were allowed to correct their initial responses, when they had to verify every decision, and when they had a “second chance” to view the face pairs. These results suggest that, under realistic viewing conditions, the low-prevalence effect in face matching is a large, persistent source of errors.

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• PERCEPTION I •

(1009)

Interference Effects of Angry Stimuli. DEAN G. PURCELL, *Oakland University*, ALAN L. STEWART, *Stevens Institute of Technology*—When pictures of two individual faces are presented, one following the other, and observers are asked to judge if the two faces represent the same emotion, faces paired with an angry first face are often misidentified. Errors of 35 percent are found when the first face displays anger. The errors drop to 10 percent when the first stimulus displays a happy expression. Our conjecture is that identification errors result from the angry first face interfering with the identification of the following face's expression. Our conjecture is supported when a single face is presented by itself and an observer is asked to identify the face's expression. The expression of an individual face is identified quickly and accurately, with errors ranging from 10 percent for angry faces to 5 percent for a happy face.

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(1010)

A Race and Gender Face Space. WILLIAM J. HOPPER and DAVID E. HUBER, *University of Massachusetts Amherst*—Research on face processing often uses multidimensional face spaces although the labeling of dimensions is typically post-hoc and open to interpretation. Here we report a new face space that intentionally varied along the dimensions of gender and race (Asian versus Caucasian). Experiment 1 collected paired comparisons for a set of 40 real face images that varied on these dimensions and used multidimensional scaling



(MDS) to extract the locations of the faces. As expected, race and gender were the two most important dimensions, although, somewhat surprisingly, race captured more of the variance than gender. Using these results, a set of 24 faces was created using morphing technology, with these images equally spaced around a circle in the 2D race-gender face space. Experiment 2 collected paired comparisons for these morphed faces, confirming their psychological locations in the 2D face space. Providing an example application of these stimuli, Experiment 3 used a race and gender categorization task. Assuming normally distributed distance to criteria, the results were as predicted from the face space. These images should prove useful for a wide variety of race or gender studies that require well characterized stimuli.

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(1011)

Face Memory Compensation in Older Adults Hinges on Face Expertise. SVEN OBERMEYER and THORSTEN KOLLING, *Goethe University Frankfurt*—Face memory is a key cognitive ability that undergoes age-related decline. In this study, cognitive and social factors responsible for compensation based on data of 2 healthy student adult age groups (20-30; 60-80 years) and 1 group of older adults living in a retirement home are discussed. Subjects encoded 20 unfamiliar faces for either 800ms or 8000ms. In addition to the un-manipulated faces, a horizontal pass-filter was applied to the images during recall. Filtering for these frequencies evokes early visual processing mechanisms, which differ among younger and older age groups. Creating two levels of artificial expertise triggered different outcomes among groups: while younger subjects showed higher recognition performance for both un-manipulated and filtered stimuli of the long exposure condition, healthy older subjects could only share the same benefit for un-manipulated faces. Older adults living in a retirement home did not show increased performance for stimuli with higher expertise. These findings suggest that compensatory mechanisms in face processing at an older age can only manifest when specific criteria are met, such as a certain level of cognitive functioning and daily exposure to new faces.

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(1012)

The Role of Personality in Facial Emotion Expression Recognition. JESSIE J. PEISSIG and TRISHA WIESE, *California State University, Fullerton*—The purpose of this study was to investigate the relationship between specific aspects of personality and the ability to interpret the facial expressions of others. Our study measured the “Big Five” personality domains, attachment styles, and both state and trait anxiety levels. The facial emotional expression recognition task included photographs of genuine displays of happy, sad, confused, neutral, and disgust emotional expressions. Participants had to identify the emotion in each photograph. Results showed that levels of extraversion and agreeableness were both positively related to accuracy but only for the expression of happiness, indicating that those who test high on the extraversion and agreeableness scales

are better at recognizing happy expressions. Both state anxiety and trait anxiety were negatively related to accuracy for the expression of happiness, indicating that individuals who report higher levels of stress are poorer at recognizing happy expressions. Those who rated high on agreeableness were also faster at recognizing emotions. These results suggest that specific personality characteristics are related to differential performance in an emotion recognition task.

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(1013)

Holistic Processing of Emotional Faces in Visual Search. RUTH A. SAVAGE and OTTMAR V. LIPP, *The University of Queensland* (Sponsored by Stefanie Becker)—Previous evidence is inconsistent as to whether face inversion attenuates emotion detection advantages in visual search, suggesting the utilization of holistic processing (Fox & Damjanovic, 2006) or not (Lipp, Price, & Tellegen, 2009). Experiments 1 and 2 improved on prior methodologies using a larger number of different posers and varying set size. Consistent with Fox and Damjanovic, both experiments demonstrated that faster detection of angry faces was attenuated by inversion, regardless of array size. However, replicating the methods of Lipp et al., Experiment 3 yielded no effect of inversion on emotion detection. These findings seem to suggest that emotional expression detection in visual search is mediated by holistic face processing under some conditions, e.g., when multiple posers are used. However, when task design permits, e.g., when only one poser is used, participants may engage simpler, feature based search strategies to detect an emotional target face.

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(1014)

An ERP Study of the Integration of Face and Voice of Anger and Sadness. SHIH-TSENG T. HUANG and MING CHUEN LEE, *National Chung-Cheng University*—The present study investigated the integration of emotional face and voice. Twenty young adults participated. Congruous and incongruous faces and voices of angry and sad emotion were presented. In a congruous angry (or sad) pair, an angry (or sad) face was presented with an angry (or sad) tone. The incongruous angry pairs contained an angry face presented with a neutral tone, or a neutral face with an angry tone. Similarly, the incongruous sad pairs contained sad face with neutral tone or neutral face with sad tone. In the event-related potential procedure, congruous emotional pairs were presented in 80% and the incongruous pairs were in 20% of the trials. Data were analyzed in three temporal phases of initial (100-300 msec), morpho-syntactic (300-500 msec), and integrated (500-1000 msec). The results found the latency of P120 and N170 were both greater at Pz than at Fz and Cz. Results also found higher mean amplitudes (MAs) of P300-500 on sad than on angry pairs. During 500-800 msec, greater MAs were found on the sad pairs at Cz. The results suggested a greater activation at the parietal lobe at the initial phase and higher activation in the integration of sad pairs of face and tone than angry pairs at the later phases.

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(1015)

Bank of Standardized Stimuli (BOSS) Updated: 1,420 Normative Photos of Various Concepts to be Used in Cognitive Science. MATHIEU B. BRODEUR, *McGill University*, KATHERINE GUÉRARD and SÉBASTIEN LAGACÉ, *Université de Moncton*, MARTIN ARGUIN, *Université de Montréal*—In cognitive science, results are obtained following the manipulation of one stimulus' variable and the control of potential confounding variables. To avoid the tedious task of measuring confounding effects, scientists often refer to normative sets of stimuli. The Bank of Standardized Stimuli (BOSS) is one of these sets. It initially included 480 normative stimuli of common objects and norms for seven variables (name, category, familiarity, visual complexity, object's typicality, manipulability and orientation). The BOSS has expanded and provides a wider variety of stimuli in order to fulfill the needs of experiments. To date, the latest version of the BOSS is comprised of 1,420 normative stimuli, including photos of animals, and new norms (color diagnosticity, symmetry, and action related norms). In order to demonstrate the influence of normative variables on cognitions, experiments on episodic memory were completed using the BOSS. Analyses were conducted as a function of the norms and indicated that name agreement, visual complexity, object/viewpoint agreement, symmetry, and color diagnosticity all influenced memory in distinct ways mostly by affecting the performance to new stimuli and by inducing response biases.
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(1016)

Spatial Grouping and Visual Enumeration Performance: Signal Detection Analysis. ANTHONY D. CATE and LIHI TZUR, *Virginia Tech* (Sponsored by Rachel Diana)—We examined the relationships between spatial grouping and visual enumeration (e.g., subitizing and counting). Specifically, we examined interactions between inter- and intra-group enumeration processes. Healthy observers enumerated small numbers of dots shown at threshold durations, with sensitivity (d') and bias as the key dependent measures. For a given set size, displays were created to exhaust every possible arrangement of dots into different numbers of groups. Groups were formed by aligning dots in compact rows, and different groups were made perceptually distinct by randomly jittering the large separation between groups. Observers could efficiently enumerate multiple groups containing multiple dots, as long as a 3-4 item limit was not exceeded at either level. Within this constraint, performance was efficient for larger set sizes. Response bias also played a strong role, and this result complements earlier studies of grouping and enumeration (e.g. Oeffelen & Vos, 1982).
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(1017)

Vertex Polarity and the Perceived Beauty of Polygon Shape. JAY FRIEDENBERG, *Manhattan College*, ELENA ROTONDO, *University of Wisconsin-Milwaukee*, CHRISTOPHER RYPL, *University at Buffalo, SUNY*—Recent research has examined polygon convexity and concavity and the role they play in

shape perception (Bertamini and Wagemans, 2013). In this experiment we manipulated vertex polarity, defined as a switch between convex and concave vertices on a polygon contour. In octagons there are eight distinct sequences of these patterns excluding orientation that vary in the number and positioning of their vertices. We presented multiple randomized examples of each sequence to participants. Rating judgments of perceived attractiveness increased linearly with the number of alternations. The data suggest a preference for shapes with more variety or complexity. Polygons with only convex vertices were generally perceived as attractive regardless of polarity shifts, demonstrating a preference in this particular case for quasi-symmetric forms. The results are interpreted in the context of the history of research on complexity and aesthetics.
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(1018)

The Mere Presence of a Photo on a Product Label Can Change Taste Perception. RANDI BECKETT, *Brock University*, BRITTANY CARDWELL, *Victoria University of Wellington*, ANTONIA MANTONAKIS, *Brock University*, ERYN NEWMAN and MARYANNE GARRY, *Victoria University of Wellington*—Photos that are related to claims but not diagnostic of their truth can nonetheless lead people to think those claims are true. Photos might produce this effect by making it easier for people to generate information related to claims, boosting conceptual fluency. Might photos also affect taste perception? We developed a set of wine names and told participants they would sample each. All of the wines were actually the same. As participants tasted each wine, they decided whether the claim "This wine tastes high quality" was true or false. Some wine names appeared with a related photo during tasting, other wine names appeared alone. People responded true more often to the claim when wine names appeared with photos. This finding suggests that photos related to product names can affect people's taste judgments, and fits with the idea that people use conceptual fluency as a metacognitive cue to evaluate taste.
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• ACTION AND PERCEPTION I •

(1019)

A Temporal Analysis of the Effects of Numerical Magnitude on Grasping. GAL NAMDAR, *Ben-Gurion University of the Negev*, DANIEL ALGOM, *Tel-Aviv University*, TZVI GANEL, *Ben-Gurion University of the Negev*—Numerical magnitude has been shown to affect the initial pre-shaping of the fingers prior to grasp, with larger numbers leading to larger grip apertures compared to smaller numbers. Such effects have been attributed to a common neural network within the parietal lobe that mediates the processing of magnitude across different domains. In a series of experiments, we manipulated the temporal overlap between grasping preparation and computation of numerical magnitude to test the nature of the relationships between these two processes.



In Experiment 1 we showed that numerical magnitude affected grip apertures only for slow-initiated trials, while no effects of magnitude were found for the faster responses of the subjects. In experiments 2a and 2b, we extended these findings by directly manipulating the availability of numerical information during movement preparation. Again, numerical magnitude affected grasping only for fast responses in which information about numerical magnitude was available during grasping preparation. These findings suggest that movement programming and the processing of numerical information are mediated by dissociable, yet interacting mechanisms.

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(1020)

Explicit Knowledge on Perturbed Movement Relations Versus the Robustness of Aftereffects in Tool Use. STEFAN LADWIG, ANNA-LENA KÖHLER, JOCHEN MÜSSELER and CHRISTINE SUTTER, *RWTH Aachen University*—In tool use perturbed relations between distal (visual) and proximal (proprioceptive/tactile) action effects challenge the human information processing system. This affect related motor performance, e.g. in the way of crosstalk between distal and proximal action effects. This phenomenon provides evidence for a common representational domain as proposed by common coding approaches. The present study investigated whether terminal feedback might reduce this crosstalk in contrast to a non-feedback condition. We came up with a simple drawing paradigm introducing varied translational transformations between hand movements on a digitizer tablet and resulting cursor movements on a screen. The task required to either reproduce previously performed (seen) hand (cursor) amplitudes. Results revealed prominent aftereffects of visual (distal) action effects in motor actions. The mutual interference of competing sensory information confirms that perceived events and actions are represented in commensurable feature codes. Moreover, the results indicated that explicit knowledge on perturbed movement relations did not affect the robustness of aftereffects.

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(1021)

Grasping Affordance or Feature Asymmetry in Correspondence Effects for Flashlights. JING CHEN, *Purdue University*, XIAOLEI SONG, *Shaanxi Normal University*, ROBERT W. PROCTOR, *Purdue University*—Three experiments examined whether an object-based correspondence effect for flashlight pictures is due to a grasping affordance provided by the handle or asymmetry of feature markings on the flashlight. Participants in all experiments made upright/inverted orientation responses to the flashlights with left-right keypresses. In Experiment 1 the stimuli were the same as those in Pellicano et al.'s (2010) Experiment 2, and a small correspondence effect favoring the handle end was evident when the flashlight was in an active state. With the graspable handle removed in Experiment 2, making the feature markings more asymmetric in the display, the correspondence effect was larger. In Experiment 3, when only the half of the markings nearest the light end of the

flashlight was included, the correspondence effect shifted to favor that end. The results are in agreement with a visual feature-asymmetry account and difficult to reconcile with a grasping-affordance account.

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(1022)

When Others' Hands Are in My Workspace: Evidence for a Social Hand-Posture Effect. ROMAN LIEPELT, *University of Muenster*—Previous research has shown that one's own hand position affects spatial attention in a covert orienting of attention paradigm. The present study examined if and how hand position affects spatial attention in a social Simon task. A Simon task was distributed across two individuals, each person was taking care of only one of two responses with varying hand positions. An Individual go/nogo and a standard (two-choice) Simon task were also used as control tasks. The size of the Simon effect was modulated by hand position in the social Simon task, but not in the Individual go/nogo nor in the standard Simon task. A second experiment tested if the modulatory effect of hand position on the social Simon effect is related to one's own or the other person's hand position. The findings of both experiments are discussed in relation to different spatial attention mechanisms (prioritization of space and attentional inhibition) and their relevance for joint action.

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(1023)

Covert Attentional Orienting to Implied Human Action in Adults With Autism. MARCUS N. MORRISEY and M. D. RUTHERFORD, *McMaster University*, CATHERINE L. REED, *Claremont McKenna College*, DANIEL N. MCINTOSH, *University of Denver*—Images of implied human action act as attentional cues, directing attention towards the target of the action. However, individuals with ASD process social attentional cues, like eye-gaze, differently. The current study compared the spatial cueing effect, between typical and autistic groups, of an image of a person poised to throw a ball. We manipulated the extent to which the depicted action was social, by presenting either social (people) or non-social (trees) flanking images, tested automaticity, by varying stimulus onset asynchronies (SOA) between 150 (automatic) and 300 (controlled) ms, and manipulated cue predictiveness, by varying the proportion of trials in which the direction of the central body was a valid cue to the location of the target (.8 in the predictive block, .5 in the non-predictive). All participants were faster to respond to a peripheral target on validly cued trials and faster to respond at the 300 ms SOA. Social context was relevant only in the typical group, for whom valid trials were faster for bodies than trees at both SOAs. The results suggest that while both ASD and typical individuals orient attention to implied human actions, a social context enhances performance for typical individuals.

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(1024)

Multiple Motor Planning Causes Sluggish Action Changes in Older Adults. MAYA KATSUHARA, RYUTA ISEKI, SAYAKO UEDA and TAKATSUNE KUMADA, *RIKEN*—

This study examined mechanism of sluggish action changes in older adults. Forty-five older and forty young adults participated in two experiments that required them to move one hand according to a cue. Under action change conditions, one trial consisted of two successive actions. In older adults, reaction times to stop current action were longer in the action change condition than in the single action baseline (ACC: action change cost). In addition, the switch lag (SL) from stop of one action to start of the next action was longer in older adults than in young adults (Experiment 1). Prior change cues reduced the SL, while the ACC remained in older adults (Experiment 2). These findings suggest that planning new actions delayed under holding other motor plans in older adults, and this cost can be reduced by sufficient time for preparation of a new action.

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(1025)

Influence of Finding Points of Spatially Extended Objects on a Visuomotor Tracking Task. SAYAKO UEDA, RYUTA ISEKI, MAYA KATSUHARA and TAKATSUNE KUMADA, *RIKEN Brain Science Institute TOYOTA Collaboration Center*—When we hit a visible object by a tool, a reference point of the tool (referred to as an “effector”) should be spatially matched to an appropriate reference point of the visual object (“target”). We explore whether these reference points were independently extracted using a visuomotor tracking task, in which participants tracked a target (a small vertical line segment or a horizontal bar) moving left or right randomly by an effector (the same line or bar) manipulated by a joy-stick under three conditions. (i) the allocentric reference (AR) condition: the center of a bar was tracked by a line, (ii) the egocentric (ER) condition: a line was tracked by the center of a bar, (iii) the dual (DR) condition: the center of a bar was matched to the center of a bar. If AR is independently processed from ER, the tracking performance of DR should be additive to these of AR and ER. Results indicated that the performance of DR was not different from either of that in AR or ER, suggesting that the mechanism AR is not independent of that of ER.

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(1026)

What You See is Not What You Get: The Influence of Approach and Escape Motivation on Visual Perception in Spider-Fearful Individuals. ARASH FARSHID, JEFFREY S. KATZ and LEWIS M. BARKER, *Auburn University*—We examined the influence of approach motivation on visual perception, and whether these perceptions affect action responses in a direction congruent with this motivation, by comparing thirsty and quenched individuals (Experiment 1) as well as spider-fearful and spider-tolerant individuals (Experiment 2). In Experiment 1, thirsty individuals perceived a water bottle to be closer than quenched individuals. The closer the water bottle was perceived, the shorter the distance that participants stepped away from the water bottle relative to their baseline. In Experiment 2, spider-fearful individuals perceived a stimulus that evoked threat (tarantula) as physically closer and bigger than stimuli that evoked disgust

or a neutral affective signal compared to spider-tolerant individuals. The closer the tarantula was perceived by spider-fearful individuals, the longer the distance that they stepped away from it relative to their baseline. These results are the first to demonstrate a linear association between biased visual perceptions and approach/escape behavior.

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(1027)

Get in My Belly: Anterior-Posterior Postural Shifts in Response to Food. TAD T. BRUNYÉ, JACKIE F. HAYES, CAROLINE R. MAHONEY and AARON L. GARDONY, *Tufts University; U.S. Army*, HOLLY A. TAYLOR and ROBIN B. KANAREK, *Tufts University*—Postural sway along the anterior-posterior axis may indicate subconscious activation of approach versus avoidance motivational states, though extant evidence is equivocal. Mixed results might partially derive from unpredictably individualized interpretations of stimuli. To test this hypothesis we presented participants (N = 80) with 100 food items that were personally preferred, non-preferred, or elicited no strong preference. While participants viewed the images we monitored center of pressure variation on a standing balance board. Participants reliably swayed toward (anterior) highly preferred foods, and away (posterior) from foods they did not prefer, or showed no strong preference toward. This pattern was most pronounced during later portions of the 3-second viewing epoch, and was not predicted by participant eating or dieting behavior. We propose that postural variation along the anterior-posterior axis can reliably indicate the activation of approach motivational states resulting from subjective hedonic evaluation of foods. These results support emerging theory positing links between motivational systems and behavior, and carry applied implications for the measurement and management of abnormal eating.

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(1028)

Complementary Coordination Strategies in a Joint Fitts's Reciprocal Aiming Task. IVANA KONVALINKA, *Technical University of Denmark; Central European University*, LEA SKEWES, *Aarhus University*, JOHN MICHAEL, *University of Copenhagen*, JOSHUA SKEWES, *Aarhus University; Aarhus University Hospital*—How do people coordinate their actions to achieve a common goal when one person has the more difficult task? In the present study, dyads were instructed to engage in a Fitts's reciprocal aiming task as accurately as possible, and at a given tempo sent through their headphones. They were in conditions where they either received auditory feedback of 1) SELF-generated taps, 2) taps generated by the OTHER co-actor, or 3) regular, COMPUTER-generated taps. In conditions 2) and 3), they were also instructed to synchronize with their feedback as best as possible. In each trial, each participant was assigned to either the target's role – with varying target width, and hence task difficulty – or the reference role – with the widest (easiest) target. Results show that when the task was performed interactively with the other person, they were most synchronized, and also used the target most similarly, while compromising rhythmic accuracy. In addition, as task difficulty increased for the member with



the target's role, the participant with the reference role became more adaptive to her tempo. This suggests that interacting members of a dyad optimally negotiate coordination strategies to achieve a joint goal, by taking on leader-follower roles.

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(1029)

Response Costs Due to Action-Feature Overlap Between Action Plans are Influenced by Working Memory Span.

ALEXANDRA M. STUBBLEFIELD, LISA R. FOURNIER and LAWRENCE P. BEHMER JR., *Washington State University*—When prioritizing actions, we often maintain one action plan in working memory (WM) for later execution while executing another. Research shows that executing an action can be delayed if it partly overlaps (vs. does not overlap) with another action plan maintained in WM (overlap cost). This study examined whether overlap costs increase for individuals with low vs. high working memory spans. Two visual events occurred in a sequence, and participants planned an action to the first event (Action A) and maintained this action in WM while executing a speeded response to the second event (Action B). Afterwards, participants executed Action A. Both low- and high-span participants showed an overlap cost, and costs were greater for the low-span participants. Also, alpha-desynchronization over frontal, motor, and parietal areas was greater for the low-span versus high-span participants while maintaining Action A in WM. These findings suggest that overlap costs are influenced by demands on WM, consistent with a code confusion hypothesis vs. a code occupation hypothesis.

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(1030)

Transfer of Motor Learning From a Virtual to Real Task Using EEG Signals Resulting From Embodied and Abstract Imagery. FLAVIO J.K. DA SILVA and MICHAEL MCBEATH, *Arizona State University*—We use an EEG brain-computer interface (BCI) to explore the phenomenon of motor learning transfer (MLT). We test whether MLT is more related to use of shared neural structures between imagery and motor execution or to more generalized cognitive factors. Using an EEG-BCI, we train one group of participants to control the movements of a cursor using embodied motor imagery. A second group is trained to control the cursor using abstract motor imagery. A third control group practices moving the cursor using an arm and finger on a touch screen. We hypothesized that if MLT is related to the use of shared neural structures then the embodied motor imagery group would show more MLT than the abstract imaging group. If, on the other hand, MLT results from more general cognitive processes, then the abstract motor imagery group should also demonstrate MLT to the manual performance of the same task. Our findings support that MLT is due to the use of shared neural structures between imaging and motor execution of a task. The abstract group showed no motor learning transfer despite being better at EEG-BCI control than the embodied group. The choice of EEG-BCIs using abstract vs embodied imagery depends on the neuromuscular disability of the user.

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(1031)

What Makes Stimulus-Response Codes Similar? Reaching Into Response Selection Using Mouse Trajectories. TIM WIFALL, AARON T. BUSS, JOHN P. SPENCER and ELIOT HAZELTINE, *University of Iowa*—To behave adaptively in complex and dynamic environments, one must link perception and action to satisfy internal states, a process known as response selection (RS). A largely unexplored topic in the study of RS is how inter-stimulus and inter-response similarity affect performance. To examine this issue, we manipulated stimulus similarity by using colors that were either similar or dissimilar and manipulated response similarity by having participants move a mouse cursor to spatial locations that were either close together or far apart. Stimulus and response similarity produced an interaction such that there was more curvature in the mouse trajectory when both were similar compared to when either was dissimilar, a result obtained under task conditions emphasizing speed and conditions emphasizing accuracy. These findings are inconsistent with symbolic look-up accounts of response selection but are consistent with central codes incorporating metrical properties of both stimuli and responses.

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(1032)

Spatial Compatibility Effects in Extrapersonal Space: Further Support for Referential Coding. PATRICK NALEPKA, MIJA M. VAN DER WEGE and JULIA STRAND, *Carleton College*—When partner-pairs share responsibility in completing the Simon task (Craft & Simon, 1970), a spatial compatibility effect (SCE) emerges. The SCE is only present when participants complete the task together, not when they complete the task alone. This discrepancy could be due to participants co-representing their partner's task in addition to their own, leading to task interference (Sebanz, Knoblich, & Prinz, 2005). However, a referential coding account suggests that the SCE is due to individuals spatially coding their actions in relation to their partners (Dolk, Hommel, Prinz, & Liepelt, 2013). This study differentiated between these accounts. Participants completed the Simon task either to the left (right) of their partner or back-to-back. A SCE only emerged when participants completed the task to the left (right) of each other, regardless whether the task was performed in the same room or in separate rooms. These findings support a referential coding account of the SCE.

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(1033)

Cognitive Offloading: Determinants of External Normalization. EVAN F. RISKO and TIM DUNN, *University of Memphis*, SRDAN MEDIMOREC, *Arizona State University*—Recent interest in the embodied nature of cognition has drawn attention to the various ways that individuals use their body in an attempt to lessen the "cognitive load" (i.e., cognitive offloading). One putative example of this type of behavior can be found in individuals' tendency to physically rotate their body (e.g., tilt their head) when presented with rotated text (i.e., external normalization). In the present investigation, we report a series of experiments exploring the

influence of various perceptual manipulations (e.g., number of display elements, type of rotation) on the likelihood that individuals adopt this strategy, the associated performance costs, and the evaluations of subjective effort. Results suggest that subjective effort evaluations play an important role in cognitive offloading.

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(1034)

Perceiving in Terms of Planning: Intentional Dynamics Reverse the Influence of Implied Friction of Spatial Perception. DEVIN GILL and J. SCOTT JORDAN, *Illinois State University*—Individuals who continually track an object that suddenly vanishes indicate a perceived vanishing point 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). The present study examined the effect of control upon stimulus tracking. Participants either controlled or observed the movements of a box-shaped stimulus in three levels of implied friction (i.e., no surface, and surface below, and surface above and below). Results indicate that FD increased significantly from the low to medium friction conditions for both observers and controllers. Simple effects tests show that observers indicate significantly more FD than controllers at the high friction condition. This partial reversal of Hubbard (1995) may be a result of economy of action effects (Proffitt, 2006) inherent with the intentional (i.e., non-inertial) dynamics of the controlled stimulus (Guerreschi et al., 2007).

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(1035)

Converging Operations: All Measures of Distance Perception do Not Measure the Same Underlying Construct. ELYSSA TWEDT, *University of Richmond*, JONATHAN Z. BAKDASH, *U.S. Army Research Laboratory*, DENNIS R. PROFFITT, *University of Virginia*—It has been suggested that highly correlated responses across different measures of perceived distance is evidence that these measures tap into the same unitary construct (Philbeck & Loomis, 1997). However, correlations between mean response values do not necessarily imply a unitary distance perception construct. Intra-individual variability across converging operations must also be assessed (Ashby & Townsend, 1986). Thus, to assess the construct validity of five traditional measures of distance perception (verbal estimation, visual-matching, blind-walking away from target, blind-walking toward target, and triangulated blind-walking) intra-individual variance across measures was examined. Participants judged the distance to five targets placed between 7 and 11 meters for all five measures. Confirmatory factor analysis for a unitary construct yielded a poor fit. However, an exploratory factor analysis revealed a multi-factor model, suggesting independent underlying processes or representations across distance measures. Our findings indicate that measures of distance perception are not measuring the same underlying construct.

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(1036)

Attentional Expectations of Periodicity in a Rapid Serial Visual Presentation Task. JACQUELINE C. SHIN, MICKEAL KEY and GREGORY SIMMONS, *Indiana State University*—Research on dynamic attending indicates that entrainment to periodicity can influence auditory perceptual processing at stimulus frequencies around 2 Hz. We investigated the role of attentional entrainment in cognitive processing of visual stimuli presented at a much higher frequency. In a rapid serial visual presentation paradigm, participants identified a blue letter target among a series of black letter distractors. In one condition, each distractor was presented with a stimulus onset asynchrony of 102 ms. Critically, the target was presented on time or slightly early or late relative to that periodic time pattern. In the other condition, the target and distractors were all presented non-periodically—synchronous with or slightly before or after points on a tacit 102 ms periodic grid. Results will be presented with respect to effects of periodicity and target timing on target identification. The implications of these results with respect to attentional entrainment and expectation will be discussed.

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• EMBODIED COGNITION I •

(1037)

Stroop-Like Interference Between Structural and Functional Hand Gestures Within Objects. MARGAUX LARRE-PEREZ, *Paris Descartes University; ENS*, PIERRE JACOB, *ENS*, THÉRÈSE COLLINS, *Paris Descartes University* (Sponsored by Patrick Cavanagh)—Man-made objects elicit two kinds of hand gestures: structural (associated with the shape-based properties of objects) and functional (associated with their typical usage) hand gestures. We adapted a Stroop-like paradigm to assess whether they are both automatically activated when viewing an object and if they compete with each other. Participants learned to associate either a “clench” or a “poke” movement with a color, and then executed them in response to the color of pictures of objects associated with both actions. Objects were displayed either entirely or only partially colored, congruently or incongruently relative to the relationship between the color and the object part. Results show that planning any hand movement on an object is slower when attention is drawn to its functional part, suggesting that elicitation of hand gestures may depend on the allocation of visual attention.

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(1038)

The Joy(stick) of Motor-Induced Remembering. MARK A. OAKES, ALAN SEARLEMAN and BRIDGET M. SHEA-GANDER, *St. Lawrence University*—The current study tested 37 right-handed undergraduates who manipulated a joystick to induce remembering or forgetting of words in a subsequent recognition task. Thirty-six words appeared sequentially on a computer, 1/3 of the words were displayed in brown, blue, or black. Based on the color of the word, participants either



moved a joystick toward themselves, away from themselves, or sideways. A recognition test revealed that words moved closer to the body were significantly easier to distinguish from never-presented foils than words moved away from the body. Moreover, there was no evidence of a difference between words that were initially moved away from the body or given a sideways movement (control condition). This pattern of results replicates and extends previous work in our lab and supports the notion that physical movements influence memory processing.

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(1039)

Goal-Dependency and Perspective-Change in Motor Resonance. THOMAS A. MCWILLIAMS and MYEONG-HO SOHN, *George Washington University*—Motor resonance refers to the activation of mirror neurons in the motor cortex while observing human action, and has been considered as the basis of action understanding. To investigate the boundary condition of motor resonance, we used a picture-comprehension task. The pictures depicted two human characters (e.g., a doctor and a nurse) engaged in an action (e.g., hitting). When participants were explicitly instructed to process the action (e.g., “To whom the action is being done?”), processing the same action twice in a row was faster than processing different actions. This action priming effect was greater when the same action perspective (e.g., actor or recipient) was maintained than not. However, the action priming effect disappeared when the processing of action was implicit in the task instruction (i.e., “Is a doctor in the picture?”). These results suggest that motor resonance is goal dependent and subjected to the perspective of the action.

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(1040)

Reversing the Mental Timeline: Exploring Flexibility in Spatial Representations of Time. KEVIN S. AUTRY, AUDREY DUNN and WILLIAM H. LEVINE, *University of Arkansas*—Metaphorical mapping theory (Lakoff & Johnson, 1980) proposes that people use concrete domains to represent abstract concepts. For example, there is evidence that time is represented spatially, with English speakers typically representing the past on the left and the future on the right. Subjects first completed a non-linguistic priming task in which they placed historical events on a timeline with early events on the left (canonical) or the right (non-canonical). Subjects then made younger/older judgments for the second face in pairs of celebrity faces using keys arranged with younger on the left (canonical) or the right (non-canonical). Following the canonical timeline task, subjects responded more quickly using the canonical button order. However, following the non-canonical timeline task, subjects responded more quickly when using the non-canonical button order. This suggests that the particular direction of the time-space metaphor is malleable and that metaphors may be generated ad hoc.

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(1041)

Spatial Interference in Mental Arithmetic. OLIVER LINDEMANN, *University of Potsdam*, MICHAEL WIEMERS, *Radboud University Nijmegen*—The study investigates the effects of spatial information on mental arithmetic. In Experiment 1, participants solved addition and subtraction problems and indicated the result verbally while moving their arm continuously either leftwards, rightwards, upwards or downwards. The analysis of the problem solving performances revealed a mapping between arithmetic operations and spatial actions along both the horizontal and vertical axes. Performances in additions were enhanced while making upwards compared to downwards movements as well as when moving right compared to left. Importantly, the inverse pattern was observed in subtractions. In Experiment 2, spatial information was irrelevant for the task and instead of performing active body movements, participants calculated while the problems moved in one of the four cardinal directions on the screen. Interestingly, for visual motions, the spatial effect on arithmetic performances was restricted to the vertical dimension. Our finding shows an impact of spatial processing on mental arithmetic. This linkage is stronger and more automatized for the vertical dimension, supporting the notion that sensory motor experiences provide a grounding for arithmetic operations.

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(1042)

Investigating the Level of Mechanistic Understanding in Physical Versus Virtual Learning Environments. ALLISON S. LIU and CHRISTIAN D. SCHUNN, *University of Pittsburgh*—As technology advances, an increasing number of physical environments are being replaced by virtual environments. Previous research suggests that both types of environments can provide unique learning affordances. An important consideration is whether we are losing potential learning benefits by moving away from physical environments. In Study 1, we compared students who worked with a physical or a virtual robot during a programming task, and found that students working with physical robots spontaneously used mathematical strategies more often, and attended more to the robot’s mechanistic and mathematically-related parts. In Study 2, we investigated whether the differences between the physical and virtual groups from Study 1 were caused by greater mechanistic understanding in the physical group, by manipulating students’ levels of mechanistic understanding and comparing subsequent mathematical strategy use. The studies have implications for mathematical learning, and the unique learning affordances that should be integrated into both learning environment types.

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(1043)

Building Creativity: How Our Physical Environment Can Influence Creative Thinking. ELENI NASIOPOULOS, AGNES CYWINSKA, THARIQ BADIUDEEN and ALAN KINGSTONE, *University of British Columbia*—Certain elements of our physical environment are known to influence cognitive performance. Recent research has shown that

seemingly trivial factors such as ceiling height and lighting can influence creative thinking. The present study investigates the potential influence of one's working environment on creative thought. To measure creativity, participants performed an array of convergent and divergent thinking tasks in one of two very different working environments: (1) a "green building" with an abundance of windows throughout, outdoor visibility and natural light, or (2) a traditional concrete building with minimal outdoor views and windows with limited access to natural light. The results indicate that creativity levels increased significantly when participants completed the tasks in a green building, suggesting that this type of environment can facilitate connections to nature and influence creative problem solving, thereby providing its residents with a cognitive advantage.

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(1044)

Investigating the Role of Embodiment in Sound Symbolism.

DAVID M. SIDHU and PENNY M. PEXMAN, *University of Calgary*—A longstanding issue in Cognitive Science is the relationship between sound and meaning in language. Saussure (1916) argued that the relationship is arbitrary, but there are now a number of demonstrations that this may not be true in every case. For instance, the Bouba/Kiki effect is the finding that people tend to pair 'round' nonwords like bouba with rounded shapes, and 'sharp' nonwords like kiki with sharp shapes. In the present study we tested the hypothesis that this association depends on the nonwords' sensorimotor qualities—namely their articulation. We used a manipulation that selectively interfered with the experience of articulation, and found that this diminished the nonword-shape congruency effect. This suggests that sensorimotor experience is important to the Bouba/Kiki effect, and points to a new mechanism for sound symbolism.

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(1045)

Emotional Response to Imaged Motor Fluency: Evidence From Facial Electromyography.

VALERIE DENNEHY, AMY E. HAYES and STEPHAN G. BOEHM, *Bangor University*—Moving an object in a fluent manner evokes a more positive affective response toward the object (measured by verbal report) than movement in a less fluent manner (Hayes et al, 2008). We recently found the same effect for imaged actions. The current study tests whether imaged motor fluency evokes emotion if the task does not require attending to emotional states. To measure affect, electromyographical recordings were taken from two facial muscle sites, zygomaticus major (ZM; involved with smiling), and corrugator supercilii (CS; involved with frowning). Results: ZM activity was stronger for actions imaged in a fluent condition (no obstacle present), whereas CS activity was stronger for non-fluent conditions (obstacle present), suggesting emotional response to fluency is more positive and less negative than to non-fluency. This muscle-by-fluency interaction was evident while planning the

imagery. Conclusion: Emotional responses to imaged motor fluency occur spontaneously, even when attention is not directed toward emotional states.

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(1046)

Large Ants and Small Mansions: Perceptual Information Does Not Generally Affect the Representation of Words.

NATALIE A. KACINIK and RITA W. EL-HADDAD, *Brooklyn College, CUNY*, KENDALL J. ESKINE, *Loyola University New Orleans*, LOLLY STARR-GLASS and SAMUEL SALAMON, *Brooklyn College, CUNY*—Embodied accounts of semantics propose that representations of word meaning are grounded in sensorimotor experiences (Barsalou, 2008; Glenberg, 2010; Zwaan et al., 2002), but these theories have mostly been supported by research relying on priming and interference procedures, or on measuring or manipulating brain activity. The present study investigated whether perceptual information about a word's appearance would be incorporated to potentially alter participants' representations of those words. Participants were presented with words in small or large fonts to be congruent or incongruent with an object's actual size (e.g., mansion in a large vs. small font, respectively) in explicit and incidental learning paradigms, prior to completing recognition memory and property judgment tasks, in the same session and after a 2-week delay. Font size generally did not significantly affect the representation and processing of words. These results therefore potentially challenge embodied accounts of word meaning, but some possible explanations will be discussed.

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(1047)

Spatial Configuration of Vertically Related Word Pairs Modulates the N400 Component of ERPs.

TYLER M. HUBBARD, CYRILLE MAGNE, WILLIAM E. LANGSTON and EMILY SHIELDS, *Middle Tennessee State University*—Researchers have suggested neural measures are more sensitive than reaction time (RT) data. Although embodied language studies have benefited from various imaging techniques, this area has significantly underutilized the event-related potential (ERP) method. This study used the ERP method to examine neural responses to an embodiment task, the spatial iconicity task. Participants made relatedness judgments for word pairs (64 semantically related and 64 unrelated) presented vertically (Experiment 1) or horizontally (Experiment 2) on a computer screen. Related word pairs shared a vertical spatial relationship (32 were presented in a congruent arrangement and 32 were presented in an incongruent arrangement) whereas unrelated words (algebra-silver) did not. Experiment 1 found incongruent pairs elicited a larger N400 amplitude than congruent pairs, but no difference was observed in the RT data. Experiment 2 found no difference in the N400 amplitude for congruent and incongruent pairs, and this was corroborated with the RT data. These results suggest perceptual simulations are recruited for the task, but RT measures are not sensitive enough to detect this.

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(1048)

Testing the Asymmetric and Strategic Nature of Category-Container Metaphoric Association. YANLI HUANG and CHI-SHING TSE, *The Chinese University of Hong Kong*—We used an modified Boot and Pecher's (2011) paradigm to examine the nature of conceptual metaphors: (a) whether concrete image schema “container” is activated when understanding abstract concept “category,” but not vice versa, and (b) whether the activation of this metaphoric association is strategic. Subjects saw displays of two items inside or outside a frame, which may activate the container schema. They judged whether these two items were from the same category (animal/vehicle) in categorization trials or whether the frame was in red/green color in color-discrimination trials. Performance of categorization, but not color-discrimination, was modulated by whether the display was congruent with the metaphoric association (i.e., same category—inside bounded region; different category—not in same bounded region). This supports the asymmetric nature of the metaphoric association. This metaphor congruency effect in categorization occurred only when two types of trials appeared in separate blocks (Study 1), but not when they were intermixed within one block, in which a trial was followed by a post-cue indicating the type of judgments that subjects had to make (Study 2). This suggests that the metaphor congruency effect was strategic.

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(1049)

Imaged Motor Fluency Evokes Emotion: Evidence of Embodiment. AMY E. HAYES, VALERIE DENNEHY and NICHOLA CALLOW, *Bangor University*—Affective judgments of objects can be influenced by motor fluency (Hayes et al, 2008). However, the mechanisms that link emotion to motor fluency are not well understood. Here we demonstrate that imaging actions evokes an emotional response to fluency, and this effect relies on kinaesthetic imagery. In Study 1, participants imaged moving objects non-fluently (avoiding an obstacle) or fluently (no obstacle). Results indicated higher liking ratings for objects of fluent actions. Moreover, higher kinaesthetic imagery ability was associated with stronger emotional responses to fluency condition. In Study 2, participants completed the movement imagery task from Study 1 using one of three imagery conditions: internal visual imagery, kinaesthetic imagery, or a combination of the two. Liking ratings were higher for objects of fluent actions, but only for the groups that used kinaesthetic imagery. Taken together, these findings demonstrate the possible embodied nature of emotional responses to movement fluency via kinaesthetic imagery.

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• SPATIAL COGNITION I •

(1050)

Spatial Updating of Map-Acquired Representation. CHENGLI XIAO and YANGMIN LIAN, *Nanjing University*—The current study examined whether people can update the map-acquired spatial representation. The participants learned a spatial layout from a map displayed on a computer screen, and then performed spatial judgments at a novel position either in the same room or in a distal room. They were required to imagine from the perspective aligned with the learning direction, aligned with their facing direction, and a novel direction misaligned with the two directions mentioned above. In both the immediate and non-immediate environments, the participants performed more accurately and rapidly from the learning direction than from the novel direction, and also performed more accurately and rapidly from the facing direction than from the novel direction. These results reveal that people establish an orientation-specific spatial representation by map learning, and they can also update the map-acquired representation during locomotion.
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(1051)

The Landmark Expansion Effect: Navigational Relevance Influences Memory of Object Size. JOSHUA B. JULIAN and RUSSELL A. EPSTEIN, *University of Pennsylvania* (Sponsored by Eiling Yee)—Humans often use visual objects as landmarks to navigate through their environment. Several qualities of an object can make it useful as a landmark; for example, (i) being positioned at a navigationally relevant location, or (ii) being large and stable. How do we represent these spatial properties of an object? To investigate this question, we presented subjects with a movie depicting a route through a virtual museum, with objects placed at intersections (navigational decision points) or at simple turns (non-decision points) along the route. Following learning, subjects performed a magnitude estimation task in which they judged the size of the objects on a scale of 1-9. We found that objects previously encountered at decision points were remembered as being larger than objects encountered at non-decision points. These results are consistent with the idea that there is a common representational code for the properties that make an object a landmark, such that if an object attains salience as a landmark by having one of these properties, it is more likely to be remembered as having another as well.

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(1052)

Navigation With Severely Degraded Vision Requires Increased Attentional Demands: A Mobility-Related Safety Account. KRISTINA M. RAND, WILLIAM B. THOMPSON and SARAH H. CREEM-REGEHR, *University of Utah*—Spatial learning while navigating under low vision conditions may be impaired for several reasons. We tested one possible account- increased attentional demands during navigation. In Experiment 1, we led participants through several short indoor paths while performing an auditory listening task, half with simulated degraded vision and half with normal vision.

Errors were significantly higher on the auditory task when navigating with simulated low vision, suggesting increased cognitive demands with degraded vision. Experiment 2 tested whether the cost could be attributed to additional attentional resources needed to walk safely. Participants with simulated low vision walked half the paths holding the arm of a guide, and half independently. Auditory task performance error rates were higher in the unguided condition, supporting our predictions. Together, these studies suggest the simple task of navigating a path with low vision is more cognitively demanding than normal vision, and mobility-related safety is part of the explanation.

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(1053)

Categorizing Individual Differences in Navigation: Insights From a Comparison of Paradigms. BENJAMIN D. NELLIGAN, *Johns Hopkins University*, LAURA A. CARLSON, *University of Notre Dame*, AMY L. SHELTON, *Johns Hopkins University*—Humans show remarkable variability in both their navigational success and their use of different navigational strategies. Although previous measures of these differences in ability and style have relied primarily on self-report, there is a growing body of evidence suggesting that some navigational behaviors cannot be captured by subjective reporting and require empirical measures. To date, these measures have largely been restricted to learning and testing one environment. We present a novel empirical measure of navigational success and style, the One-Shot Navigational Paradigm, which encapsulates learning and retrieval within each of multiple trials. We compared One-Shot performance to self-report and alternative empirical measures. The results suggested that empirical measures, including the One-Shot paradigm, appear to capture biases in the use of navigational styles, but comparisons across measures also revealed the need to consider how these biases might interact with the type and degree of experience one has with an environment.

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(1054)

Polarity Correspondence Between the Lateralized Response-Set and Sound Amplitude. SEAH CHANG, SUNG KYU MOON and YANG SEOK CHO, *Korea University*—It has been suggested that there is stimulus-response compatibility between the pitch of sound and the response location: Performance is better when the ‘right’ response is associated with a high tone and the ‘left’ response with a low tone compared to the opposite pairs. In the present study, four experiments were conducted to test correspondence effects between the amplitude of an auditory stimulus and the location of a lateralized response. When participants performed an amplitude judgment task in Experiment 1 and a timbre judgment task in Experiment 2, high-right/low-left advantages were obtained regardless of whether the tone amplitude was task-relevant or not. In Experiments 3 and 4, in which the auditory stimulus was presented to a left or right ear, the high-right/low-left advantage was modulated by the ear

to which the stimulus was presented. These results are in line with the Proctor and Cho’s (2006) polarity correspondence principle.

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(1055)

Spatial Transformations as a Function of Spatial Ability and Expertise. MARGARET R. TARAMPI and SARAH H. CREEM-REGEHR, *University of Utah*—The use of spatial transformations is ubiquitous in everyday cognitive processing from reading maps to planning actions. Use and proficiency in spatial transformations may vary based on both spatial ability and spatial expertise. We examined three classes of transformations—object-based (i.e., object rotation), perspective-based (i.e., body rotation), and effector-based (i.e., body-part rotation)—and their relationship to three spatial abilities—spatial orientation, spatial visualization, and kinesthetic imagery. Participants (controls and dancers) completed psychometric tests predicted to recruit the three spatial ability factors. They also performed timed computer-based spatial transformations of bodies and body-parts in two types of tasks (same/different and left/right). Overall, we found that performance on the transformations as a function of task type and stimulus was predicted differentially by the three spatial ability factors. This suggests that three distinct processes are involved. Furthermore, dancer performance on the transformation tasks suggested more dynamic vs. static processing of stimuli than controls.

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(1056)

Exploratory Flexibility in Older and Younger Adults. KATY VARNER, STEPHEN DOPKINS and DARIN HOYER, *George Washington University*—We examined the way flexibility in exploratory style varies with age. Participants searched for a target object in a two-dimensional rendering of a room. On each trial, participants chose a view of the interior of the room from two options. These options corresponded to diametrically opposed corners of the room, such that participants could alternate between two opposing vantage points in conducting their search. The level of alternation was used as the primary measure of flexibility in exploratory style. In general, older adults alternated more than younger adults. Additionally, older adults demonstrated a higher level of alternation following correct responses. Since alternation may have afforded better encoding of the appearance and relative locations of objects within the room through the principle of encoding variability, spatial memory for the room was examined, as well as any potential correlation between level of alternation and spatial memory.

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(1057)

Brain Lateralization Predicts Sex Differences on Spatial Tasks. SARA J. STEELE and BEVERLY ROSKOS, *The University of Alabama*—Sex differences in performance on spatial tasks may arise because men and women use their brain hemispheres differently. In the current study, subjects completed tasks that are known to recruit the left hemisphere



or the right hemisphere, in addition to mental rotation and spatial visualization tasks. Results showed that performance on the left hemisphere tasks correlated with performance on the spatial visualization task more strongly with women than with men. Conversely, performance on right hemisphere tasks correlated with performance on the mental rotation task more strongly with men than with women. We conclude that sex differences on some spatial tasks have a biological basis, at least in part.

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(1058)

Availability and Use of Early Numeracy Content in Pre-Kindergarten Classrooms. SHWETHA SRIKANTH, SANDY GONZALEZ, AMANDA COSTALES, NATALIE HERRADON and SHANNON M. PRUDEN, *Florida International University*—Florida's Voluntary Pre-Kindergarten program (VPK) aims to ensure that all 4-year-olds, especially those from low socioeconomic (SES) backgrounds, are prepared to excel in K-12 mathematics. Critically, early numeracy/spatial skills are predictive of success in K-12 mathematics. Research suggests children from low-SES families are at-risk for failure in early numeracy/spatial content. To date, no research has examined whether VPK classrooms servicing low-SES families are equipped with the materials/manipulatives necessary to teach numeracy/spatial skill. The Pre-Kindergarten Numeracy and Spatial Environment Survey was created to examine the frequency of access to and use of numeracy and spatial materials and manipulatives in VPK classrooms. This 69-item survey was completed by the lead educator from a sample of over 60 pre-k classrooms. We predicted that schools servicing low-SES children would have decreased access to, as well as usage of numeracy/spatial materials/manipulatives in classrooms when compared to schools servicing high-SES families. Preliminary data are presented.

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(1059)

Spatial Aging and Memory Load on the Updating of Multiple Target Arrays. CHRISTOPHER R. BENNETT and NICHOLAS A. GIUDICE, *University of Maine*, ROBERTA L. KLATZKY, *Carnegie Mellon University*, JACK M. LOOMIS, *University of California, Santa Barbara*—People can simultaneously update their self-position relative to multiple locations when walking without vision, but it is unknown how performance changes across the lifespan. Here, two participant groups (younger: 20-40 years and older: 60-80 years) viewed 1, 3, or 6 targets (colored lights) on the floor of a dimly lit room. Without vision, either immediately after viewing (direct) or after a period of forward walking (indirect), they walked to a target designated by its color. For younger participants, neither the accuracy nor the precision of walked distance relative to the target location showed a significant effect for number of targets or direct vs. indirect walking, indicating that six targets were updated as effectively as one. Older participant data is in-progress but we predict they will exhibit significant degradation for both walking

accuracy and precision compared to younger participants and that their updating performance will decline as target number increases.

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(1060)

Biases in the Perception of 3D Forms From 2D Cross-Sectional Views. KRISTIN M. GAGNIER and THOMAS F. SHIPLEY, *Temple University*—Estimating how regions of objects extend in 3-dimensions from a single 2D view is an unconstrained problem. We asked whether observers recognize this ambiguity in visual completion of solid volumes? Participants viewed pictures of a single side of 16 common objects (wood, rocks, food). In Experiment 1 (N=30), participants reported whether a region appeared “on the surface” or “extended in,” and indicated how it extended. In Experiment 2 (N=19) participants were explicitly given the option of saying the answer is unknowable. Despite the inherent ambiguity, participants perceived 3D forms; in Experiment 1 “surface” was chosen on only 26% of the trials and in Experiment 2 participants reported the answer was unknowable on only 17% of the trials. Results show a bias to estimate the angle of extension in the 80-100° range. Results suggest constraints on models of visual completion and have implications for science education that requires penetrative visualizations.

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(1061)

The Effects of Visual and Auditory Beacons on Human Reorientation by Enclosure Geometry. SAMUEL P. POLICE and KENT D. BODILY, *Georgia Southern University*—After learning to find a goal near a distinctive beacon in a rectangular room, humans primarily search in the correct and opposite corners when the beacon is removed. This ubiquitous finding suggests that incidental learning of the enclosure shape occurred. The purpose of the present study was to investigate whether the stimulus modality of beacons influences subsequent reorientation in their absence. During training, each corner of a rectangular enclosure contained a distinct visual and white-noise auditory beacon (Visual Group), or a white visual and distinct auditory beacon (Auditory Group), one of which reliably marked the goal location. During testing, white visual and white-noise auditory beacons were placed in each corner of the enclosure for both groups. Where participants searched was compared between groups. Results and implications will be discussed.

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(1062)

Course Relies on Idiopathic Cue Whereas Heading Relies on Visual Cue in Human Path Integration. WEIMIN MOU and LEI ZHANG, *University of Alberta*—This project demonstrated a method of dissociating position estimation and heading estimation during path integration and also examined the roles of idithetic cues and visual cues in update position and heading during path integration. Participants learned four objects around their body and then moved through two legs. Participants pointed to the origin and the

objects. Participants' testing position and testing heading were estimated with the errors in pointing to the origin and other objects. Experiment 1 showed that the angular error of position estimation was comparable between the participants who physically walked the path and who physically walked the path but were disoriented afterwards whereas the error of heading estimation was smaller in the former group, verifying the validity of the method. Experiment 2 showed that participants' heading relies on visual cue but their walking direction relies on idiothetic cue when a conflicting visual orientation cue was presented during test.

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(1063)

Understanding Complex Graphs: Domain Knowledge Compensates for Diagrammatic Reasoning Skills.

ANGELA BRUNSTEIN, *Royal College of Surgeons in Ireland - Bahrain*, JOERG BRUNSTEIN, *Carnegie Mellon University in Qatar*, BAKR NOUR, *Weill Cornell Medical College in Qatar*, ANAM WAHEED, *Texas A&M University at Qatar*—Physicians encounter difficulties understanding complex graphs associated with risk communication. Some of these difficulties might be due diagrammatic literacy issues. For exploring this explanation, 85 premedical and medical students performed one medical and one economy diagrammatic reasoning tasks in a web-survey. For the medical tasks, medical students outperformed pre-medical students. In addition, performance for the most complex task was better than for the simpler tasks. In contrast, performance for the unrelated diagrammatic task was poor for all students. This indicates that medical knowledge and temporal aspects of a procedure can compensate for missing spatial knowledge resulting in better performance for the complex task. However, these do not generalize to understanding diagrams from other domains. This implies diagrammatic reasoning skills acquired in medical school tend to be task-specific and might explain observed difficulties for understanding and communicating graphically represented risk information.

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(1064)

A Spatial-Search Task for Investigating Conditional Relations With Pigeons and Humans. KENNETH J. LEISING, CHAD M. RUPRECHT, JOSH E. WOLF and NINA QUINTANA, *Texas Christian University* (Sponsored by Aaron Blaisdell)—Discriminative stimuli may be structured in a hierarchical fashion, thus requiring knowledge of the conditional relations between them to emit the correct response. In this task, we investigated higher order modulation of operant responding that involved a spatial relation. Humans and pigeons were presented with a colored background display followed a few seconds later by a landmark (a patterned square) presented at one of eight linearly arranged response locations. The landmark signaled which of the remaining locations was designated as the goal but only on trials in which the landmark was preceded by a colored display. Transfer tests in both subjects revealed modulation by the colored display and transfer to other landmarks trained with a different colored display. We also report some differences between

species on transfer tests with novel stimuli. The results will be discussed in terms of the importance of conditional relations in the spatial domain.

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• **COGNITIVE SKILL ACQUISITION** •

(1065)

Video Game Expertise and the Enhancement of Spatial Perception in the Face of Uncertainty. ERIC GREENLEE and DAVID B. BOLES, *The University of Alabama*—Our study expands upon previous research that has demonstrated transfer of training from action video games (AVGs) to laboratory tasks that require visual selective attention (Green, Li & Bavelier, 2009 for review). Here, the potential of AVG training is further examined by measuring visual-spatial and auditory-spatial discrimination performance under varying conditions of stimulus uncertainty. Expert AVG players and novices completed a visual and an auditory discrimination task, and accuracy and reaction times were recorded. Expert participants were expected to possess superior discrimination skills overall and be less affected by stimulus ambiguity. Preliminary data analysis of 46 participants (23 experts, 23 novices) revealed that experts reacted faster during the visual discrimination task than during the auditory discrimination task, whereas novices did not. This interaction suggests that AVG training may result in enhancement of spatial discrimination skills selectively in the visual modality, while spatial auditory processes are unaffected.

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(1066)

The Effect of Compensation on Transfer Following Dual n-Back Training. BENJAMIN KATZ, *University of Michigan*, SUSANNE JAEGGI and MARTIN BUSCHKUEHL, *University of Maryland, College Park*, PRITI SHAH and JOHN JONIDES, *University of Michigan*—The outcome of working memory training is a topic of intense debate. A salient question is what factors determine transfer gains to non-trained abilities following a working memory intervention. One possible determinant of training and transfer gain is the degree to which participants are intrinsically or extrinsically motivated. A review of working memory training studies suggests that when participants are monetarily compensated transfer effects are smaller relative to studies when participants are not paid. We tested whether payment for participation (extrinsic motivation) affects training and transfer. Both paid and unpaid training groups improved on transfer measures compared to an active control group, but payment had no effect on transfer. However, paid participants who self-reported being intrinsically motivated showed steeper training gains than those who did not. We conclude that payment may affect training and transfer performance, although a variety of additional factors contribute to the outcome of any individual study.

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(1067)

Counting Performance in Background Noise Only Affects High Load Tasks. ROBERT LJUNG, *University of Gävle*—The present paper examined the effect of different background sounds on counting performance. Two experiments were carried out to test how counting performance was affected by three background noise conditions: spoken numbers, names of occupations and a silent control condition. The hypothesis was that the condition with spoken number noise should have strongest negative effect on counting performance. The results from experiment one gave no evidence to the hypothesis, no significant difference between conditions was found. Experiment two used a more complex counting. The results in experiment two showed that spoken number noise had largest effect on counting performance, and performance in the control condition was better than all background sound conditions.

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(1068)

Basic Math Performance Relates to Math Anxiety in Two-Year College Students. LISA A. SPRUTE and SIAN L. BEILock, *The University of Chicago*—Students attending two-year community colleges often report having math anxiety (Yeager, 2012). Further, they tend to have poor basic math abilities, like comparing exact numbers or approximate sets, which are important for predicting math achievement (Halberda et al., 2008; Holloway and Ansari, 2009). Here we ask how math anxiety relates to basic symbolic and nonsymbolic numerical processing (i.e., indicating the larger number of either digits or dot arrays, respectively) in two-year college students (N=75). We regressed math anxiety (using the Abbreviated Math Anxiety Scale, Hopko et al., 2003) on nonsymbolic numerical ability (Weber-fraction) and symbolic numerical ability (ratio effects for accuracy and response time). Both the Weber-fraction ($\beta=.269$, $t=2.37$, $p=.021$) and symbolic ratio effect for response time ($\beta=.276$, $t=2.47$, $p=.016$) were related to math anxiety; those with higher math anxiety showed poorer basic math skills. Thus, to increase success in basic math courses at two-year colleges, attention may need to be devoted to both reducing math anxiety and increasing basic numerical proficiency.

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(1069)

Individual Differences in Subitizing, Approximate Number and Symbolic Number Systems as Predictors of Math Outcomes. CARLA C. SOWINSKI and JO-ANNE LEFEVRE, *Carleton University*—In the current study, we will examine individual differences in basic numerical processes as differential predictors of math outcomes. Math outcomes include speeded addition, subtraction, and multiplication, as well as a Brief Math Assessment developed by Steiner and Ashcraft (2012). The basic numerical processes of interest are a) subitizing latencies, b) large quantity discrimination accuracy (thought to assess individual differences in approximate number system processes) and c) symbolic number comparison latencies. Individual differences in symbolic magnitude comparison latencies were the strongest predictor

of addition and subtraction performance. However, individual differences in subitizing latencies were the strongest predictor of both multiplication fluency and performance on the Brief Math Assessment. The results will be discussed within the context of existing theories of math skill development which place differential emphasis on the roles of the subitizing, the approximate number, and symbolic number systems.

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(1070)

Decimals Are Not Processed Automatically, but the Decimal Point Is. ARAVA Y. KALLAI and JOSEPH TZELGOV, *Ben-Gurion University of the Negev*—Common fractions have been found to be processed intentionally but not automatically. However, decimals are more similar to natural numbers in their form and thus might be better candidates for automatic processing by educated adults. In this study, the automatic processing of decimals by college students was investigated in three experiments. When decimals were presented in a familiar form (e.g., 0.3, 0.05), the length of the stimuli (i.e., the number of digits) was processed automatically but not the fractional value. When controlling for the number of digits, using the place-value task (e.g., 00.3, 0.05), decimals showed no congruency effect in either a numerical comparison task or a physical comparison task. Under the same conditions, natural numbers did show a congruency effect. We conclude that decimals are not processed automatically. These results support the claim that numerical primitives are culture dependent, and correspond to a very limited set that include the digits and some structural markers.

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(1071)

Overnight Learning in First-Degree Relatives of Those Diagnosed With Schizophrenia, Bipolar Disorder, Major Depressive Disorder, and Attention Deficit Hyper-Activity Disorder. ANSLEY FLANAGAN and KATHERINE M. MATHIS, *Bates College* (Sponsored by Todd Kahan)—Overnight learning involves participants learning a task, sleeping for a night, and returning to the lab 24 hours later to perform the task again. Individuals with impaired sleep, such as patients diagnosed with various mental disorders, show less overnight consolidation than healthy people. In the current study, overnight learning in first-degree relatives (siblings, offspring, or parents) of those diagnosed with ADHD, MDD, bipolar disorder, or schizophrenia were assessed along with controls. To target both procedural and verbal overnight learning, the finger-tapping motor sequence task and the paired-associates verbal memory test was administered to 45 participants on 2 consecutive days. Findings indicated significant overnight learning across groups within the procedural learning task, but no significant differences in overnight consolidation between groups. The current study also found first-degree relatives to have significantly poorer sleep quality than healthy controls according to scores on the Pittsburgh Sleep Quality Index.

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(1072)

Decreasing the Costs of Interruptions: Interruption Recovery as a Trainable and Transferable Skill. WINSTON E. JONES and JARROD MOSS, *Mississippi State University*—The ability to handle interruptions is an important aspect of multitasking skill. Although evidence has suggested that time to recover from interruptions improves after greater interruption exposure, prior studies have not examined whether this improvement is specific to the task or whether it generalizes to handling interruptions in other tasks. Experiment 1 tested the hypothesis that interruption recovery is a trainable skill that generalizes to other tasks. Results from the training-transfer paradigm indicated that interruption recovery times were significantly lower during transfer to a novel task, suggesting that interruption recovery improvements are not task-specific. Experiment 2 built on this finding by testing the hypothesis that recovering from interruptions from the environment (external interruptions) and recovering from self-initiated interruptions (internal interruptions) require distinct skills that will not transfer. The results of the second experiment did not support the second hypothesis, suggesting that external and internal interruption recovery share a common skill.

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• EXPLICIT MEMORY I •

(1073)

On the Contribution of Object Identification to Object Recognition: Recollection May Require Identification, but Familiarity Does Not. MOSES M. LANGLEY, *Minnesota State University*—Zimmer and Ecker's (2010) neurocognitive model of object memory proposes familiarity, recollection, and perceptual priming are based on distinct representations. In their model, object tokens (object-file-remnant memory traces of intra-item features) support familiarity. Episodic tokens (spatiotemporal context) support recollection and type traces (3-dimensional structure) support priming. Their model emphasizes the role of encoding processes, like those involved in identification, in the formation of object tokens. It follows that subsequent recognition-familiarity would depend on the extent to which object identification processes succeeded during initial encoding. Using behavioral and electrophysiological measures, the present study demonstrated that successful perceptual closure (N250) during encoding predicted subsequent memory, and the degree of successful object-model selection (N350) predicted whether subsequent memory was based on recollection+familiarity (left-parietal old/new effect + FN400) or familiarity alone (FN400). It was also found that even when object identification failed during encoding, objects during retrieval could still be recognized on familiarity alone.

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(1074)

Evidence for Object and Context Binding in Episodic Memory. STEPHANIE MARTIN and SEAN M. LANE, *Louisiana State University*—To accurately recall details of an event you must bind together features, objects and context at encoding into an episodic memory representation (e.g., Johnson, 1983). In two experiments, we examined what type of information is bound together (object-to-object, object-to-context) into a memory representation and how attention may influence this process. Participants viewed a series of scenes and their attention was drawn to some objects (focus of attention – FOA) but not others. At test, they attempted to identify previously seen objects that were cued by objects-only, context-only, or a blurred context. Exp. 1 provided evidence of object-object binding when the objects used as cues and targets had been the FOA at encoding. Exp. 2 revealed evidence of object-context binding, in that context cues enhanced memory for target objects whether or not the objects had been the FOA at encoding. Altogether, the studies provide strong evidence of binding in episodic memory.

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(1075)

The Representation of Shape and Colour in Object Memory: Evidence From Retrieval-Induced Forgetting. KATE E. WILLIAMS and IRENE REPPA, *Swansea University*—Learning new information may require the temporary forgetting of related information in order to reduce competition in memory - a phenomenon known as retrieval-induced forgetting (RIF) (e.g., Anderson, Bjork, & Bjork, 1994). Five experiments utilised RIF as an implicit measure to discover the perceptual representations mediating familiar and novel object recognition. Participants studied familiar and novel objects. For each practiced (Rp+) object there were four different unpracticed (Rp-) objects: those that shared the same shape only, the same colour only, both shape and colour, or neither property with the Rp+ objects. In a subsequent old/new recognition test, there was significant RIF for objects sharing shape and those sharing colour with the Rp+ objects. The same pattern of results was found even when no distractor objects were used in the test phase. The results suggest that colour is represented in familiar and novel object memory and guides object recognition.

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(1076)

Does Reinstating the Study Context Eliminate Retrieval-Induced Forgetting? DOROTHY R. BUCHLI and ROBERT A. BJORK, *University of California, Los Angeles*, BENJAMIN C. STORM, *University of California, Santa Cruz*—The finding that retrieving information impairs recall of related information—retrieval-induced forgetting (RIF)—has been attributed, by ourselves and others, to inhibitory mechanisms. Recently, however, Jonker, MacLeod, and Seli (2012) proposed an alternate account: (a) that the study and retrieval-practice phases are two disparate contexts; (b) that participants search the practice phase first; and (c) that impairment of RP- items reflects their absence from the retrieval-practice context. To test this contextual-cuing account, we asked participants to



recall only those items that were studied and not practiced—that is, to recall only Nrp and Rp- items on the final category-cued recall test. Across two experiments, significant RIF was still observed despite participants being directed to access the study phase and avoid accessing the practice phase. These results are difficult to reconcile with the contextual-cuing account without additional assumptions, such as that the participants accessed the practice phase in order to exclude Rp+ items from being recalled.

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(1077)

The Inability to Ignore Misleading Feedback: Evidence for Implicit Recognition Criterion Learning. JUSTIN C. COX and IAN G. DOBBINS, *Washington University in St. Louis*—Recognition memory decision criteria are often assumed to be strategically controlled. However, prior work has demonstrated robust criterion shifts following misleading false positive feedback (FPF), when one class of recognition error was probabilistically reinforced (e.g., receiving ‘CORRECT’ after 70% of false alarms; Han & Dobbins, 2008). Critically, observers appeared unaware of their shift in reaction to the FPF, suggesting a possibly implicit form of criterion regulation linked to reinforcement probabilities. We replicated and extended these results by demonstrating that observers are unable to inhibit the effects of FPF when explicitly instructed to do so (‘the feedback provided may impair your test performance; please try to IGNORE the feedback as best you can and do not let it affect your responding’). Further, we demonstrated that items that received FPF are subsequently remembered better than items that received veridical error feedback. We relate these findings to results from the reinforcement learning literature.

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(1078)

The Effect of Presentation Modality on Output Interference. MELISSA PRINCE and AMY H. CRISS, *Syracuse University*, KENNETH J. MALMBERG, *University of South Florida*, SHANTAI PECKOO, *Syracuse University*—Output interference (OI) is the finding that accuracy decreases across test trials. Malmberg, Criss, Gangwani & Shiffrin (2012) demonstrated release from OI in a study-test recognition paradigm when the nature of the items changes during testing (e.g., switching from one block of semantically related items to another). This release from OI is consistent with models of memory that propose interference arises due to the similarity between items. An alternate class of models propose that interference arises from source or context confusions. In this experiment we examine whether a release occurs using a manipulation common for assessing memory for context: presentation modality (e.g., auditory, pictorial, and visual). If OI is driven by item-noise, then substantial OI and no release from OI is predicted when test items are blocked by modality. If however, OI is driven by changing context at test, then a complete release from OI is predicted when modality changes at test. Results and implications for both classes of models are discussed.

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(1079)

A Comparison of Three Perceptual Fluency Manipulations. MEREDITH LANSKA and DEANNE L. WESTERMAN, *Binghamton University, SUNY*—On a recognition memory test, fluently processed items are more likely to be given an “old” response compared to less fluent items. This study compared three manipulations of perceptual fluency that have been reported in the literature: perceptual priming, typography, and clarity. Experiment 1 examined whether each of these manipulations would elicit the same degree of facilitation (fluency) on a lexical decision task. The results showed that typography and clarity changes produced more facilitation than perceptual priming. Experiment 2 compared the impact of these manipulations on recognition memory responses. The results were opposite to what was found in Experiment 1; although perceptual priming showed the smallest amount of facilitation on lexical decision, it had the largest effect on recognition memory. The results suggest that the magnitude of fluency effects in recognition may depend more on the salience of the manipulation than the amount of fluency engendered.

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(1080)

The Effect (?) of Age on Incorporating External Information With Memory. ALEX KONKEL, DIANA SELMECZY and IAN G. DOBBINS, *Washington University in St. Louis*—Ideally, memory judgments should be sensitive to contextual cues, including the recommendations of others. Additionally, the ability to judiciously incorporate recommendations may become critical as we age and core memory abilities decline. Across two experiments we used a cued recognition paradigm to examine how well older adults (compared to college-aged adults) incorporate external cues that forecast the likely old/new status of each recognition probe. Experiment 1 demonstrated similar cue accuracy benefits for younger and older adults. Experiment 2 confirmed the similar accuracy benefit in older adults across a range of external cue validities. Although there was evidence of working memory and executive control decline in our old adult sample, they were nonetheless equally able to integrate external cues into their memory reports, suggesting that judicious weighting of environmental cues was not dependent on either ability and declines minimally if at all with age.

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(1081)

A Brief Meditation Reduces False Alarms to Non-Living Lures. ANGELICA SZANI and KATHERINE BOWERS, *Seton Hall University*, LUCIENNE PEREIRA-PASARIN, *Caldwell College*, MARIANNE E. LLOYD, *Seton Hall University*—Previous research on the effects of meditation on memory has often used specialized populations or long term meditation training. The present experiment used a 3-minute mindfulness meditation between the encoding and test phases of an experiment. Some participants were told the meditation would reduce stress and others were told it would improve memory performance. The stimuli of interest in the study were a set of 24 living and non-living words matched

on a variety of other dimensions as discussed by Nairne et al. (in press). The results of the experiment demonstrated two things. First, there was an advantage in hit rate for the targets that were living words, conceptually replicating the recall data of Nairne et al. Second, the false alarm rate to non-living words were significantly lower in the two meditation conditions. An item analysis showed that the reduction was not due to a reduced false alarm rate of a particular subset of the stimuli. The results of the study are discussed in the context of the adaptive memory framework and research on the effects of meditation on cognitive processes.

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(1082)

Animacy Effects Persist in Foreign-Language Learning. JOSHUA E. VANARSDALL, JAMES S. NAIRNE and MINDI COGDILL, *Purdue University*, JOSEFA N.S. PANDEIRADA, *University of Aveiro*—Recent evidence from our lab suggests that animate stimuli are remembered better than matched inanimate stimuli (Nairne, VanArsdall, Pandeirada, Cogdill, & LeBreton, in press; VanArsdall, Nairne, Pandeirada, & Blunt, 2013). Two experiments tested whether this animacy effect persists in paired-associate learning. Experiment 1 randomly paired Swahili words with matched animate and inanimate English words and replicated the basic animacy effect in paired-associate learning. Concerned that the effect may be due to enhanced organizational processing (that animates presented a better category to learn), Experiment 2 used animate and inanimate English words from two equated categorized lists (four-legged animals and furniture). Once again, an advantage in paired-associate learning was found for animate words. These results provide evidence against an organizational account of the animacy effect, and also have important educational implications for foreign language vocabulary learning.

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(1083)

Dissociation Between Negative and Positive Emotion on Source Memory Retrieval. GRAHAM MACKENZIE and DAVID I. DONALDSON, *University of Stirling*—Evidence for memory impairment exists despite widespread belief that memory is enhanced by emotion. Here we test predictions inspired by object-based binding theory (Mather, 2007), which states that memory enhancement or impairment depends on the nature of the information to be retrieved. We investigated emotional memory in the context of source retrieval, using images of scenes that were negative, neutral or positive in valence. At study each scene was paired with a colour and during retrieval participants reported the source colour for recognized scenes. Critically, we isolated effects of valence by equating stimulus arousal across conditions. In experiment one colour borders surrounded scenes at study: memory impairment was found for both negative and positive scenes. Experiment two used colours superimposed over scenes at study: valence affected source retrieval, with memory inhibition for negative scenes only. These findings show that emotion can impair memory for intrinsic and extrinsic source information. Moreover, the observation that the emotional

valence of an episodic memory can influence whether source memory impairment occurs challenges current theories of emotional memory.

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(1084)

Effects of Emotional Arousal on Judgments of Frequency and Continuous Recognition. TANYA KARAM-ZANDERS and SEAN LANE, *Louisiana State University*—Negatively arousing information does not appear to benefit from repetition as much as neutral information (e.g., Karam-Zanders & Lane, in preparation; Novak & Mather, 2009). One possible explanation is that the degree of recursive reminding that occurs during re-presentation (Hintzman, 2004) is stronger for emotional than neutral stimuli, increasing internally directed attention and reducing attention to the external stimulus. In Experiment 1, participants viewed emotional and neutral pictures 0-3 times and made judgments of frequency (JoFs) at test. JoFs were higher and more similar to actual frequency for emotional than for neutral pictures. However, it is possible the higher estimates were due to “inflation” rather than improved accuracy. In Experiment 2, performance on a continuous recognition test revealed increased accuracy for emotional stimuli and a similar pattern of false alarms across stimuli type, consistent with the latter interpretation. Overall, the results are consistent with a recursive reminding explanation.

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(1085)

Directed Forgetting of Emotionally Arousing Stimuli and Divided Attention. HAJIME OTANI, OLESYA SENKOVA, ABBY R. KNOLL, TYLER FOSTER and TERRY M. LIBKUMAN, *Central Michigan University*—The directed forgetting (DF) effect occurs when participants are instructed to remember some items and forget the other items. The present experiment investigated the reason that the DF effect is smaller with negatively arousing stimuli than with neutral stimuli. One possibility is that participants engage in post stimulus elaboration of negatively arousing stimuli even when they are instructed to forget these stimuli. Participants were presented with negatively arousing, positively arousing, and neutral pictures. Half the pictures were followed by a remember instruction whereas the other half were followed by a forget instruction. Further, half the participants were asked to perform a divided attention task that was designed to prevent post stimulus elaboration. The results showed that the DF effect was smaller for the negatively arousing pictures than for the positively arousing or neutral pictures in the full and divided attention conditions. Therefore, the results did not support post stimulus elaboration but instead supported preattentive processing.

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(1086)

Recall Dynamics After Survival Processing. JAMES S. NAIRNE, MINDI COGDILL and MELISSA LEHMAN, *Purdue University*—Processing information for survival relevance produces a robust memory advantage. Two



experiments assessed possible mechanisms responsible for the survival processing advantage in free recall. Extant models of free recall often rely on two explanatory mechanisms—a temporal factor, which measures the extent of temporal clustering, and a semantic factor, which taps semantic relatedness. Measures of temporal and semantic clustering were obtained after survival processing, moving, and pleasantness controls. Although a robust recall advantage was found for survival processing, little evidence for temporal or semantic clustering was obtained, and there were no differences among the conditions. An analysis of output clustering based on scenario rating also failed to explain recall differences. Our results suggest that temporal and semantic clustering play little role in recall when retention is tested after incidental learning. Our results also help rule out common proximate mechanisms as determinants of survival processing advantages.

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(1087)

Featural Description Facilitates Face Memory Differently Than Trait Description. DAWN R. WEATHERFORD, *Arkansas State University*, CURT A. CARLSON and AMANDA TUCKER, *Texas A&M University-Commerce*—Describing a face can benefit its subsequent recognition, but this Verbal Facilitation Effect is not well understood. Although some studies attribute the benefit exclusively to face learning, others suggest that featural and trait verbalization might differentially affect recollection and familiarity. Across two study blocks, participants viewed a series of faces and performed one of two post-stimulus tasks. In one block, participants either described the features or described the traits of each face; in the other block, participants performed a control task. The Process Dissociation Procedure revealed that both featural and trait description increased familiarity; however, only featural description increased recollection over control. In addition, number of featural descriptors was positively related to confidence and number of trait descriptors was positively related to source accuracy. These results suggest that featural and trait description facilitate memory in different ways, despite equivalent memory performance on some tasks.

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(1088)

Examining the Own-Race Bias Using a Value-Based Remembering Approach. SARAH J. TURNER and MATTHEW G. RHODES, *Colorado State University*—Previous research has shown that individuals are better able to recognize faces of their own race compared to faces of another race, a finding termed the own-race bias (ORB). The ORB may reflect greater expertise with own-race faces or, according to social-categorization accounts, less motivation to distinguish between other-race compared with own-race faces. In the current experiments, participants studied own- and other-race faces that were associated with high and low point values indicating how important the face was to remember. Experiment 1 demonstrated that although the ORB was equally prevalent for high- and low-value faces, recognition increased for high-value, own-race faces. In Experiment 2, learners self-paced their study, allocating more study time to

high-value items, resulting in a decreased ORB for high-value faces. Overall, our results suggest that under some conditions social-categorization plays a strong role in the ORB; however, experience with own-race faces also contributes to the effect.

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(1089)

Interference With Face Memory Under Divided Attention at Retrieval Depends on Visual Processing Demands of Concurrent Tasks. JEFFREY D. WAMMES and MYRA A. FERNANDES, *University of Waterloo*—Participants studied faces under full attention (FA) and subsequently performed recognition under either FA or divided attention (DA) conditions. Under DA, face recognition judgments occurred while simultaneously making either featural- or configural-based decisions about a concurrently presented face. Under 'featural DA', participants indicated whether the eyes on the distracting face were light or dark, and under 'configural DA', whether the nose was closer to the eyes than to the mouth. Face recognition was lower in both DA conditions relative to FA. The distracting faces under 'featural DA' were then inverted to prevent configural-, and better isolate featural-based processing. In this condition, face memory was more immune to interference relative to the configural DA condition. Results show larger face memory interference when the distracting task requires configural than featural processing, and that the magnitude of interference under DA at retrieval depends on overlap in processing demands of the concurrent tasks.

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(1090)

Creativity and Unconscious Plagiarism. WILLIAM G. WENZEL, RICHARD J. GERRIG and SUPARNA RAJARAM, *Stony Brook University*—We suggest that people's level of creativity affects the extent to which they mistakenly recall creative products as their own. To test this hypothesis, we performed a study of unconscious plagiarism. In the first phase of the study, participants generated alternate uses for a newspaper and wrote fortunes for a fortune cookie company. Participants provided their own products and also viewed "example" uses for a newspaper and fortunes. We assessed participants' creative ability and established the relative creativity of particular alternate uses and fortunes. In the second phase (two days later), participants attempted to recall their own products (recall-own task). Next, they generated new alternate uses and fortunes (generate-new task). People unconsciously plagiarized example tokens during both the recall-own and generate-new tasks. Confirming our predictions, we found that people's own creativity affected both which products they unconsciously plagiarized and the circumstances (recall-own vs. generate-new) in which they did so.

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(1091)

Investigating the Effects of Cue Familiarity and Modality on Imagined and Remembered Events. JESSICA ROBIN, JORDANA WYNN and MORRIS MOSCOVITCH, *Rotman Research Institute*—More familiar spatial contexts are

associated with more detailed and vivid autobiographical memories and imagined events, possibly owing to the dependence of episodic memory on scene construction (Hassabis & Maguire, 2007). We used a novel paradigm to compare memory for imagined events based on cues varying in both familiarity and modality (place vs. person). Participants read and visualized short stories either involving a person or place cue of high or low familiarity to them. At encoding, more familiar cues resulted in more vivid imagining of the events, with no difference between place and person cues. At retrieval, more events based on high, rather than low, familiarity cues were remembered, and in more detail. Participants also remembered marginally more events based on spatial cues than those based on person cues. However, at retrieval, participants also consistently tended to add a spatial context to imagined events based on person cues. These results demonstrate that the familiarity of context plays an important role in the experience and recall of events, and suggest that spatial context may drive this effect via its central role in episodic memory.

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(1092)

Does Source-Constrained Retrieval Influence the Encoding of New Information for Action Events? TETSUYA FUJITA and DAISUKE CHO, *Hosei University*—Jacoby, Shimizu, Daniels, and Rhodes (2005) showed that new words presented as foils among a list of old words that had been deeply encoded were themselves subsequently better recognized than new words presented as foils among a list of old words that had been shallowly encoded. In Experiment 1, by using action sentences (instructions; e.g., “pinch your nose”) without performing the action, we demonstrated that the effect is robust and that it generalizes, also occurring with a different type of material. In Experiment 2, by substituting an enactment manipulation versus a non-enactment manipulation for the levels-of-processing manipulation, we demonstrated the enactment effect on old items, but not on foils. In Experiment 3, we adapted a manipulation of LOP for action sentences with demonstrating the action, however, we did not find the effect on foils. These findings suggest that the effect of source constrained retrieval depends on not only the manipulation of encoding, but also the distinctiveness of the materials.

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• WORKING MEMORY I •

(1093)

Evidence for Intrusion-Based Interference in Short-Term Memory. TYLER BANCROFT, PHILIP SERVOS and WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—Theoretical treatments of interference in short-term and working memory have suggested that the presentation of irrelevant stimuli during working or short-term memory tasks can reduce performance by intruding into or overwriting the contents of memory (Lange & Oberhauer, 2005; Nairne,

1990). We provide direct experimental support for this class of theories by presenting an irrelevant “distractor” stimulus during the maintenance period of a vibrotactile working memory task, and demonstrating that the salient property of the distractor was integrated into the stored contents of memory. Further support for this position comes from the application of a neurocomputational model of prefrontal cortex to our data, which was able to fit over 97% of variance in the experimental data.

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(1094)

An Interference Model of Visual Working Memory. HSUAN-YU LIN and KLAUS OBERAUER, *University of Zurich*—In visual-working memory, the nature of working memory capacity has been debated recently. We propose that the capacity limit arises from the interference between items. We developed a mathematical model, the Generic Memory Model (GMM), to implement this theory. In GMM, decisions about which response option to choose in a recall experiment are based on the relative evidence generated internally for each response option. One major source of evidence is context-dependent activation of items arising at retrieval in response to activating a context cue (e.g., a location) bound to that item. Interference is modeled by retrieving non-target items because of overlapping in the representation of context cues. We ran a replication of experiment testing recall of visual stimuli (Zhang & Luck, 2008) and a similar version with pre-cue. We fit GMM alongside other models to the data. The result shows that GMM model is the best account of the data. Email: Klaus Oberauer, k.oberauer@psychologie.uzh.ch

(1095)

Directed Forgetting Reduces Proactive Interference in Working Memory. SARA B. FESTINI and PATRICIA A. REUTER-LORENZ, *University of Michigan*—Proactive interference (PI) occurs when previously learned information interferes with new learning. In a working memory task, PI induces longer response times to recent negative probes compared to new probes, presumably because the recent probe’s familiarity induces conflict. Warnings, longer inter-trial-intervals, and increased contextual salience can reduce but not eliminate PI, suggesting that cognitive control over PI is limited. Here we test whether intentional forgetting performed during working memory can reduce the magnitude of PI. Participants performed a working memory task with directed forgetting instructions and the occasional presentation of recent probes. Surprise long-term memory testing indicated better memory for to-be-remembered than to-be-forgotten items, documenting the classic directed forgetting effect. Critically, in working memory, PI was virtually eliminated for recent probes from prior to-be-forgotten lists compared to recent probes from prior to-be-remembered lists. Thus, cognitive control, when executed via directed forgetting, can reduce the adverse and otherwise persistent interference from familiarity, an effect that we attribute to attenuated memory representations of to-be-forgotten items.

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(1096)

Release From Proactive Interference With Emotional and Neutral Semantic Shifts. HUGH KNICKERBOCKER and JEANETTE ALTARRIBA, *University at Albany, SUNY*—Release from proactive interference was compared when shifting from emotion to emotion-laden words, emotion-laden to emotion words, and neutral to emotion or emotion-laden words. On the first three trials, word category was constant (either emotion, emotion-laden, or neutral). On the fourth trial, word category was shifted as described above. Emotion and emotion-laden words were matched in valence and arousal (and differed from neutral words) using ANEW (Bradley & Lang, 1999). Word stimuli were presented using a Brown-Peterson task where participants viewed four words per trial (300 milliseconds each) followed by a retention interval (RI) with a distracting task (counting backwards from a random number) across a series of trials. Participants then completed an immediate recall task after each RI. The data revealed significant release from PI for all four types of semantic shifts. Processing differences between emotion and emotion-laden words are explored.

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(1097)

Oscillatory Brain Activity in an Auditory Short-Term Memory Task: Evidence From Electroencephalography. SOPHIE NOLDEN, CHRISTINE LEFEBVRE, PATRICK BERMUDEZ, STEPHAN GRIMAUULT and PIERRE JOLICOEUR, *University of Montreal*—Auditory short-term memory was investigated with electroencephalography (EEG) oscillatory activity. Participants retained memory tones for 2000 ms. They then indicated if probe tones were the same as memory tones or different. Data were band-pass filtered in the alpha (8-12 Hz) or beta (18-28 Hz) frequency band and subsequently submitted to a Hilbert transform calculating the envelope of the signal amplitude. From 200 ms to 500 ms after probe onset at electrode site Cz, the amplitude of the signal was significantly greater for 'different' than for 'same' probes in the alpha band and decreased more for two retained tones than for one retained tone in the beta band. There were neither effects of memory load in the alpha band nor effects of probe type in the beta band. Thus, beta band activity might be related to access to retained items and alpha band activity to the result of the comparison process.

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(1098)

Non-Invasive Brain Stimulation Enhances Learning in an Adaptive Complex Span Task and Near Transfer Outcomes. LAUREN L. RICHMOND, *Temple University*, DAVID A. WOLK, *University of Pennsylvania*, INGRID R. OLSON, *Temple University*—An emerging body of research shows that working memory (WM) can be enhanced with practice. However, whether these effects transfer to other tasks is more controversial. We hypothesized that transcranial direct current stimulation (tDCS) might enhance outcomes following from WM training. tDCS has been shown to influence WM performance in a single session (e.g., Fregni et al., 2005, Marshall et al., 2005), but the extent to which tDCS

can influence training and transfer outcomes has yet to be explored. To this end, healthy young adults completed a pretest battery tapping WM, sustained attention, and inhibition. During the training phase, active or sham tDCS was applied to dorsolateral prefrontal cortex while participants performed an adaptive complex WM task (see Chein & Morrison, 2010; Richmond et al., 2011) over 10 sessions. The battery of tasks was administered again at completion. We also included a test-retest control group for comparison. Participants receiving active tDCS showed improved learning on the training task compared to sham. Active participants also exhibited improved transfer to other WM tasks. These data represent the first demonstration that tDCS can enhance training effects in the domain of working memory.

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(1099)

Tracing a Curve in Memory. CHRISTINE LEFEBVRE, THIBAUD AUDEVAR and PIERRE JOLICOEUR, *Université de Montréal*—EEG was recorded while subjects covertly traced a curve that disappeared after 200 ms. The starting point of the curve was on the vertical midline and it became lateralised near fixation (Early) or farther away (Late), and could end on a lateral or a midline point. Subjects could trace the curves successfully even if the curves disappeared before the task was finished (mean RT was 848 ms), and the sustained posterior, contralateral, negativity (SPCN) that is usually recorded during tracing of the lateralised portion of the curves remained after its disappearance. As in previous studies, the negativity started earlier when the curve became lateral nearer to the starting point. For the Early condition, the negativity returned to zero earlier when the curve ended on the midline compared to when it ended on a lateral point, suggesting attention disengaged from the curve once it was traced.

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(1100)

Stability of Whole Brain and Regional Network Topology Within and Between Resting and Cognitive States. JUSTYNA K. RZUCIDLO and PAIGE L. ROSEMAN, *Wake Forest University*, PAUL J. LAURIENTI, *Wake Forest University School of Medicine*, DALE DAGENBACH, *Wake Forest University*—Graph theory based analyses of fMRI data were used to explore differences between functional connectivity during resting state and while performing a working memory task in a voxel-based network. A repeated measures design assessed functional connectivity across 5 resting state and 2-back working memory sessions. For whole brain analyses, local efficiency varied significantly between rest and working memory. Region of interest analyses for the precuneus and dorsolateral prefrontal cortex found further differences in degree for both regions and local efficiency for the precuneus. Conversely, no significant differences were observed across repeated session of the same state. These findings suggest that network topology is fairly stable within individuals across time for the same state, but also fluid between states.

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(1101)

The Influence of Saccade Execution on Spatial Working Memory Precision. SEONGMIN HWANG, *University of Iowa*, STEVEN J. LUCK, *University of California, Davis*, ANDREW HOLLINGWORTH, *University of Iowa*—Several theories implicate spatial attention in the maintenance of locations in spatial working memory (SPWM). We investigated this claim in three experiments. Participants remembered the location of a small dot. In the saccade condition, they executed a saccade to a box (Exps. 1 and 2) or to empty space (Exp. 3) during the retention interval. Because saccades require an exclusive shift of attention to the target location, attention could not have been maintained at the dot location. In the fixation condition, no saccade was required, allowing continuous maintenance of attention at the dot location. Memory precision was measured by a psychophysical manipulation of position change (Exp. 1) or by the accuracy of a memory-guided saccade to the dot location (Exps. 2 & 3). A saccade to the box during retention introduced a minor but reliable decrement in precision relative to the fixation condition. However, a saccade to empty space produced no decrement, implying that the memory disruption was caused by the consolidation of the box's location into SPWM and not by the shift of attention per se. Our findings suggest that precise memory for location is not dependent on the sustained allocation of visual attention.

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(1102)

The Role of Neural Synchronization in the Integration of Perceptual Groups. DAVID E. ANDERSON, EDWARD K. VOGEL and EDWARD AWH, *University of Oregon*—We examined the neural processes that enable the integration of perceptually grouped elements. Oscillatory models of working memory (WM) assert: (1) representations are maintained through synchronization of stimulus-specific neural activity and (2) item individuation is accomplished by the temporal decoupling of these ensembles. Supporting (1), we recently demonstrated that inter-hemispheric coherence strongly predicts the precision of representations in working memory. Here we show that increasing the number of perceived items from one to two (while holding constant the number of elements in the stimulus display) leads to reductions in inter-hemispheric coherence between visually sensitive electrodes, and this predicts the associated decline in mnemonic precision. These findings suggest that neural synchronization supports the binding of the sensory population codes that represent integrated perceptual groups.

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(1103)

Working Memory Differences in Antisaccade Performance: Attentional Preparation or Goal Neglect? CHAD C. MOFFITT, *University of Utah*, KEITH A. HUTCHISON, *Montana State University* (Sponsored by Michelle Meade)—In saccade tasks, a peripheral distractor cue follows a centrally-located fixation point presented for a variable duration to prevent participants from predicting the time sequence of events. However, fixation duration could influence response

suppression, preparatory attention, and goal maintenance processes required for accurate antisaccade performance. The current experiment tested the prediction that increasing fixation duration during saccade tasks will differentially impact performance between individuals higher and lower in Working Memory Capacity (WMC). Participants completed the OSPAN task, followed by blocks of pro- and antisaccade trials with four fixation delays. Thought probes were inserted on 25% of the trials as an index of goal neglect. High-span participants outperformed low-span participants, and increased in accuracy across delay. Low spans tended to mind wander more than high spans. However, goal neglect did not mediate the effect of delay on accuracy. Finally, goal neglect impacted accuracy more for high than low spans.

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(1104)

Parallel Consolidation of Color Information Into Visual Short-Term Memory (VSTM). JAMES MILLER, MARK W. BECKER and TAOSHENG LIU, *Michigan State University*—Recent studies investigating the capacity limit of consolidating items into VSTM suggest that two orientations are consolidated in a serial manner, but two colors can be consolidated in parallel. However, it is unclear whether this apparent difference represents a true difference in the consolidation process or is an artifact of methodological differences between experiments. Here we examined the consolidation of color information using two methods used in prior orientation experiments. The stimuli were colored circles briefly displayed and masked, presented either sequentially or simultaneously, followed by a location cue indicating the target. Participants either identified the target color via button-press (Experiment 1) or reproduced the color by clicking a location on a color wheel (Experiment 2). In both experiments, overall task performance did not differ between the simultaneous and sequential conditions. A mixture model analysis of Experiment 2 data also showed a lack of difference between the sequential and simultaneous condition. These results further demonstrated that two colors can be consolidated in parallel, and suggest that different features (orientation and color) have different consolidation capacities.

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(1105)

The Development of a Short Domain-General Measure of Working Memory Capacity. FREDERICK L. OSWALD and SAMUEL T. MCABEE, *Rice University*, THOMAS S. REDICK, *Purdue University*, DAVID Z. HAMBRICK, *Michigan State University*—Working memory capacity is among the most frequently assessed individual differences in cognitive psychology and related disciplines. However, administering and taking multiple complex span measures of working memory typically requires a great deal of time. Given practical constraints (e.g., limited testing time; test-taker fatigue), a short measure of working memory capacity would benefit future research. Thus, the current study developed a short, domain-general measure of working memory capacity, sampling items from three existing automated complex span



tasks: operation, reading, and symmetry span (e.g., Redick et al., 2012). Using data from a large archival sample ($N = 4,885$), the authors conducted a series of factor analysis and cross-validation procedures that informed the development of the resulting shortened working memory measure. Overall, findings indicated good model fit to the shortened measure, and in conclusion, we suggest future research directions in terms of further psychometric development and practical use of the shortened automated complex span tasks.

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(1106)

Mood Induced and Working Memory Strategy Training. KELLY L. PEARCE, RACHEL LALE, KANDI J. TURLEY-AMES and TINA M. MIYAKE, *Idaho State University*—Working memory (WM) is an individual's ability to maintain and process relevant information (e.g., Baddeley & Hitch, 1974). Rowe, Hirsch, and Anderson (2006) suggest that mood may impact cognitive performance. Given that WM is considered to be vital to cognitive performance (e.g., Daneman & Carpenter, 1980), mood may influence WM in important ways. Considering that Turley-Ames and Whitfield (2003) found that the use of strategies consistently enhanced WM, one avenue of influence may be through altering the effectiveness of strategies. In the present study, participants were assigned randomly to either a positive, negative, or neutral mood condition in a single-session, pretest-posttest design measuring WM performance. Half of all participants were assigned randomly to a rehearsal condition. Strategy improved WM performance from pre to post differentially across mood conditions. Differences as a function of WM are discussed.

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(1107)

Differential Use of Verbal Coding by Young and Older Adults in Static and Dynamic Visual Tasks. MARK J. HORNE and IAN DEARY, *University of Edinburgh*, LOUISE BROWN, *Nottingham Trent University*, ROBERT H. LOGIE, *University of Edinburgh*—We assessed the effect of 'easy' (ETN) and 'hard' (HTN) to name visual matrix patterns on performance of younger (18-25) and older (60-75) adults on static and dynamic versions of a test of immediate visual recall, the Visual Patterns task (VPT). Using a static version of the VPT, Brown et al. (2006) found that younger and older adults both showed lower visual spans in the HTN condition than in the ETN condition. Johnson, et al. (2010) suggested that older adults might perform the VPT in a qualitatively different way than younger adults. In the static condition, both younger and older adults showed a benefit from ETN. In the dynamic condition, the ETN benefit was absent in younger adults, but present in older adults. This suggests that older adults may be more reliant on strategy use, such as verbal labelling to perform visuospatial tasks.

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(1108)

Individual Differences in the Capacity and Resolution of Visual Working Memory. MICHAEL CHOW and ANDREW R. A. CONWAY, *Princeton University*—While capacity estimates of visual short-term memory (VSTM) have been the subject of much investigation, there is still some debate with respect to the relationship between VSTM capacity and more traditional measures of working memory (WM) capacity. Also, individuals differ in VSTM capacity and in the resolution of objects maintained in VSTM, yet only a few studies have explored variation in resolution. In order to clarify the relationship between VSTM capacity, VSTM resolution, and WM capacity, we examined individual differences on a battery of VSTM tasks, complex span tasks, and general intelligence tests. Though highly related, VSTM capacity and WM capacity were best represented by separate factors, and each accounted for unique variance in general intelligence. With respect to VSTM capacity and resolution, capacity estimates were reliable across tasks but resolution estimates were not. These results suggest that VSTM and WM reflect distinct memory processes, that VSTM capacity and WM capacity reflect independent constraints on general cognitive ability, and that VSTM resolution may be task-dependent.

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(1109)

Noise-Vocoded Speech Contexts Produce the Irrelevant Sound Effect. JOSHUA DORSI, *State University of New York-New Paltz*, NAVIN VISWANATHAN, *State University of New York-New Paltz; Haskins Laboratories*, BRIAN GEORGE and DANIEL CASSIDY, *State University of New York-New Paltz* (Sponsored by Giordana Grossi)—The Irrelevant Sound Effect (ISE) is the finding that serial recall performance is impaired under auditory backgrounds such as speech as compared to white noise or silence. This study, investigated whether speech-specific qualities of the irrelevant background have an effect on the ISE. We used noise-vocoded speech, an acoustic transformation that preserves intensity profile of natural speech without retaining spectral detail of the signal. Experiment 1 found noise-vocoded speech to be more disruptive than white noise backgrounds. Noise-vocoded speech matches the intensity variation of natural speech within a series of amplitude channels. Experiment 2 systematically varied the resolution of noise-vocoded speech by adjusting the number of these channels. Despite the regular increase in channels, the difference in ISE between different noise-vocoded conditions was not regular. Implications for role of speech-specific properties and changing state complexity of the signal for ISE are discussed.

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(1110)

The Role of Near and Distant Lures in N-back Performance. ZACHARY M. SHIPSTEAD, *Arizona State University West*, RANDALL W. ENGLE, *Georgia Institute of Technology*—Little is known about the mechanisms that relate n-back performance to higher cognition. Several studies indicate that the presence of lure items (i.e., previously presented, but not correct memoranda) is critical to this task's predictive

powers. The present study employed several 3-back tasks in which lure items occupied positions from 2- to 5-back, or 7- to 9-back. Participants' accuracy was highest when lures were distant (7-, 8-, or 9-back), indicating that the task was hardest when lures repeated near the 3-back position (2-, 4-, or 5-back). However, contrary to intuition, the relationship of n-back performance to fluid intelligence and working memory capacity was strongest when lures occupied the distant positions. False alarm data revealed that only people with higher fluid intelligence benefited from distant lures. We conclude that a person's ability to disengage from no-longer-relevant information is a critical component of both n-back performance and higher cognitive abilities.

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(1111)

Worry Frequency Effects on Verbal Working Memory With and Without Binding. ANDRE L. MORENO, JULIANA A. DESOUSA and GUSTAVO GAUER, *Federal University of Rio Grande do Sul*—Worry is a clinically relevant thought pattern in the realm of Cognitive Behavioral Therapy. It is defined as intrusive, repetitive, negative thoughts, usually in verbal form, regarding future events with uncertain outcomes. Excessive occupation of working memory (WM) by worry-related representations is hypothesized to cause deficits, especially in verbal tasks. We tested worry effects on verbal working memory in 46 Brazilian undergraduates from a former study ($n=276$), divided in two groups by worry frequency: low (LW, $n=21$, 11 female) and high (HW, $n=25$, 23 female). Subjects responded to a modified version of the constrained sentence span, with binding and non-binding conditions as primary task in a dual-task paradigm. Significant group differences in accuracy were found only in the non-binding condition. Within the HW group, lower RTs were obtained in the binding condition. Results are discussed in terms of a role for the episodic buffer module within the WM model in worry and its cognitive impact.

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• METAMEMORY/METACOGNITION I •

(1112)

Having Had a Concussion Aids in Sports Concussion Knowledge Level. KATIE FELTMAN and RIC FERRARO, *University of North Dakota*—Students who self-reported having had a concussion (C, $n = 25$) or not having one (NC, $n = 62$) took the Sports Concussion Knowledge questionnaire (9 true/17 false statements about concussions; e.g., A Sports Concussion is harmless and never results in long-term problems or brain damage). They responded true or false to each statement and estimated their confidence level (0-100%). Groups did not differ for the TT (true statement responded to as being true) and TF (true statement responded to as being false) statements, $F_s < 1.0$. However, for the FF (false statement responded to as being false) statements, the C group was more accurate than those in the NC group (79% versus

74%, $p < .05$). Confidence levels were high for both groups (78-80%). For the FT statements (false statement responded to as being true), the C group was less accurate than the NC group (21% versus 26%, $p = .05$). Confidence levels were high (70%). Overall those in the C group a) were more accurate at indicating a false statement was false and b) displayed less misperception about Sports Concussions. In some instances, having had a concussion facilitates the understanding of concussion knowledge.

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(1113)

Highlighting Successful Metacognition: Students Optimize Quantity of Highlighting When Studying. CAROLE YUE, DANIEL M. OPPENHEIMER and ALAN CASTEL, *University of California, Los Angeles*—Although text marking (e.g., highlighting, underlining) is an ubiquitous practice among students, the research on its effectiveness as a study aid is mixed. Some research suggests marking could be ineffective due to students' inability to successfully select the appropriate content or quantity of text to mark (e.g., Bell & Limber, 2010). In the present study, we examined the potential interaction between a required amount of text to mark and individual preferences for that behavior. Participants were asked to bold a certain percentage of words (0, 15, 30, 45, or 60%) in each of two text passages before taking a test. Participants were divided into quartiles based on what percent of a document they reported usually marking when reading for class. Results indicate an interaction between preferred and required amount of text marking: people performed best when they were required to mark an amount similar to their preferred amount. Further analyses indicate that regardless of quartile, people were more likely to answer a test question correctly if they had bolded the relevant sentence in the passage.

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(1114)

New Insights on the Influence of Schizotypal Traits on Source Memory and Meta Cognition. MATTHIAS R. HOHMANN, *University of Mannheim*, BEATRICE G. KUHLMANN, *Heinrich-Heine-University Düsseldorf*, EDGAR ERDFELDER, *University of Mannheim*, DAYNA R. TOURON, *University of North Carolina at Greensboro*—Schizotypy is a risk factor for schizophrenia and involves memory impairment. Deficits have been found in the ability to discriminate between external stimuli and internal thoughts and the tendency to maintain false beliefs about their own cognitive performance. In our study, students first completed the Wisconsin Schizotypy scale and other metacognitive questionnaires. Afterwards, a list of words was learned one at a time, with half printed on a screen and simultaneously heard over headphones whereas the other half was only printed on the screen and participants were asked to imagine what the word would sound like. Participants indicated their confidence for remembering each word in the upcoming memory task. We found a lower global cognitive confidence and a relative by-trial overconfidence during the task with increasing symptomology. Further



analysis based on multinomial modeling revealed an overall decreased performance for the schizophrenic risk population in item recognition, but not in source discrimination.

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(1115)

Does Processing Fluency at Study Diminish the Effects of Knowledge Updating on People's Judgments of Learning?

MICHAEL L. MUELLER, JOHN DUNLOSKY and SARAH K. TAUBER, *Kent State University*—Learners do not know how some cues will affect memory, but they update their knowledge about the cue effects with task experience. Even after experience, however, cue effects are typically larger on memory than on judgments of learning (JOL). One explanation is that processing fluency during learning reduces the likelihood that new knowledge is used when making JOLs. To evaluate this explanation, learners studied items with category clues (e.g., “something you sit in – chair”) or letter-stem clues (e.g., “ch – chair”). JOLs did not differ for the two kinds of clues, although test performance was much higher for category clues. Most important, on a second study-test block, we examined knowledge updating for two kinds of JOL – one that could be influenced by processing fluency and one that could not. In contrast to the fluency explanation, both JOLs showed similar updating but still underestimated the size of the cue effect on performance.

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(1116)

The Impact of Testing Effects and Judgments of Learning on Reading Comprehension.

TARA L.R. BEZIAT, *University South Carolina Aiken*, CHRISTOPHER A. WAS, *Kent State University*—One way to improve students' academic performance is to improve reading comprehension. Previous investigations have demonstrated that testing students on to be learned material and having them use metacognitive strategies have independently improved reading comprehension. In the current study, participants read a lengthy passage (3000 words) divided into six segments of 400-600 words each. After reading each segment participants were either allowed to study the passage again (study condition) or were instructed to freely recall as much about the passage as possible (recall condition). After studying or recalling each segment participants were asked to make a judgment of learning (JOL) regarding the segment. Participants in the study condition recorded significantly higher JOLs than participants in the recall condition. Furthermore, accuracy of JOLs was greater for the recall condition.

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(1117)

Is the Effect of Positive Emotion on Judgments of Learning due to Valence or Arousal?

SARAH K. TAUBER and JOHN DUNLOSKY, *Kent State University*, HEATHER L. URRY and PHILIPP C. OPITZ, *Tufts University*—Judgments of Learning (JOLs) are sensitive to the emotional valence of to-be-remembered material, which is evident when adults learn positive (relative to neutral) words. No research to date has investigated the mechanisms that drive this effect of

positive emotion on JOLs. If this effect arises from subjective experience caused by different levels of arousal for positive versus neutral items, then the effect of valence on JOLs will be minimized when arousal is held constant. Thus, we evaluated the degree to which positive valence and level of arousal contribute to adults' JOLs. To do so, young and older adults' viewed images that varied in valence and arousal and made a JOL for each image. Results revealed that adults' JOLs were sensitive to valence but were insensitive to arousal, suggesting that people's belief about emotions are responsible for emotional effects on JOLs.

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(1118)

Generating Memory Cues for Others.

JONATHAN G. TULLIS, *Indiana University*, AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—Many situations require us to generate external cues to support later retrieval from memory. For instance, we create file names that should successfully cue our memory to a file's contents, and instructors create lecture slides to remember what points to make during lectures. We even generate cues for others when we remind friends of shared experiences. Here we explore how and how well learners tailor retrieval cues for different intended recipients. Across three experiments, subjects either generated cues for themselves or for others. On a later memory test, they received some cues that they had generated and some that others had generated. Learners effectively tailored their cues to support others' memory performance by reducing the distinctiveness of the cues and increasing the normative cue-to-target associative strength. However, generating cues for others required significantly more time than generating cues for oneself. Learners responded to the differential demands of cue generation for others by effortfully shifting away from personal, episodic knowledge to knowledge that they estimate to be more shared, semantic knowledge.

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(1119)

Spatial Metacognition: Are You Sure the Student Union Is That Way?

CHRISTOPHER A. STEVENS and RICHARD A. CARLSON, *The Pennsylvania State University*—The way in which people monitor the accuracy of their spatial memories remains largely unexplored. In this study, participants made judgments of relative direction (JRDs) about unseen locations on a familiar college campus. On each trial, they imagined themselves at one location, facing a second, pointing to a third. After making their pointing judgments, they made confidence judgments and estimated their errors by giving a confidence interval. Several predictors of both confidence and error magnitude were examined, including familiarity with locations, deviation of target from egocentric front, and deviation of heading from preferred orientation. In addition, imagery strategy (egocentric vs. allocentric) was manipulated between participants. Results suggest that participants were successful in predicting the magnitude of their errors. Target deviation and location familiarity both predicted

confidence after controlling for error magnitude, suggesting that participants used these factors to inform their confidence judgments.

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(1120)

Understanding the Role of Rereading in the Metacognitive Monitoring of Reading Comprehension. AARON Y. WONG, JARROD MOSS, DEBORAH K. EAKIN and ELAINE TAN, *Mississippi State University*—Rereading has been shown to improve metacomprehension accuracy by improving situation model level cues. However using only text-level judgments of learning (JOLs), in which single JOLs are provided for entire texts regardless of the number of concepts in the texts limits understanding of the rereading effect. Therefore, it is unclear whether rereading improves metacomprehension accuracy when people are asked to make question-level JOLs concerning specific subtopics of the text. In the present study, participants read or reread texts and made text- and question-level JOLs, as well as other metacomprehension judgments. Comprehension was assessed using tests consisting of text-based and bridging questions. For text-based questions, rereading interacted with reading ability; the rereading effect was strongest for high ability readers. These results suggest that rereading improves cues for high ability readers besides situation model level cues, possibly due to the difficulty of the texts used in this study.

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(1121)

Tests Potentiate Self-Regulated Learning of Tested and Non-Tested Material. NICHOLAS C. SODERSTROM and ROBERT A. BJORK, *University of California, Los Angeles*—Prior findings suggest that tests enhance learning both directly (by rendering retrieved information more recallable in the future than it would have been otherwise) and indirectly (by potentiating subsequent encoding). We examined how testing potentiates the self-regulation of subsequent learning. Participants, after studying paired associates that varied in difficulty, either restudied or were tested on all the pairs (Experiment 1), or restudied half the pairs and were tested on the remaining pairs (Experiment 2). All items were then restudied at participants' own pace before a final cued-recall test was administered. In Experiment 1, interim tests enhanced the subsequent allocation of study time, leading to robust test-potentiated learning, whereas interim restudying had no such benefits. Experiment 2 demonstrated that the benefits of interim testing can transfer to restudied pairs, boosting their final recall to the level of tested items. The results have implications for the interaction of theory-based versus experience-based debiasing.

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(1122)

Test Items Influence Whether Unskilled Performers are Aware or Unaware. MARISSA K. HARTWIG, *Kent State University* (Sponsored by Christopher Was)—The unskilled-and-unaware phenomenon is when low performers overestimate their global (overall) performance on a test, in

contrast to the more accurate estimation or underestimation of high performers (e.g., Kruger and Dunning, 1999). However, this phenomenon does not occur for all tests (Hartwig and Dunlosky, in press), and further research is required to determine when it will (vs. will not) occur. Accordingly, the present studies explored whether the selection of items included in a trivia test would influence the appearance of the phenomenon. Item sets designed to induce many false alarms produced global overestimates for low performers and accurate estimates for high performers (i.e., the unskilled-and-unaware phenomenon), whereas item sets inducing misses produced underestimates for high performers and accurate estimates for low performers. Also, item sets inducing accurate item judgments produced accurate global estimates for all performers. Thus, item selection is one factor that can influence whether unskilled performers are unaware.

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(1123)

Correcting False Memories. HILLARY G. MULLET and ELIZABETH J. MARSH, *Duke University*—People often falsely recall information that was not directly stated; for example, after reading a sentence like “The new baby stayed awake all night,” people often remember that the new baby cried all night (Brewer, 1977). In general, such false memories are notoriously difficult to correct, persisting despite repeated study and warning. However, the feedback literature suggests that even confidently held errors are correctable, given the right kind of feedback. We connected these two literatures, examining the power of correct answer feedback over the types of feedback traditionally used in the false memory literature (correct/incorrect feedback and pre-encoding warnings). Both correct/incorrect feedback and warnings were relatively ineffective at correcting errors; correct-answer feedback (i.e., re-presentation of the original sentence) was required for the majority of these false memories to be corrected. Correcting false memories requires knowledge of what was originally presented, not simply knowing that one's memory is false.

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(1124)

Prior Knowledge Protects Older Adults From Illusory Truth. NADIA M. BRASHIER, SHARDA UMANATH, ROBERTO E. CABEZA and ELIZABETH J. MARSH, *Duke University*—People mistakenly perceive repeated statements to be truer than new statements, the illusory truth effect (Dèchene, Stahl, Hansen, & Wänke, 2010). Assuming that prior knowledge eliminates this effect, previous experiments utilized obscure trivia statements. The current study directly tested this assumption by examining truth ratings of repeated and new statements, based on participants' demonstrated knowledge on a knowledge check. Additionally, because older adults show reduced susceptibility to semantic illusions (Umanath & Marsh, 2012), we examined age-related differences in the role of prior knowledge in the illusory truth effect. We found that prior knowledge protects older, but not young, adults from illusory truth. These data suggest that (a) in contrast to previous assumptions, prior knowledge does



not eliminate the illusory truth effect in young adults, and (b) the strength of older adults' general knowledge reduces their reliance on fluency as a heuristic for perceived truth.

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(1125)

Agenda-Based Regulation and Strategy Use for Younger and Older Adults. ROBERT ARIEL, *Georgia Institute of Technology*, JODI PRICE, *The University of Alabama in Huntsville*, CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Learners typically allocate more time to studying high than low valued items. However it is unclear how they use their time and whether time use differs for younger and older adults. We evaluated study time allocation and time use for paired associates varying in point value using an information seeking paradigm. On each trial, participants could move a mouse cursor to different spatial locations to reveal word pairs for study or the point value participants would receive for remembering each pair. They could only access one type of information at a time, which allowed us to track the decision process dynamically. Most important, some participants provided strategy reports following each trial. Younger and older adults regulated their study in a similar manner. They both allocated more time to high than low valued items and they selectively utilized more effortful encoding strategies to learn high valued items.

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(1126)

Know Versus Familiar in Recognition Memory. HELEN L. WILLIAMS and D. STEPHEN LINDSAY, *University of Victoria*—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 a feeling of familiarity varies across researchers. Such differences have been shown to influence responding (Geraci et al., 2009) and some researchers have separated Know and Familiar as response options (e.g., Conway et al., 1997; Dewhurst et al., 2009). In the current experiment, definitions of Remember and Guess were kept constant, but definitions of Know and/or Familiar were varied across participants to emphasize (a) a subjective experience of high-confidence-without-recollection, (b) a feeling of familiarity, (c) both of these subjective experiences combined within one response option, or (d) both of these experiences as separate response options. Distribution patterns and accuracy for subjective experiences responses are explored and findings are discussed in terms of how experiential states are conceptualized in current theories of recognition memory.

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• HUMAN LEARNING AND INSTRUCTION I •

(1127)

Expanding, Contracting, or Equal Learning Schedules? The Optimal Distribution of Learning Sessions Depends on Retention Interval. CAROLINA E. KÜPPER-TETZEL, *Washington University*, IRINA V. KAPLER and MELODY WISEHEART, *York University*—The distributed practice effect is a successful learning strategy that promotes long-term retention of the to-be-learned material. In essence, it describes the benefits of distributing a fixed amount of study time across multiple learning sessions instead of massing it into a single one. While the optimal distribution of two learning sessions has been intensively examined in laboratory and classroom studies, it is still unclear how three learning sessions should be optimally distributed across educationally relevant time intervals. More precisely, should intervals between learning sessions expand, contract, or be equal across time? In this experiment, we examined whether a specific learning schedule fares better than the others or whether there is an interaction between optimal learning schedule and retention interval. We used a paired associate learning paradigm and independently manipulated learning schedule and retention interval in a 3 by 4 experimental design. Our results reveal that the optimal learning schedule is conditional on the length of the retention interval. This finding bears important implications for two theories – ACT-R and the Multiscale Context Model – that are discussed in this context.

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(1128)

Learning Better, Learning More: The Benefits of Expanding Retrieval Practice. VERONICA X. YAN, MICHAEL A. GARCIA, ELIZABETH LIGON BJORK and ROBERT A. BJORK, *University of California, Los Angeles*—How can we optimize learning schedules? We already know that distributing practice is better than massing practice, but should practice be distributed in a uniform or expanding fashion? Strong theoretical reasons support expanding schedules: As information is learned, it is forgotten more slowly, and thus the delay to the next presentation can be increased without loss of the information. Expanding schedules thus allow information to be re-presented when such an event will be maximally beneficial (i.e., when the information is minimally accessible). Although recent studies have found inconsistent memorial benefits of expanding schedules (particularly on delayed tests), these studies overlook a different advantage of expanding schedules: They allow for an increasingly greater repertoire of information to be learned compared to uniform schedules. Across two delayed-test experiments, expanding retrieval practice (with feedback) of GRE word pairs was more effective and efficient for learning compared to uniform retrieval practice. Not only did an expanding schedule lead to equal (Exp 1) or greater (Exp 2) memory for critical to-be-learned words, it also allowed for the learning of additional “filler” items.

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(1129)

Are the Benefits of Longer vs. Shorter Test Lags Due to Differences in Elaborative Retrieval? KALIF E. VAUGHN and KATHERINE A. RAWSON, *Kent State University*, SHANA K. CARPENTER, *Iowa State University*—Carpenter (2011) proposed the elaborative retrieval hypothesis (ERH) for why testing benefits memory. According to ERH, testing activates related semantic information (e.g., ‘mother – ???’ activates ‘father’ en route to the target ‘child’), providing additional pathways to target information. Carpenter (2011) showed that practice testing improved performance on a final test involving mediator cues (e.g., ‘father’ to retrieve ‘child’). Can ERH also explain the benefits of longer versus shorter lags between practice tests? Experiment 1 showed no benefit of longer versus shorter practice lags on an immediate final test with either original cues or mediator cues. However, lag effects often emerge after a delay. In Experiment 2, longer versus shorter practice lags improved performance on a delayed final test with both original and mediator cues. Experiment 3 replicated the lag-delay interaction shown across Experiments 1-2. Thus, the advantage of longer versus shorter practice test lags can be explained via ERH.

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(1130)

Interpolated Testing During Online Lectures Helps Students to Monitor Their Learning. KARL K. SZPUNAR and DANIEL L. SCHACTER, *Harvard University*—In recent years, educators have increasingly made use of online lectures as a learning tool. However, little is known about how students learn from online lectures and what pedagogical techniques can be used to improve learning from online lectures. We have previously demonstrated that interpolating online lectures with brief tests can help students to avoid task-irrelevant activities such as mind wandering and encourage task-relevant activities such as note-taking and retention (Szpunar, Khan, & Schacter, 2013). Here, we demonstrate further that interpolating online lectures with brief tests can help students to monitor their overall level of learning during extend periods of study. Implications for self-regulated study of online lectures are discussed.

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(1131)

Training in Auditory Perceptual Learning: Fixed vs. Adaptive Progressive Training. COURTNEY L. RICE, BARBARA A. CHURCH and EDUARDO MERCADO III, *University at Buffalo, SUNY*—In cognitive learning paradigms and educational settings, adaptive training methods are assumed to be most efficient. However, the research that has been done comparing adaptive methods to others is limited and has produced mixed results (Paschler, 2013; Griff & Matter, 2012; Cook et al., 2008). Also, research in auditory perceptual learning has found that progressive training is more efficient than extensive difficult training (Liu et al., 2008), anchored training (Radell et al., submitted), or equally variable training that does not follow a progressive sequence (Church et al., 2013). However, all of these studies used fixed progressive sequences. In this study, we compare perceptual

learning in an auditory discrimination task following adaptive progressive training, fixed progressive training, and other non-progressive paradigms. Regardless of training, performance improved. However, fixed progressive training produced more accurate performance and greater generalization than other conditions. These findings suggest that adaptive training may be less beneficial than a fixed progression.

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(1132)

Modality-Specific Retrieval Practice in Multimedia Learning. CAROLE L. YUE and ELIZABETH LIGON BJORK, *University of California, Los Angeles*—Multimedia presentations, increasingly used in classrooms, incur a benefit when learners successfully integrate audio and visual components into a single, coherent mental model (Mayer, 2005). Another line of research suggests that retrieval practice (vs. restudy) promotes better long-term learning (Roediger & Karpicke, 2006). The present study combines these lines of research by using separate audio and visual portions of multimedia presentations as cues for retrieval practice. Three conditions were investigated: Study Twice (ST), Retrieve Animation (RA), and Retrieve Narration (RN). Following presentation of an animated, narrated lesson about the life-cycle of a star, ST participants received the intact lesson again, while RA and RN participants drew or wrote the non-presented modality, respectively. Results indicate an interaction between condition, test type, and test time, such that ST is better for immediate recall, but RA and RN are better for delayed recall and immediate transfer, and RA is best for delayed transfer.

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(1133)

Learning From Scientific Illustrations: Do Gestalt Principles Matter? DAVID B. BELLINGER and MARCI S. DECARO, *University of Louisville*—People learn more when pictures accompany text than from text alone (Fletcher & Tobias, 2005), and modern science textbooks capitalize on this principle. However, scientific illustrations may not all equally benefit learning. Specifically, illustrations that emphasize Gestalt principles of perceptual organization (i.e., similarity, proximity, and connectedness) might enhance the quality of schema construction by aiding knowledge organization and decreasing cognitive load (e.g., Carlson, Chandler, & Sweller, 2003). To investigate this question, we compared learning and transfer from scientific text alone to learning from text accompanied by either a traditional or Gestalt-enhanced illustration. Traditional and Gestalt-enhanced illustrations both significantly improved learning outcomes compared to text alone. However, learning outcomes were comparable between the two illustration conditions. These results suggest that traditional illustrations may be sufficient for schema construction. Additional research is needed to determine what aspects of illustrations best enhance learning from text and for whom they are most beneficial.

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(1134)

Consequences of Math Learning via Formulas versus Graphical Representations: Behavioral and Neurological Contrasts During Transfer. ARYN PYKE and JOHN R. ANDERSON, *Carnegie Mellon University*—Participants each learned two novel math operations via either formulas or graphical representations. Ideally, learners become able to solve problems not only in the practiced format but also problems with slightly different formats or different operand types (e.g., negative numbers), here termed ‘computational-transfer’. Further, learners may develop an appreciation for various systematic magnitude patterns that characterize the operation (“operation sense”, Slavit 1998). Our ‘relational-transfer’ problems probed learners’ understanding of such magnitude relations across problems and across operations. As hypothesized, learning via graphical representations, which rendered magnitude information more explicit, facilitated superior performance on relational-transfer problems, even though graphical representations were not available during the transfer phase. Both behavioral and neuroimaging (fMRI) contrasts are discussed.

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(1135)

Repetition, Not Visual Format, Produces the Recall Advantages of Diagrams. FRANCESCA R. FLORES, MICHAEL J. SERRA and BENJAMIN D. ENGLAND, *Texas Tech University* (Sponsored by Pat DeLucia)—Supplementing text-based learning materials with diagrams increases both cued-recall (i.e., low-level memory) and free-recall (i.e., integrated memory). Diagrams are visual in nature, and visual information is remembered better than verbal information. However, diagrams also repeat information from the text they accompany, and repetition also aids memory. To examine whether diagrams aid recall because they are visual or repetitive, college students read a science text and subsequently completed cued-recall and free-recall tests. We manipulated the format and repetition of target information (once in the text, twice in the text, once in a diagram, or in both the text and in a diagram). Both diagrams and repetition aided cued-recall, but only repetition (regardless of format) aided free-recall. Further, free-recall was reduced when target information appeared in a diagram without also being in the text. These results demonstrate the role of repetition in producing the effects of diagrams on recall.

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(1136)

Repeated Retrieval Produces Better Learning Than Elaborative Study Even After Practicing Concept Mapping. JUANA M. ORTEGA-TUDELA, M. TERESA LECHUGA and CARLOS J. GÓMEZ-ARIZA, *Universidad de Jaén*—In a recent study, Karpicke and Blunt (2011) showed that retrieval practice produced better performance than concept mapping on a 1-week delayed test that comprised conceptual questions. This finding is quite surprising because a) concept mapping is thought to involve elaborative processing and help students encode meaningful relationships among concepts and b) this strategy has become very popular as a learning tool. In

one experiment we aimed to explore whether the above-mentioned results are replicated after providing participants with a short period of practice in concept mapping. Thus, we compared the performance on a conceptual test of a repeated practice group, a re-study group, a group that only received instructions on how to elaborate a concept map, and a group of participants that practiced concept mapping before dealing with the experimental material. Our results essentially replicate the Karpicke and Blunt’s finding and point to the need of experimentally specifying effective ways to use concept mapping as a learning strategy.

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(1137)

A Comparison of Concept Maps and Text Summaries: The Benefits for Learning and Transfer. KENNETH J. BARIDEAUX JR., JACLYN K. MAASS and PHILIP I. PAVLIK JR., *The University of Memphis*—Reder and Anderson (1980) compared text summaries to full-length texts and found summaries to be more beneficial to the learning process. While there is support for the benefits of concept maps for various types of learning (Nesbit & Adesope, 2006), there is little research on the different effects of learning with concept maps compared to text summaries. In the current experiment, participants (n = 103) were randomly assigned to study a science topic from either a concept map or text summary. Immediately following study, participants completed a post-test that contained concept map and text fill-in-the-blank questions. A median split on overall post-test scores and a repeated measures analysis of variance (ANOVA) revealed that low learners performed better when studying the concept map. The results also provided evidence in support of transfer-appropriate processing. These findings suggest that concept maps, when used as an instructional device, may be more beneficial than summarized text for lower learning students.

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(1138)

Correlation of Dance Experience and Spatial Memory Ability. ERICA BARHORST and ROMAN TARABAN, *Texas Tech University*—Practice correlates with memory ability in a given domain. Experts excel in domain-specific memory because they store large numbers of “chunks,” or patterns of information in long-term memory. This study investigated the spatial and verbal memory of 13-26 year-old dancers and non-dancers using two memory tasks related to dance: the Corsi block-tapping task (spatial memory), and a full-body version of the Corsi block-tapping task (dance-specific spatial memory). A word-span task (verbal memory) was the control task. Participants also filled out extracurricular activity questionnaires. The primary hypothesis was that years of dance experience would be uncorrelated with verbal-memory performance and positively correlated with performance on spatial-memory tasks. Results showed non-significant correlations with verbal memory and significant positive correlations between dance experience and domain-specific spatial-memory performance. Somewhat unexpectedly, sport and musical-instrument experience were also significantly

associated with spatial-memory performance. These findings suggest spatial-memory enhancement effects for movement activities.

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(1139)

Learning Isn't Random: Assessing How Students' Expectations Moderate Behaviors That Affect Learning.

ERICAL.SNOW, G. TANNER JACKSON, LAURA K. VARNER and DANIELLE S. MCNAMARA, *Arizona State University*—Researchers have previously examined how individuals' prior expectations affect performance within digital learning environments (Jackson, Graesser, & McNamara, 2009). The current study utilizes dynamical analyses to investigate the relations among students' expectations of technology, their interactions within a computerized tutoring system (e.g., editing personalizable features and playing practice games), and their overall learning gains. Forty high school students interacted with a game-based intelligent tutoring system across eight learning sessions. Hurst exponents (Hurst, 1951) were calculated based on students' system interaction patterns. These exponents indicate the extent to which interaction patterns are random or deterministic. Results of this study revealed a negative relation between the randomness of students' system interactions and their daily performance measures. Further analysis indicated that this relation was moderated by students' prior expectations of their enjoyment of the system. Overall, these initial results provide insight into the potential relations between students' expectations, pattern of choices, and learning gains.

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(1140)

Concept Learning Through Similarities and Differences: An Individual Differences Approach.

FARIA SANA, DANIELLE ALLEN, CHRISTOPHER TEETER and JOSEPH KIM, *McMaster University* (Sponsored by Geoff Norman)—We tested two processes that can facilitate transfer of knowledge in learning statistical concepts. When exemplars from multiple concepts are interleaved, learners can use discrimination-based comparisons to highlight differences between concepts. When presented with a block of exemplars of a single concept, learners can use similarity-based comparisons to highlight similarities among exemplars of the same concept. Participants studied examples of three statistics concepts that were presented interleaved or blocked. Results demonstrated that interleaving exemplars of different concepts fostered discrimination between concepts, and any interruption to this discriminative process impeded performance (Experiment 1). Blocking exemplars of a concept fostered the understanding of connecting common features of a concept when blocked exemplars were presented simultaneously but not sequentially (Experiment 2). These manipulations were particularly beneficial for participants with low WM capacity. The findings provide evidence for discrimination- and similarity-based comparisons of the benefits of interleaving and blocking effects in the context of educationally relevant learning material.

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(1141)

Errorful Categorization Does Not Impede Inductive Learning.

COURTNEY M. CLARK, ROBERT A. BJORK and ALAN D. CASTEL, *University of California, Los Angeles*—Mechanisms of category induction, whereby participants learn how to classify new members of a category by studying exemplars of that category, have attracted recent research using complex stimuli and natural categories. In many experiments, interleaving the presentation of exemplars of a category promotes better learning than does massing (e.g., Kornell & Bjork, 2008). In the current investigation, we sought to further optimize categorization by introducing anticipatory learning. Generating a guess, even when wrong, can lead to better performance than merely studying information (e.g., Kornell, Hays & Bjork, 2009). Before showing participants the correct artist when presented with a painting during the learning phase, we asked them guess from a list of potential artists. This anticipatory learning paradigm produced many more errors for interleaved artists than massed artists. However, on the final delayed test, a benefit for interleaving was found. The findings suggest that making errors during initial interleaved learning does not impede the successful formation and use of category information.

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(1142)

Teaching as a Generative Learning Activity.

LOGAN FIORELLA and RICHARD E. MAYER, *University of California, Santa Barbara*—The present study further explored the idea that students learn by teaching others. In Experiment 1, participants studied a brief paper-based lesson on how the human ear works and then either took a recall test on the material (test group), taught the material by providing a video-recorded lecture (teach group), or received additional study time (study group). Results indicated the teach group outperformed both the study group ($d = .70$) and the test group ($d = .57$) on a delayed comprehension test; further, the test group did not significantly outperform the study group ($d = .19$). Experiment 2 tested whether similar benefits could be obtained when students are instructed to create a lesson plan while studying (create group) compared to studying normally (study group). Results indicated that the create group outperformed the study group on the delayed comprehension test ($d = .47$). Overall, these results suggest that engaging in teaching-related activities can effectively promote generative processing in learners by encouraging them to actively reorganize and integrate to-be-learned material with their existing knowledge.

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(1143)

Unsuccessful Retrieval Enhances Subsequent Encoding.

KATHLEEN M. ARNOLD and KATHLEEN B. MCDERMOTT, *Washington University in St. Louis*—Taking a test prior to restudying the tested material enhances learning relative to learning when no prior test is taken, a phenomenon known as test-potentiated learning (Arnold & McDermott, 2013; Izawa, 1971). Why do tests have this potentiating effect? One possibility is that unsuccessful retrieval attempts during



initial tests may enhance subsequent learning by enhancing metacognitive knowledge (Arnold & McDermott, 2012) or by increasing study-phase retrieval (Nelson et al., under review). Alternatively, successful retrieval of some items may enhance learning of other items through processes such as learning-to-learn (Postman & Schwartz, 1964) or reducing interference (Szpunar, McDermott, & Roediger, 2008). Finally, tests may enhance learning by increasing the spacing between study trials (Cepeda et al., 2006). These three hypotheses were tested by varying the number of unsuccessful and successful retrieval attempts made prior to restudying. The results point to the importance of unsuccessful retrieval attempts in enhancing subsequent encoding.

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(1144)

Decontextualization of New Knowledge. STEVEN M. SMITH, JUSTIN D. HANDY, JEREMY H. NICHOLS and GENNA ANGELLO, *Texas A&M University*—Tulving's distinction between episodic and semantic memories is that episodic memories are remembered as experiences that occurred at some particular time and place, whereas semantic memories are known facts, and may not be rooted in specific contexts. How does knowledge progress from its initial dependence on specific context cues to knowledge independent of episodic contexts? We examined effects of repeated practice on paired associate learning, either varying the contexts of retrieval practice attempts, or holding contexts constant. Repeated retrieval practice done with constant contexts, relative to varying practice contexts, improved acquisition, but impeded retention. This interaction was found for face-name pairs with unrelated contexts, and for Tagalog-English pairs that had semantically supportive contexts, and occurred for both long and brief retention intervals. An "expanding" contextual shift condition, in which contexts first changed a little, and later changed more, showed similar effects. The effect was not found when trials involved repeated study, rather than repeated retrieval practice. These results support a desirable difficulties view, and provide an approach for decontextualizing new knowledge.

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(1145)

Deliberate Practice and Performance in Music, Games, Sports, Professions, and Education: A Meta-Analysis. BROOKE N. MACNAMARA, *Princeton University*, DAVID Z. HAMBRICK, *Michigan State University*, FREDERICK L. OSWALD, *Rice University*—Why do people differ in the rate at which they acquire skills and the ultimate level of performance they reach? Twenty years ago, K. Anders Ericsson and colleagues (Ericsson, Krampe, & Tesch-Römer, 1993) proposed that individual differences in performance largely reflect individual differences in deliberate practice—engagement in effortful activities created specifically to improve performance. This view has gained particular prominence in the scientific literature, and is discussed in numerous popular books. But is it defensible? We conducted meta-analyses to determine the magnitude of the relationship between deliberate practice and performance. We found that

deliberate practice accounted for a much smaller proportion of variance than Ericsson and colleagues' strong claims suggest—only about 30%, even after correcting for measurement error. We also found three significant moderators of the relationship between deliberate practice and performance: (1) domain; (2) degree of intellectual processing, with larger contributions for domains with low intellectual demands; and (3) predictability of the task environment, with larger contributions for domains in which the task environment is highly predictable.

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(1146)

Achievement Goals, Instruction of Strategy, and Memory. TSUYOSHI YAMAGUCHI, *Hosei University* (Sponsored by Tetsuya Fujita)—Murayama & Elliot (2011) suggested achievement goals influence recognition memory. On the other hand, the influence of motivational variables such as achievement goals and instruction of memorization strategies on recall memory has not been clarified. In the present study, participants were instructed knowledge about distributed learning and assigned to three conditions: engaging in an irrelevant task, practicing distributed learning, and testing with feedback on the benefit of distributed learning. The analysis revealed that the feedback condition showed significantly higher recall performance than any other condition. Meanwhile, all three conditions showed a high degree of strategy use. Additionally, positive correlations were found between recall performance and subcategories of achievement goals such as performance-approach and performance-avoidance goal. Similar to Murayama & Elliot (2011), these results raise the possibility that performance goal affected immediate recall performance since no difference was found in degree of strategy use.

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(1147)

Parental Perceptions of Communication Competence: Predictor of Deaf Children's Pre-Emergent Literacy? DIANE CLARK and THOMAS E. ALLEN, *Gallaudet University*—Items from the Communication and Language Concepts sections of the Adaptive Behavior Assessment System (ABAS) were completed by parents of deaf children who were part of the Early Educational Longitudinal Study (EELS) of the Science of Learning Center on Visual Language and Visual Learning. Items were factor analyzed to provide latent factors, which were then used to predict children's pre-emergent literacy skills. Measures included the PTONI (non-verbal intelligence), the Woodcock Johnson Picture Vocabulary subtest, Letter Writing, the TOPEL Print Knowledge and Phonological Awareness subtests, and Word Letter Knowledge to assess if phonological awareness, orthographic knowledge, both or neither were related to parental perceptions of their child's communication competency.

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• ATTENTIONAL PROCESSES •

(1148)

Gaze Cueing Effect of Emotion Faces. YONGNA LI, *Renmin University of China*—The observed eye gaze shift of other people may direct the observer's attention to the same peripheral event. Emotion faces bias attention sometimes. Hence, it is important to ask how facial expressions influenced the cueing effect of eye gaze. In a precueing paradigm, eye gaze elicited by neutral, happy, and angry faces served as a precue. The target was a letter in Experiment 1 and an emotional picture from the IAPS in Experiment 2. The results of Experiment 1 showed that the happy and angry eye gaze facilitated the target localization in both cued and uncued conditions. A cueing effect was found at 200 ms and 500 ms cue-to-target SOAs, but no IOR (Inhibition of Return) at 2400 ms SOA. Experiment 2 only obtained a cueing effect. These findings suggested that emotion does not affect the cueing effect, but emotion eliminates IOR at long SOA.

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(1149)

The Effect of Aging and Selective Attention During Memory Retrieval on Subsequent Memory Performance. JEREMY K. MILLER, KYLE L. DIXON and TYLER YOUNG, *Willamette University*, MARIANNE E. LLOYD and ASHLEY HARTMAN, *Seton Hall University*—Many studies have shown that manipulating attention during encoding influences performance on a memory tasks (Craik, Govani, Naveh-Benjamin, & Anderson 1996). However, fewer studies have examined the consequences of manipulating attention during memory retrieval on memory performance during subsequent retrieval attempts. The current study examined the influence of selective attention and aging on recognition memory performance. Younger (mean age=18.87) and older adult (mean age=71.04) participants were exposed to a study list followed by a recognition test. During the initial recognition test, participants made memory judgments while selectively attending to some stimuli and selectively ignoring others (Dudukovic, DuBrow, & Wagner, 2009). Participants then completed a 2nd recognition test consisting of items that had been previously tested under full attention, selective attention, and selectively ignored conditions as well as previously untested items. The results revealed no differences between performance in the selectively attended and full attention conditions regardless of age group, suggesting that participants encoding was not hindered by extraneous stimuli.

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(1150)

Cultural Differences in Flanker Task Interference. PETER MILLAR, *Brandeis University*, BERNA ARSLAN, *Bogazici University*, ANGELA GUTCHESS, *Brandeis University*, AYSECAN BODUROGLU, *Bogazici University*, ROBERT SEKULER, *Brandeis University*—Culture influences strategies of visual attention, with individualistic Westerners favoring an object-focused approach and interdependent Easterners adopting a holistic approach. Consistent with a demonstration that priming for interdependence induced a larger Flanker

interference effect than priming for independence, we tested the hypothesis that interference would be greater for Easterners than for Westerners. Turks and Americans completed the Flanker task, with compatible or incompatible flanking letters either close to or far from the target. Although cultural differences did not emerge for RTs, Americans were less accurate than the Turks, particularly in the near incompatible condition. Conditional Accuracy Functions relating accuracy to reaction time for near incompatible flankers showed that Americans took longer to achieve the same level of accuracy as Turks. This suggests that Americans suffer greater interference when incompatible stimuli are close together, perhaps because they process the items as multiple objects rather than as a single entity.

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(1151)

Detection of Natural and Manmade Threats by New Mothers and College Women. LYNDSEY K. LANAGAN-LEITZEL and ALITA J. COUSINS, *Eastern Connecticut State University*—The ability to rapidly detect threatening stimuli offers an evolutionary advantage by allowing organisms to reach maturity and procreate. Once offspring are born, maternal aggression to protect them has been documented in animals and humans. Lactating mothers are more aggressive than formula-feeding mothers and experience less fear, anxiety, and stress, suggesting that the hormones released during nursing could have far-reaching effects. We explored threat detection in college women and mothers of young infants (2 – 6 months old) who were lactating or formula-feeding. Participants viewed 14-image RSVP streams and classified two target objects with a short or long lag as natural or manmade. Half of the trials had a threat object for Target 2 (natural: snake/spider or manmade: gun/knife/needle). Preliminary results show the non-mothers (N=11) to have enhanced processing of threat stimuli (higher accuracy) but no difference between ancestral threats and manmade threats. Recruitment of participants, especially mothers, is ongoing.

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(1152)

Estimating Time Durations of Cognitive Search Tasks. CAROLE J. YOUNG, *Bethel University*—Prospective judgments of time durations generally are too short if one's attention is occupied on another task and generally too long if one experiences a high rate of reinforcement during the interval. Seventeen college students estimated how many seconds it took them to retrieve 6, 8, or 10 words either from a designated word set (such as “the names of the months of the year”) or from a natural category of items (such as “a kind of bird”). As predicted, participants showed greater underestimation as the time interval grew longer and as the memory search became more difficult, in accordance with attention being distracted from the temporal task. However, when the rate of retrieval was faster, the underestimation was lessened, in accordance with rate-biasing.

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(1153)

To Inhibit or Not to Inhibit? Strategies in Time-Based Selection. ZORANA ZUPAN, ELISABETH BLAGROVE and DERRICK G. WATSON, *University of Warwick*—Top-down attentional inhibition can be applied to facilitate the selection of new stimuli (Watson & Humphreys, 1997). However, it is unclear to what extent such inhibition is applied by default or is influenced by observer strategies. To test this, over three experiments, we presented participants with conditions in which inhibiting the previewed items would lead to task benefits on either a majority or minority of trials. This was achieved by changing the locations (Experiments 1 and 2) or locations and features (Experiment 3) of previewed items before the onset of the new stimuli, on 20% or 80% of trials. Overall, the results showed that participants continued to apply inhibition to previewed items even when there was little benefit to doing so. This suggests that in time selection tasks inhibiting irrelevant information appears to be the default behaviour.

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(1154)

Attentive Screening: A Parallel Limited-Capacity Processing Stage That Locates Likely Targets. SIMONA BUETTI, ALEJANDRO LLERAS and DEBORAH A. CRONIN, *University of Illinois*—Up to now, the visual search literature has for the most part studied two types of distractors: those that can be filtered out, with no per-item cost (noise), and those that are scrutinized as potential targets and therefore have a direct influence on the search slope (candidates). Here, we document, for the first time, the existence of a third class of visual distractors: quandidates. These distractors are filtered out with a per-item cost, without influencing the search slope. They are similar to the target, yet can categorically be ruled out as unlikely to be the target. As a result, their presence on the display does not fundamentally alter the number of items to be attentively scrutinized (thus, they don't affect search slope), yet the more quandidates there are, the higher the intercept of the search function is. These results suggest that attention proceeds in two separate, sequential, parallel and capacity-limited stages: an initial "attentive screening" stage, where all items in the display are categorized as either likely to be the target (candidates) or not (quandidates or noise elements), and a second "attentive scrutiny" stage, where only the likely targets are scrutinized.

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(1155)

Attempting to Improve Attention Through Executive Function Training. MEREDITH MINEAR, *University of Wyoming*, MANDY BRASHER, *University of Kentucky*, ANDREW MOORE and MINDI PRICE, *The College of Idaho*, JOSHUA SUKEENA, *University of Idaho*—We report the results of a large study comparing two interventions that have been proposed as improving attentional capacity. 100 undergraduates were randomly assigned to one of three conditions, a four-week executive function training program, an 8-week mindfulness course and a no-contact control group. The executive function training consisted of a combination of

working memory training using spatial and verbal n-back and training on task-switching. Participants in the mindfulness course were taught simple focused meditation as well as given weekly mindfulness based stress reduction exercises. The pre-test/post-test battery included simple speeded tasks, working memory and fluid intelligence measures, executive function measures such as multiple variants of the Stroop and task-switching paradigms and measures of attention such as the CPT, ANT, and attentional blink. We also administered various personality indices as well as surveying self-reported stress and rumination. Our preliminary analyses show little evidence of broad transfer of training.

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(1156)

Power Posing: Do Brief Nonverbal Displays Influence Attentional Processes? NEYMI OROZCO, W. MATTHEW COLLINS and LEANNE BOUCHER, *Nova Southeastern University*—Body positioning is known to affect subjective feelings (Schubert & Koole, 2009), hormone levels (Carney, Cuddy, & Yap, 2010), and even decision making (Huang et al., 2011). However, little is known about how body positioning can affect attentional processes. The current study examined how posing in different positions affected memory updating processes and processes of inhibition. Participants positioned themselves in both a high power position and a low power position for two minutes before completing the Stop Signal task and the N-Back task. After posing in a high power position, participants were slower at stopping their responses compared to a low power position. However, there were no reaction time differences between the high and low power positions in terms of going behaviors. Furthermore, participants performed less accurately on the N-Back task following a high power position relative to a low power position. These results suggest that performing high power positions reduces cognitive flexibility.

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(1157)

Habituation Rate is Not Facilitated by Predictability: Evidence From a Cross-Modal Oddball Task. ANATOLE NÖSTL and PATRIK SÖRQVIST, *University of Gävle*—Habituation of the orienting response elicited by novel events is a crucial mechanism underpinning selective attention. The purpose of the current study was to investigate if the habituation rate is increased given that the deviating events occur in a predictable pattern. A cross-modal oddball task in which the participants categorized visual targets across 6 blocks of trials was used. Each visual target was preceded by a sound. In most trials, the sound was a standard sound, on rare trials, however, the visual target was preceded by a deviant sound. In one condition, the deviants were presented every 10th trial, and in another condition, the deviants occurred in a pseudo randomized order. Habituation was observed in both conditions, but there was no difference regarding habituation rate. The results indicate that habituation rate does not depend on the temporal regularity of the surprising events, which could be used to facilitate their prediction.

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• LETTER AND WORD PROCESSING I •

(1158)

A Behavioral Database for Masked Form Priming. C.J. DAVIS, *Royal Holloway, University of London*, R.L. JOHNSON, *Skidmore College*, S.F. MCCORMICK, *Royal Holloway, University of London*, M. MCKAGUE, *University of Melbourne*, S. KINOSHITA, *Macquarie University*, J.S. BOWERS, *University of Bristol*, J.R. PERRY and S.J. LUPKER, *University of Western Ontario*, K.I. FORSTER, *University of Arizona*, M.J. CORTESE, *University of Nebraska, Omaha*, M. SCALTRITTI and A.J. ASCHENBRENNER, *Washington University, St. Louis*, J.H. COANE, *Colby College*, L. WHITE, *Plymouth University*, M.J. YAP, *National University of Singapore*, C. DAVIS and J. KIM, *Marcs Institute, University of Western Sydney*, J.S. ADELMAN, *University of Warwick* — The masked form priming paradigm has been widely used over the last decade to investigate the “front-end” of visual word recognition, in an effort to “crack” the orthographic code underlying reading. Previous studies have contributed greatly to our understanding of orthographic input coding, but their relatively small-scale has resulted in two main limitations: a) the precision of the estimated priming effects is not great, and b) a comprehensive assessment of models currently requires combining priming effects across experiments conducted in different labs (and often different languages). The present mega-study addressed these limitations by conducting a single very large within-subject experiment across labs in the UK, US, Canada, Singapore and Australia. Researchers from 14 universities collected data from 28 prime types with 420 word targets (and 420 nonword foils). Over 1000 participants were tested; the resulting statistical power enables us to reliably distinguish priming effects that differ by as little as 3 ms. This database (which is freely available to the research community) substantially advances our empirical knowledge of masked form priming phenomena, and greatly enhances our ability to assess and improve models.

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(1159)

Masked Repetition Priming With Nonwords: ERP Evidence for Case and Size Sensitivity. STÉPHANIE MASSOL, *Basque Center on Cognition, Brain and Language*, KATHERINE J. MIDGLEY, *San Diego State University*, PHILLIP J. HOLCOMB, *Tufts University; San Diego State University*, JONATHAN GRAINGER, *CNRS; Aix-Marseille University* — Type of target was manipulated in an experiment combining masked repetition priming with ERP recordings. Targets were either a random string of consonants or a pronounceable sequence of consonants and vowels, and all were 7 letters long and presented in uppercase. Targets were preceded by primes that could be identical to the target or composed of seven different letters. The size and case of the prime were also manipulated. ERPs revealed a main effect of target type, with differences arising around 250ms post-target onset. An N/P150 effect was found at occipital sites only when prime and target shared the same size and case. Between 200 and 500ms, repetition priming effects were found to interact with target type, with stronger priming effects arising for pronounceable

nonwords. The results provide new insight into the earliest phases of visual word processing - those involved in the formation of a sublexical orthographic code.

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(1160)

Emotional Effects in Visual Word Recognition. PAUL D. SIAKALUK, MICHAEL MOFFAT and NATHAN KNOL, *University of Northern British Columbia*, DAVID M. SIDHU and PENNY M. PEXMAN, *University of Calgary* — According to Vigliocco et al. (2009), knowledge derived through emotional or affective experience primarily underlies the semantic representations of abstract concepts. Here we examined the effects of emotional experience (the extent to which words evoke an emotional experience; Newcombe et al., 2012), arousal, and valence on the processing of abstract words in the following tasks: verbal semantic categorization, naming, and Stroop. Emotional experience exerted a facilitatory effect in verbal semantic categorization, a null effect in naming, and an inhibitory effect in Stroop (when the words were blocked by level of emotional experience). Arousal exerted inhibitory effects in verbal semantic categorization, and null effects in naming and Stroop. Valence exerted null effects in all three tasks. We discuss the impact of these findings for Vigliocco et al.'s (2009) theory of semantic representation, and for perceptual symbol systems theory, in which simulation underlies semantic processing (Barsalou, 1999).

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(1161)

Examining the N400 Repetition Effect in the Frequency Domain With a Combined Empirical and Computational Approach. BLAIR C. ARMSTRONG, *Basque Center on Cognition, Brain and Language*, SARAH LASZLO, *Binghamton University, SUNY* — Electrophysiological experiments of word reading typically provide insight into word recognition processes via analysis in the time domain. Here we show that additional insights into the mechanism of the N400 repetition effect can be garnered by examining the frequency domain as well. We found that, in both empirically derived electrophysiology and a computational model grounded in neural computation, a distortion of the power frequency spectrum occurs following repeated items across a range of lexical classes, such that there is a substantial increase in low frequency power and a modest decrease in high frequency power. Control simulations show that the model's ability to produce this spectral profile was directly attributable to neural-style selective fatigue imposed on excitatory units. Together, the empirical and computational work underscore the value of the frequency domain in providing insights to the neural mechanisms underlying ERP component effects.

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(1162)

Semantic Satiation, Lexical Ambiguity, and Semantic Distance. CHRISTOPHER WETHERILL and ANGELA C. JONES, *John Carroll University* — Semantic satiation research indicates that weakly related (Balota & Black, 1997) or more peripheral (Kuhl & Anderson, 2011) semantic information



may become more satiated than highly related information. In the current study, we used biased ambiguous words to investigate possible differences in satiation. Participants read ambiguous words three or 30 times then made a cue-target relatedness judgment; targets were consistent with the dominant meaning, the subordinate meaning, or were unrelated to either. In Experiment 1, both meanings of biased noun-noun ambiguous words (e.g., calf) were satiated, but there was no evidence that subordinate meanings were more satiated. In Experiment 2, we used both noun-noun and noun-verb ambiguous words (e.g., duck) and replicated results from Experiment 1. Furthermore, results from Experiment 2 provide convergent evidence that greater semantic distance exists between the different meanings of noun-verb ambiguous words compared with noun-noun ambiguous words (Mirman et al., 2010).

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(1163)

Is “l8r” A Word? Semantic Priming In Electronic Communication Shortcuts. MIJA M. VAN DER WEGE and DANIEL NATHAN, *Carleton College*—Texters have historically used electronic communication shortcuts (e.g., “l8r” or “2day”) when sending SMS messages, but these shortcuts are becoming more integrated into other media (e.g., instant messaging, Twitter). As they are more frequently used, these shortcuts could be incorporated into users’ mental lexicons (Perea et al., 2008). A series of four experiments found support for the integration of shortcuts into the lexicon of college-aged participants, but not in an older sample. The results from the younger sample suggest that shortcuts can be effective primes for semantically-related target words to the same extent as their real-word counterparts and are well integrated into the semantic lexical network. Surprisingly, this effect was found in the younger sample regardless of whether or not they used the shortcuts.

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(1164)

Effects of Stimulus Quality on Eye Fixation Durations During Reading. MACKENZIE G. GLAHOLT, *Defence Research and Development Canada*, EYAL M. REINGOLD, *University of Toronto Mississauga*, KEITH RAYNER, *University of California, San Diego*—We employed a variant of the single fixation replacement paradigm (e.g., Yang & McConkie, 2001) to investigate the effect of stimulus quality on fixation durations during reading. Twenty undergraduate students read text passages in preparation for a comprehension test. The text was printed in a light gray colour for half of the passages, and in a dark gray colour for the other half. The passages’ background colour was a middle gray, such that the light gray and dark gray texts were similarly readable. Participants’ eye movements were monitored and, for randomly selected critical fixations, the passage background colour was changed to black or to white. These changes either increased or decreased the contrast of the text, depending on its colour. The middle gray background was restored during the saccade following the critical fixation. The durations of critical fixations were lengthened greatly when text contrast was decreased but were

lengthened only slightly when text contrast was increased. Because both of the contrast-change conditions involved an equivalent change in low-level luminance, the present findings point to a rapid effect of the readability of the text on the duration of individual reading fixations.

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• PSYCHOLINGUISTICS I •

(1165)

Semantic and Syntactic Factors Show Graded Effects on Both the N400 and P600 ERP Components: Evidence From Individual Differences. DARREN S. TANNER and JANET G. VAN HELL, *The Pennsylvania State University*—We recorded ERPs while participants read sentences that were well-formed, semantically-anomalous, syntactically-anomalous, or contained conflicts between semantic and syntactic information. Previous work has shown categorical N400 effects to semantic violations and P600 effects to the latter two violations. In contrast, our results showed that, in each condition, ERP effects varied continuously across individuals between N400-dominant, biphasic, and P600-dominant, but the central tendency of each effect indexed the degree of semantic and syntactic content of the anomalies: the manipulations each showed graded modulations of both the N400 and P600 effects. ERPs were negatively biased in the semantic condition, positively-biased in the syntactic condition, and equally-biased in the conflict condition. Our results suggest that the N400 and P600 are more sensitive to semantic and syntactic information, respectively, but that these information streams interact in a dynamic language comprehension system. Moreover, these effects are mediated by individual differences in semantic and syntactic cue dependence.

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(1166)

Distinguishing Between ‘Sense’ and ‘Notice’: Performing Various Perceptual Actions Elicits Differentiable P300 Responses. SEAN C. THOMAS, *Laurentian University*, LAURA CIRELLI, *McMaster University*, JOELD. DICKINSON, *Laurentian University*—Several studies have now explored the differentiation of visual action verbs (e.g. see, perceive, notice). The vast number and variety to choose from, along with a common understanding between the meanings of the words suggests they may represent measurable differences in perceptual processing. The present study investigated whether manipulating the perceptual action verb embedded within a common instruction could impact the cognitive processing of a stimulus. It was hypothesized that the P300 component elicited during an oddball task would differ depending on the perceptual action that participants had been instructed to perform during the task. Results support this hypothesis. When participants were asked to ‘sense’ deviants in an oddball task, the P300 differed in amplitude compared to when they

were asked to 'distinguish' the deviants. ERP data support the notion that identical stimuli are being processed 'differently' under the different verb conditions.

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(1167)

Corpus and Rating Data Validate Classifications of Three Different Multiword Unit Types. GEORGIE C. COLUMBUS, *McGill University*—Studies of multiword units (MWUs; i.e., frequently co-occurring word combinations) often investigate online processing of phrases such as idioms in native and non-native speaker groups. There are several MWU types, a fact which is not consistently reflected in previous research, e.g., some studies use MWU stimuli that fit into distinct categories, and in other studies the results may not be generalizable from one MWU type to others. It is therefore useful to categorize MWUs in a way that corresponds to how speakers experience them. Using corpus frequencies and human ratings, this study determines whether linguistic taxonomies for MWU categories are psychologically valid. Our results offer strong support from speaker knowledge and natural text that the decomposability, familiarity, and frequency scores of MWUs all differentiate the three MWU categories investigated. As such, the findings can provide guidelines for the design and interpretation of future studies on MWU storage, access and processing.

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(1168)

The Role of Verb Bias and Plausibility in the Resolution of Temporarily Ambiguous Sentences: An ERP Study With English Speakers. PATRICIA E. ROMAN, NICHOLAS R. RAY and CARLA CONTEMORI, *The Pennsylvania State University*, EDITH KAAAN, *University of Florida*, PAOLA E. DUSSIAS, *The Pennsylvania State University*—Using ERPs, we investigate the contribution of frequency-based verb bias and plausibility in the comprehension of syntactic ambiguity. Two factors were crossed: verb bias [direct-object (DO) and subordinate-clause (SC) bias verbs] and plausibility [whether a syntactically-ambiguous noun phrase (NP) was a plausible (PL) or implausible (IM) direct object]. A P600 was elicited for DOPL compared to SCPL sentences, indicating that readers experienced difficulty when a NP following a DO verb turned out not to be a direct object. The P600 was larger for DOPL compared to DOIM sentences, suggesting that reanalyzing a syntactically ambiguous NP is easier if it is implausible as a direct object. SCPL and SCIM sentences showed no differences in brain waves—i.e. readers expect a subordinate clause to follow SC-bias verbs and plausibility of the NP as a direct object does not play a role. Results are discussed according to models of sentence comprehension.

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(1169)

Does the Local Noun Influence Neural Processing of Subject-Verb Agreement? An Event-Related Potential Study. ERIN K. ROBERTSON, *Cape Breton University*, KEVIN J. MACDONALD, *Brock University*, JENNIFER E. GALLANT, *Cape Breton University*, KENZIE N. KOZERA,

Mount Saint Vincent University—Subject-verb agreement accuracy and speed suffer when the head and local nouns differ in number (e.g., The key (head noun, singular) to the cabinets (local noun, plural) are (verb, plural) lost). These effects are strongest when the local noun is plural (Eberhard, 1997). In the current study, Event-Related Potentials (ERPs) were recorded while English-speaking adults listened to sentences and made grammaticality judgments. Number (singular versus plural) was manipulated across the head nouns, local nouns, and verbs, creating an equal number of correct and incorrect sentences. We examined the P600, an ERP component elicited when syntactic violations are encountered (Friederici, Hahne, & Mecklinger, 1996). The P600 amplitude was larger during trials with subject-verb agreement errors. However, the number of the local noun also influenced the P600. The results are discussed within the marking and morphing model of agreement (Eberhard, Cutting, & Bock, 2005).

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(1170)

Novel Phonotactic Learning of Word-Internal Consonant Clusters. AMÉLIE BERNARD and KRISTINE H. ONISHI, *McGill University*—Adults learn novel phonotactics such as F as coda and P as onset in buFPak (word-medial onset P and coda F), and generalize to PutviF (word-edge onset P and coda F), supporting the availability of syllable-based representations. Are syllable-level and word-level representations simultaneously available? After training on a restricted set of word-medial consonant pairs (e.g., cluster FP in baFPek, DZ in kiDZet). Adults falsely recognized novel items that matched the training in consonant pairings (kiFPeb) more than those that did not (kiFZeb); thus, cross-syllable consonant clusters can be learned. Adults also falsely recognized items that mismatched in consonant pairings more when they matched the training in syllable position (kiFZeb) than when they did not (kiZFeb), even when they were in novel word positions (ZebkiF vs FebkiZ); thus, syllable-level information was also learned. The results support the simultaneous availability of both syllable-based and word-based representations during phonotactic learning.

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(1171)

Learning Grammatical Structure: Direct versus Indirect Memory Tests. BARBARA LUKA, *Bard College*, LEIGH RICH, *Columbia Teacher's College*, AMANDA BENOWITZ, *Bard College*—Recent exposure to uncommon sentence structures influences the degree to which they are found to be grammatically acceptable (structural priming). Grammaticality rating is an indirect test of memory for sentence structure and shows learning of abstract phrase structure rather than individual words. In contrast, direct tests of memory typically show poor retention of verbatim sentence structure as opposed to gist. We used a depth-of-processing manipulation during sentence reading (detect target word or target letter) followed by a direct memory test for verbatim structure (forced-choice recognition with semantically equivalent options) or an indirect measure,



namely grammaticality rating. Structural priming and explicit memory for sentence structure were differentially sensitive to the study task manipulation. Attending to the words in a sentence yielded robust structural priming (although this task does not require syntactic analysis), while letter search yielded only very weak structural priming. Explicit memory for sentence structure was insensitive to the nature of the study task. This dissociation suggests that structural priming reflects a different form of learning that is distinct from explicit episodic memory.

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(1172)

Spoken Word Recognition of Produced Versus Heard Words. TANIA S. ZAMUNER and ELIZABETH MORIN-LESSARD, *University of Ottawa*, MICHAEL PAGE, *University of Hertfordshire*—As children learn language, they spontaneously produce the speech. Whether the physical act of articulation is essential to acquisition has been questioned. Some claim it is not necessary (Gathercole et al., 1999), while others argue for a tight link between perception and production (Keren-Pornoy et al., 2010). This work explores what impact these productions may have for the development of learner's lexical representations. Adult participants were trained on non-words with visual referents, half were produced by the participants and half were just heard. Using a visual world paradigm, participants were then presented with two trained images and asked to look at a target. The data suggest that production during training predicts the speed and accuracy of how newly trained words are processed. On average, participants were faster at accessing new words that were produced compared heard during training, consistent with the hypotheses that production impacts newly formed lexical representations.

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(1173)

Getting Into A Character's Head: The Role of Reading Fiction vs. Non-fiction in Empathy. CHRISTOPHER H. RAMEY and W. JAKE THOMPSON, *University of Kansas*—Why does one read? Research in the psychology of fiction suggests that one function could be to encounter complex social situations and scenarios under relatively speaking safe conditions. That is, one reads because it affords opportunities to practice how one might behave by simulating the appropriateness of actions and responding to how characters behave in a work of fiction. Thus, the fundamental character of reading might be social or moral and not entertainment: 'How do I feel about a character's betrayal?' leads to 'How ought I to behave in the world?' Reading may be a species of moral education. Previous research suggests that there may, indeed, be a relation exposure to print literature (i.e., recognition of authors' names) and at least one measure of empathy. Participants completed various personality measures and empathy questionnaires to investigate the hypothesis that exposure to fiction (but not non-fiction, for example) is related

to psychological measures of empathy. Results indicate that exposure to fiction is positively related to empathy, especially measures that have been characterized as 'affective' empathy. Email: Christopher Ramey, dr.ramey@mac.com

(1174)

Does Literacy Change Face Recognition? KARLA B. ORIHUELA, MANUEL CARREIRAS and JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain and Language*—One of the most striking differences between literate and illiterate adults corresponds to the differential pattern of neural activation seen in these two groups in tasks requiring face perception. This led some authors to suggest that there are inherent differences in face processing due to literacy. Can the acquisition of a written system influence face perception? The present study explores this hypothesis at a behavioral level, testing literate and illiterate participants with a face recognition task including varying degrees of difficulty in the comparisons. Results showed a main effect of difficulty, which was highly similar for the two groups at test (namely, no interaction). Overall, illiterate participants made more errors than literate participants. Therefore, at a behavioral level, the consequences that reading acquisition may exert on face perception are, at best, positive in essence. We conclude that face processing is not harmed by literacy.

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(1175)

The Effects of Distal Prosody on Word Learning: Interactions between Rhythmic Context and Statistical Learning. TUULI H. MORRILL, J. DEVIN MCAULEY, KATHERINE JONES, PATRYCJA ZDZIARSKA and LAURA C. DILLEY, *Michigan State University*, LISA SANDERS, *University of Massachusetts*—Both distributional information about syllable co-occurrence, and prosodic information (e.g., pitch and duration cues), affect word learning; when local prosodic cues (e.g., phrase boundaries) conflict with transitional probabilities, statistical learning abilities are attenuated. Recently, non-adjacent or "distal" prosodic information has been shown to influence native language word segmentation (e.g., Dilley and McAuley, 2008). We examine whether distal prosodic cues also affect word learning in a novel language, and how these cues interact with statistical learning. Using an artificial language, we controlled for transitional probabilities between syllables while manipulating distal prosodic context during an exposure phase. In a test, listeners were more likely to recognize as "words" syllable sequences aligned with distal prosodic patterns during the exposure phase than misaligned sequences with identical transitional probabilities. Manipulations of intonation patterns in the test items showed that differences between pitch patterns during the exposure phase and test also affected recognition of novel words.

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(1176)

Act Local AND Global: Phonotactic Probability Effects Within Polysyllabic Nonwords. FRANCIS SMITH and PRAHLAD GUPTA, *University of Iowa*—While lexical processing is known to be affected by the similarity of words

(or parts of words) to each other or to prior knowledge, most evidence pertains to monosyllabic items. We examined polysyllabic nonwords, manipulating phonotactic probability (PP), a measure of similarity to prior linguistic knowledge. In two experiments, five-syllable nonwords were presented auditorily to participants for immediate repetition. Experiment 1 manipulated PP of the first syllable of each nonword, keeping the remaining syllables identical across conditions, and minimizing relative PP differences across conditions. Experiment 2 manipulated only the second syllable of each nonword, with the same controls as E1. Both experiments revealed syllable-level repetition accuracy effects of PP only at the serial position of the manipulated syllable, and overall repetition accuracy differences between conditions despite their similar overall PP. These results show that participants are sensitive to local similarity in polysyllabic nonword processing even when overall similarity is controlled.
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(1177)

Disfluencies in the Speech of the Elderly: Effects on Real-Time Interpretation. DANIEL DESANTIS, ELIZABETH JOHNSON and CRAIG CHAMBERS, *University of Toronto*—Previous work has shown that listeners interpret disfluencies in speech as a cue that the speaker is experiencing temporary difficulty in message formulation (e.g., the “uh” in “Click on the, uh, red star” leads listeners to anticipate reference to things the speaker has not described earlier). Here, we examine age-related differences in listeners’ on-line reactions to disfluencies in referential descriptions. Because older adults are comparatively more disfluent when speaking, it is plausible that the informational cues provided by disfluencies will be disregarded in the speech of older talkers. Using a Visual World methodology, we found that listeners treated disfluencies in the recorded speech of a 70- and 20-year-old as equally informative. Further, this sensitivity did not vary as a function of listeners’ attitudes toward cognitive aging or their (mis)assessment of the 70-year-old’s extent of disfluency. Finally, a comparison of older and younger listeners showed no differences in their sensitivity to disfluencies, demonstrating the efficient and automatic use of this cue across the adult lifespan.

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(1178)

The Conceptual Representation of Number. NIKOLE D. PATSON, *The Ohio State University*, GERRET GEORGE and TESSA WARREN, *University of Pittsburgh*—We investigated comprehenders’ mental representations of plural noun phrases (NPs). Participants read a sentence that ended with either a singular NP, plural NP, or two-quantified NP (e.g., The farmer saw the apple/apples/two apples) and then saw a picture of either a single item, two items, or a small set (3-6) of items. Participants judged whether there was overlap between the pictured object(s) and a noun in the sentence. Judgment times showed an interaction between NP type and number of pictured items. For singular and two-quantified NPs, participants were reliably faster to respond “yes” to a picture of the same number of objects as the NP, but for

plural NPs, there was no reliable effect of picture type. These results suggest that the difference between singular and plural mental representations is not simply the presence or absence of a plural feature, and are consistent with theories in which plurality is unmarked (Sauerland et al., 2005).
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(1179)

The Effect of Sarcasm on Homophone Ambiguity Resolution. SARA A. PETERS, *Newberry College*, AMIT ALMOR, *University of South Carolina*—We report a visual world experiment examining how sarcasm affects homophone interpretation. We tested both balanced homophones (both meanings are equally likely) and unbalanced homophones (one meaning is dominant and the other subordinate). Homophones also varied in frequency (high vs. low). The placement of the sarcasm in discourse containing the homophone was either following the homophone or combined with it. We measured the number of fixations to two depicted scenes, each compatible with only one of the meanings. For unbalanced homophones, sarcasm resulted in more fixations to subordinate-low frequency meanings than in the sincere conditions (p 's < .001). For balanced homophones, frequency interacted with sarcasm placement but the effects were small. Thus, it appears that multiple contextual and lexical constraints contribute to how sarcasm affects spoken language interpretation. These results support general language processing theories of sarcasm resolution (e.g., Relevance Theory).

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(1180)

Neuroelectric Markers of Lexical Ambiguity Resolution of Visually Presented Words in Sentence Contexts: A Time Course Study. MARK E. FAUST and ELAINE HILL, *University of North Carolina at Charlotte*, JORDAN PIERCE, *University of Georgia*—Written language comprehension requires integration of information activated during lexical access with the prior sentence context. In the case of homographs, words with the same written form but distinct meanings (e.g., bank), this involves incorporation of contextually appropriate meanings and, perhaps, suppression of contextually inappropriate meanings. In the present study, we focus on neuroelectric markers of the activation of contextually inappropriate homograph meanings, e.g., the N400, a negative scalp potential sensitive to the semantic incongruity between a word and prior sentence context. We use a semantic relatedness task where participants judge the semantic relationship between global sentence meaning and a target word related to the alternative meaning of a sentence-final homograph. We report on neuroelectric markers associated with the suppression of contextually inappropriate homograph meanings over time.

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• JUDGMENT AND REASONING •

(1181)

The Effects of Practice, Verbalization, and Mode of Presentation, on Problem Solving Strategies for the Tower of Hanoi Problem. LUCAS WONG and GARY KOSE, *Long Island University, Brooklyn Campus*, JAY KOSEGARTEN, *Southern New Hampshire University*—This study is concerned with the interaction of practice experience, verbalization, and the mode of presentation on finding solutions to the Tower of Hanoi problem. The present study employed a 2 x 2 x 2 between groups, factorial design. The independent variables are: mode of presentation (computer analogue vs. actual task), practice (no prior practice or practice with 2 & 3 disc problems), and verbalization (no verbalization or verbalization while solving the criterion problem). The dependent variable is performance on a four disc problem, measured by the number of moves and time needed for completion. Participants were randomly assigned to one of the eight conditions in the design. Analysis revealed significant main effects and several interesting interactions. These findings are discussed in terms of the distinctions between solving a problem through a computer analogue and the overt actions involved when solving the problem with actual physical objects. The nature of a problem determines what factors may influence problem solving performance. The classic Tower of Hanoi problem has a clear starting point and end goal, with clearly defined steps within the problem space for reaching a solution. This problem has been studied because it involves executive functions, planning, recursive operations, and means-end strategies. Some studies have examined the effects of prior practice experience on problem solving strategies (e.g., Anzai & Simon, 1979; Neves & Anderson, 1981); while others have looked at the effects of verbalization on achieving solutions (e.g., Ahlum-Heath & Frances, 1986). More recently, studies have examined how the mode of working on a problem can influence the course of finding problem solutions (Fireman & Kose, 2002; Noyes & Garland, 2003; Williams & Noyes, 2007). Yet, the nature of facilitating practice experiences, whether repetition or verbalization, is mediated by the mode through which a problem is presented.

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(1182)

A Test of One-Process and Two-Process Accounts of Inductive and Deductive Reasoning. RACHEL G. STEPHENS and JOHN C. DUNN, *The University of Adelaide*—An ongoing debate in reasoning research is whether inductive reasoning and deductive reasoning can be better accounted for by one-process or two-process theories. One-process accounts assert that people apply the same cognitive mechanisms to problems of induction and deduction, such as reasoning based on a single scale of evidence for argument strength. Two-process accounts propose that separate processes, such as heuristic and analytic processes, contribute to reasoning. We present a test of these two accounts by extending the logic of state-trace analysis (Dunn, 2008) to identify the dimensionality of inductive and deductive judgements. We perform a meta-analysis on existing research that has investigated people's

inductive and deductive judgements for logically valid and invalid arguments, seeking evidence for effects that should not be observed if the single-process model is correct. We discuss whether there is sufficient evidence to reject a single-process account in favour of a multiple-processes account.

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(1183)

Metacognition About Decision-Making, Decision-Making Strategies, and Decision Competence. SHARON LEE ARMSTRONG, *La Salle University*—The present study investigated the relationships among several cognitive variables that are thought to be important for effective decision-making. These included the Metacognitive Awareness Inventory (MAI, Schraw & Dennison, 1994), which measures adults' metacognitive awareness, and the two major components of metacognition knowledge and regulation of cognition; a measure of decision-making style, the Preference for Intuition and Deliberation scale (PID, C. Betsch, 2004, 2008); and a constructed measure of metacognitive knowledge that is specifically about effective decision-making. The dependent measure of effective decision-making was performance on several decision-making scenarios for which there were pretested preferred solutions. As expected, general metacognitive awareness, specific meta-decision-making knowledge, and decision-making style were significant predictors of effective decision-making. However, the predictions were not uniform across all types of decision scenarios.

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(1184)

Unconscious Thought and Subjective Evaluation in Consumer Decision Making. BRIAN M. FRIEL, *Delaware State University*—Unconscious Thought Theory (UTT) was evaluated in an experiment similar to Dijksterhuis' (2004) Experiment 2. Participants made three separate decisions for different consumer products, and options varied by attribute valence ratio (Best = 8+/4-, Middle = 6+/6-, Worst = 4+/8-). Participants were assigned to one of three groups: (1) Immediate—choices made immediately after viewing statements about each option's attributes; (2) Conscious Thought—participants given time to think before deciding; or (3) Unconscious Thought—participants distracted with an anagram task before deciding. Results provide mixed support for UTT, in that Unconscious Thought participants were most likely to choose the Best option, but only slightly. Better anagram task performance was also associated with Best option selection, perhaps suggesting that greater distractor task engagement led to more unconscious thought devoted to the decision task. However, across all groups subjective differences between the Best and Middle options played a greater role in decisions.

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(1185)

The Effects of Image Size and Viewing Distance on Facial Trustworthiness. ROBIN S.S. KRAMER and DINKAR SHARMA, *University of Kent*—How we perceive

trustworthiness in the face has been the focus of much research, while the effect of how these faces are presented has received little consideration. Given the importance of physical distance in social interactions, we hypothesize that artificial manipulations that affect perceived distance may also influence social perceptions like trustworthiness. Using a between-subjects design with four presentation conditions, participants rated faces for trustworthiness that were small/big onscreen, and appeared near to/far from the viewer by altering the screen's position. For small images, faces were perceived as more trustworthy at the greater presentation distance. For the larger images, males rated faces that were further away as more trustworthy, while females showed the opposite pattern, with nearer faces rated as more trustworthy. These results suggest sex differences in how invasions of personal space are interpreted, informing our understanding of how social perceptions develop.

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(1186)

How Does Provided Information Influence Subsequent Information Search? PETRA BRADLEY, WILLIAM BURNS, PATRICK CAMPANELLO, SHAINA CASTLE, KRISTIN GRUNEWALD, ISAIAH HARBISON, ERICA MICHAEL and LELYN SANER, *University of Maryland*—When searching for information, is it helpful to be given a subset of information before initiating search? Would such “pushed” information change how, or even if, people continue to search for additional information? For example, might receiving a carefully vetted set of preselected articles on a topic result in a more constrained search? To examine this question, we conducted an experiment in which participants ($n=130$) were asked to search a publicly available crime database to decide whether a fictional real estate development company should consider purchasing property in each of 12 different neighborhoods. Participants were provided 0, 5, or 20 crime reports from each neighborhood before having the opportunity to search for additional crime reports. We will present data on search behavior in the three conditions by examining variables such as the total time spent searching for information, the number of submitted queries, and the number of crime reports opened. Email: Erica Michael, emichael@casl.umd.edu

(1187)

Betting the Future to the Wrong Odds: Underestimation of Probability in a Real-Life Decision. GORKA NAVARRETE, *York University*, CARLOS SANTAMARIA, *Universidad de la Laguna*—When facing probability problems people seem to disregard a basic principle of probability: the sum of the probability of the presence and the absence of an event is always 1. In 2 experiments we showed how participants were unable to calculate the probability of an event in a real-life setting, independently of their personal investment. In Experiment 1 our participants were about to take part in a competitive exam to enter the public-service. They answered a question about the probability that one of the topics they studied would be part of the exam, and they underestimated by more than a 35% the correct probability. This underestimation might have determined their chances of success. In a second experiment

with Psychology students, we showed how focusing on the complementary set (non-studied topics) changed drastically the response pattern, as more than half of the participants switched to an overestimation pattern. The inability of our participants to calculate the correct probability might be explained by their adherence to a linear approach when dealing with complex probability calculations. Their level of adjustment to this linear approach (topics studied/total topics), was surprisingly good.

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(1188)

Assessing Risk Following a Wireless Emergency Alert: Are 90 Characters Enough? MARK A. CASTEEL and JOE R. DOWNING, *Penn State York*—During a severe weather event, the public must be quickly notified so that they can make effective decisions about risk. To this end, FEMA, in collaboration with wireless carriers, developed Wireless Emergency Alerts (WEAs) that allow officials to send text-based messages to cellphone users. WEAs are geographically targeted and sent to only those users in the warning area. Notably, however, WEA standards limit the message to 90 characters with no graphics. The impoverished nature of WEAs raises the empirical question of whether they provide enough information for effective decision-making. The present research therefore compared the effectiveness of WEAs to warnings with more content. Participants were given maps with a “you are here” icon. All maps included a WEA for a tornado warning, and some maps included additional warning information. Participants assessed risk and potential action. Implications of our results will be considered in light of WEA standards.

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(1189)

Memory Indexing for Tracing the Sequential Processing of Ambiguous Evidence. GEORG JAHN and JANINA BRAATZ, *University of Greifswald*—Memory retrieval and working memory access of information that is associated with a specific location in visible surroundings triggers eye movements towards this location even if the information is no longer visible there. This looking-at-nothing phenomenon can be employed to study memory-based reasoning processes such as diagnostic reasoning. We let participants learn about causes and symptoms in a spatial array and recorded eye movements on the emptied array while the participants processed sequences of ambiguous symptoms. Their task was to infer the most likely cause. Ambiguous symptom sequences are suited to study order effects in information integration such as primacy and confirmation bias favoring the first focal hypothesis. Spatially indexing causes and symptoms allowed us to trace the memory-based processes of generating hypotheses, biased symptom processing, parallel belief updating, and hypothesis change unobtrusively via eye tracking.

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(1190)

Training Attention Toward Positive Stimuli Improves Depressives' Reward Processing Deficits in Decision Making. JESSICA A. COOPER and MARISSA A. GORLICK, *University of Texas at Austin*, DARRELL A. WORTHY, *Texas A&M University*, CHRISTOPHER G. BEEVERS and W. TODD MADDOX, *University of Texas at Austin*—Depressives show deficient reward processing, but enhanced punishment processing. Training attention away from negative-valenced words via a modified dot-probe task reduces depressive symptoms. This suggests that training attention towards positive-valence words could improve deficient reward processing. Trained depressives, untrained depressives, and non-depressives completed a reward-maximization decision task. Untrained depressives performed worse than trained depressives and non-depressives, with untrained depressives switching options too often. A novel reinforcement-learning model that separates positive and negative prediction errors was applied to the data. Results suggest that the untrained depressives learned more from negative than from positive prediction errors, leading to more frequent switching. The trained depressives and non-depressive groups showed similar learning from positive and negative prediction errors, leading to less frequent switching and better performance. Thus, training attention toward positive items in a depressive population enhances their decision-making by reducing attention to negative prediction errors, resulting in less sub-optimal switching between options.

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(1191)

Automatic Processing of Peripheral Words. YAAKOV HOFFMAN and ARI Z. ZIVOTOFSKY, *Bar Ilan University* (Sponsored by Yoav Kessler)—In the gender congruency (Stroop-like) task, participants are shown a male/female stick figure that appears with either a congruent/incongruent word. Participants were required to identify the figure by a button press as accurately and quickly as possible. Words appeared either separately (Exp. 1) or superimposed on figure (Exp. 2). Figures appeared at 3 or 6 degrees right/left of fixation. Congruent stimuli were responded to faster than incongruent stimuli and the effect was impacted by position of figure relative to fixation, suggesting that the non-monitored peripheral words were processed semantically during fixation. Further confirmation was obtained by using an eye tracker (Exp. 3) where only data in which the subject was fixating at the center was analyzed. To guarantee that subjects did not saccade to the figure, stimuli appeared for only 180 ms. Nonetheless, congruency effects were obtained even when the words appeared at 11 visual degrees eccentricity.

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(1192)

Grant Funding Agencies. Information about various grant funding opportunities is available. Representatives will be present throughout the conference.

POSTER SESSION II

Friday Noon,

Sheraton Centre Toronto Hotel, Sheraton Hall

Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• PERCEPTION II •

(2001)

Perception of the Focus of Motion in Point Light-Display: the Effect of Hierarchical Levels on Performance. REIKO YAKUSHIJIN, *Aoyama Gakuin University*, SACHIYO UEDA, *Ochanomizu University*—Hierarchical structures are embedded in biological motion. We investigated how the hierarchical characteristic affects the perception of the “focus of motion (FOM)”, which we defined as the point which positional change causes the changes in other parts of the structure. For example, when someone hitches his/her elbow, the FOM is the elbow although other parts (e.g., fingers) also change their position. It is plausible that the FOM is an important feature for our action perception. Three experiments and simulations were conducted. In Experiment 1 and 2, four-folded arm-shaped point-light display was presented. Participants were asked which point was the FOM (Exp 1), or how many points moved (Exp 2). Performance was significantly better when the actual FOM was in higher levels of the hierarchy in both experiments. In Experiment 3, position of each point was randomized so that the hierarchical characteristic was removed. Although the task was the same as in Exp 2, the performance had opposite tendency. Results of simulations suggest that the performance impairment along with the hierarchical level lowering as in the Exp 1 and 2 was an inevitable outcome when the hierarchical information was utilized efficiently in the task.

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(2002)

The Contribution of Efferent Copy to a Mirror Illusion. DAISUKE TAJIMA, *Tokyo Institute of Technology*, TOTA MIZUNO, *The University of Electro-Communications*, YUICHIRO KUME, *Tokyo Polytechnic University*, TAKAKO YOSHIDA, *Tokyo Institute of Technology*—When people view their left hand in a mirror positioned along midsagittal plane while moving both hand synchronously, the hand in the mirror visually captures the unseen right hand sensation, and people hardly notice the spatial offset of these two. This is called mirror illusion. To test the contribution of the efferent copy to this illusion, we used a finger movement illusion induced by vibro-tactile stimulation on the fingertip (Mizuno, et al., 2010). Machine learning estimated the area participants didn't notice the offset between their real and mirrored hand in a 2D plane along the mirror. The area size comparison between two conditions (illusory movement and actual one) revealed no significant difference. Furthermore, the vibro-tactile stimulation addition to actual movement condition enlarged the area. Our results suggest that the efferent copy is not necessary for mirror illusion and just the number of the modalities we receive feedbacks is the matter.

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(2003)

The Misdirection of Attention in Time: Insights From Magicians. ANTHONY S. BARNHART, *Northern Arizona University*, STEPHEN D. GOLDINGER, *Arizona State University*—Magicians are informal cognitive scientists who regularly test their hypotheses in the real world. As such, they can provide scientists with novel hypotheses for formal psychological research as well as a real-world context in which to study them. One domain where magic can directly inform science is the deployment of attention in time and across modalities. Magicians have highlighted a set of variables that can create moments of visual attentional suppression, which they call “off-beats.” The current research examines two of these variables in conditions ranging from artificial laboratory tasks to the (almost) natural viewing of magic tricks. We show that the detection of subtle dot probes in a noisy visual display and pieces of sleight of hand in magic tricks can be influenced by the rhythmic qualities of auditory stimuli (cross-modal attentional entrainment) and processes of working memory updating (akin to the attentional blink).

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(2004)

The Possibility of Out-of-Body Experience Under Correlated Visual-Tactile Input Through Air Flow. SHOKO KANAYA, MARINA MORI and KAZUHIKO YOKOSAWA, *The University of Tokyo*—Visual information from the first-person perspective and correlated visual-tactile input are necessary for a coherent representation of one's body. It has been reported that one feels as if he himself is out of the body, when he looks at a video of his back monitored by camera through head-mounted displays, while experiencing synchronized visual-tactile stimulation to the space just in front of camera and to his chest (out of view). This phenomenon has been demonstrated using local visual-tactile stimulation. Yet it remains unclear whether or not global stimulation induces a similar perceptual illusion. We investigated whether a broad air flow to one's body and a view of an electric fan circulating air can induce such an illusion. Participants' skin conductance responses and their questionnaire ratings indicated that their experiences were not identical to those of the originally reported illusion. Factors that contribute to a coherent body representation are discussed.

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(2005)

Effects of Focused Breathing on ERP Indices of Emotional Processing. MARIANNA EDDY and SARAH TOWER-RICHARDI, *US Army Natick Soldier Research, Development, and Engineering Center; Tufts University*, GINA KUPERBERG, *Tufts University; Massachusetts General Hospital*, TAD BRUNYÉ, *US Army Natick Soldier Research, Development, and Engineering Center; Tufts University*—The current study aimed to examine whether a brief mindfulness induction,



namely focused breathing, relative to an active control, unfocused breathing, can alter electrophysiological indices of processing emotional images. We focused on the late positive potential (LPP), which is sensitive to the arousal and valence of images, with more arousing positive and negative images producing larger LPPs than neutral images. Research examining dispositional mindfulness has found those who are more mindful have smaller LPPs compared to less mindful participants (Brown et al., 2012). We experimentally manipulated mindfulness with the focused breathing manipulation and found that within the focused breathing session, those who reported at the end of the session that they felt more decentered, had smaller LPPs to negative images relative to neutral images compared to those who were less decentered after the focused breathing manipulation.

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(2006)

Target Detection in a Scenario of Natural Sounds: The Role of Spatial Sound Source Separation. SUSANNE MAYR, GUNNAR REGENBRECHT, KATHRIN LANGE, ALBERT-GEORG LANG and AXEL BUCHNER, *Heinrich-Heine-University Düsseldorf*—With the experiments presented here we determined the circumstances under which spatial information is used to accomplish target searches among multiple sounds. Participants searched for a visually cued sound in a complex acoustic scenario of up to eight sounds played simultaneously (Experiment 1). Sounds were presented either from different locations each or all from the same location. Furthermore, set size and presentation time were manipulated. A search benefit for spatially separated sound sources was found that was independent of presentation time. This benefit was modulated by cue modality (Experiment 2): With auditory instead of visual cues, the spatial separation of the sound sources was beneficial in target absent trials but not in target present trials. The findings indicate that auditory searches benefit from spatial information, but only if direct auditory pattern matching processes cannot be applied.

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(2007)

Perceptual Asymmetries in a Time Estimation Task With Emotional Sounds. DANIEL VOYER and EMILY REUANGRITH, *University of New Brunswick*—Two experiments investigated potential interactions between emotional content and perceptual asymmetries in the estimation of short time intervals. In both experiments, the word “bower” was presented unilaterally to the left or right ear in an angry or neutral emotional tone and participants performed a temporal bisection task. In Experiment 1 (N = 105), stimuli ranged in duration from 260 to 440 ms (in steps of 20 ms) whereas in Experiment 2 (N = 81), duration ranged from 260 to 480 ms (in steps of 20 ms). In both experiments, results showed a larger bisection point for angry than for neutral emotional tones, and for the right compared to the left ear. Examination of constant error data suggested a left ear advantage in both experiments, although no ear effect was

observed on Weber’s ratio. Results are discussed in terms of their implications for time perception mechanisms and their potential cerebral representation.

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(2008)

Neural Oscillations, Temporal Modulation Rate Filters, and Periodicity Maps in Human Auditory Cortex. GREGORY HICKOK, ALYSSA A. BREWER and KOUROSH SABERI, *University of California, Irvine*—Temporal regularities are a property of neural signaling (oscillations), are readily detectible psychophysically (AM rate discrimination), and are reflected in the organization of human auditory cortex (periodicity maps). Building on previous work, we propose a link between these observations in the form of a neurally inspired model that uses a simple excitatory-inhibitory network to build a temporal modulation rate filter bank. Rate tuning of each filter is accomplished by varying the transmission delay between excitatory and inhibitory units. Filters exhibit phase resetting, amplify signals that are modulated at their preferred frequency, and when presented with complex modulated signals separate out the component modulation frequencies. We suggest this as a possible neural mechanism for temporal modulation rate filtering and as the basis for the formation of periodicity maps in human auditory cortex.

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(2009)

Binaural Temporal Fusion Shifts Perceptual Boundary of Stop Consonants. YOUSUKE KIKUCHI, SHUJI MORI and NOBUYUKI HIROSE, *Kyushu University*—Identification of voiced and unvoiced stop consonants depends on the duration of voice onset time (VOT), which is shorter for voiced than unvoiced consonants. Since VOT is the period of a relatively low amplitude (perceptually a silent gap), VOT-based perception of stop consonants may follow properties of gap detection: gap thresholds become considerably longer when leading and trailing markers are presented to separate ears than to a single ear. This led us to hypothesize that stop consonants tend to be perceived as voiced (shortened VOT) when the consonants and the following vowel are presented to separate ears. This hypothesis was tested in a /ba/-/pa/ identification task with speech stimuli of varying VOTs. In the binaural fusion condition, each stimulus was segmented at an approximate phoneme boundary and presented to separate ears. The results showed that the perceptual boundary of stop consonants in the binaural fusion condition was shifted toward long VOTs from that obtained in the monaural condition. This finding will be discussed in terms of mechanisms underlying speech perception and gap detection.

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(2010)

Perception of an Illusory Surface by Pigeons (*Columba livia*). YURIKA KOMATSU and TOMOKAZU USHITANI, *Chiba University*—Pigeons were investigated whether they perceived a Kanizsa-type illusion, where four inward-facing sectored disks produce an illusory bright surface in the center area that appears to occlude the shapes around it. During training, we

presented four sectorized disks, which were randomly directed so as not to form an illusory surface, around a square of varying brightness. Pigeons were trained to classify squares as light or dark. On non-rewarded test trials, we presented the inward illusory pattern or a novel non-illusory pattern in which all disks were directed outward. Pigeons responded dark to the inward illusory pattern but to the outward pattern equally as bright or dark. These results suggest that these pigeons perceived an illusory surface within the inward pattern as humans do. However, contrary to humans, this pattern seems to be perceived as a dark surface. These results support an idea that the perception of the illusory surface can be achieved by two independent sub-processes.

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(2011)

The Effects of Numerical Magnitude Size and Color Saturation on Perceived Interval Duration. DOUG ALARDS-TOMALIN, JASON P. LEBOE-MCGOWAN, JOSHUA SHAW and LAUNA C. LEBOE-MCGOWAN, *University of Manitoba*—The relative magnitude (or intensity) of an event can have direct implications on timing judgments. Previous studies have found that greater magnitude stimuli are judged as longer in duration than lesser magnitudes (Xuan, Zhang, He & Chen, 2007), including Arabic digits. One explanation for these findings is that different quantitative dimensions (size, intensity, number) are processed and represented according to a common analog magnitude system (Walsh, 2003). In the current study, we examined whether there were commonalities in how people judge the intervals of time occurring between stimuli of different magnitudes from a variety of quantitative dimensions, which included number, size and color saturation. It was found that duration judgments increased systematically as the overall magnitude difference between sequentially presented stimuli was increased. This finding was robust against manipulations to the direction of the sequence, or whether the sequence followed ordered (continuous) or non-ordered (discontinuous) trajectories. Additionally, these response biases were stronger for the size and color saturation dimensions over number.

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(2012)

Falling Stars: Acoustic Influences on Visual Meteor Detection. DARLENE EDEWAARD and MICHAEL S. GORDON, *William Paterson University*—As particles enter the earth's atmosphere they produce a burst of electromagnetic energy, including visible and radio-wave emissions. Consequently, just as meteors can be detected visually in the night sky they can be "heard" using radio telescopes. The current project investigated the potential influence of these audio signals on visual meteor detection. In related research it has been found that auditory signals can enhance or even alter visual perception of objects. The current project examined the specific effects of accompanying auditory signals on the detection of meteors. Meteors present an interesting case of audiovisual integration in that detection paradigms often entail extended vigilance and extremely brief, yet brilliant

astronomical events. Experiments specifically investigated how auditory signals that varied in spectra influenced changes in visual magnitude and duration judgments of meteors. Results are described in terms of audiovisual integration and the relation of perceptual mechanisms to meteor detection.

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(2013)

Are Visual and Auditory Motion Perceptually (or only Metaphorically) Related? LAURA M. GETZ and MICHAEL KUBOVY, *University of Virginia*—There is debate over whether the cross-modal correspondence between pitch height and visual elevation is culture- or language-dependent. Given that detection thresholds are cognitively impenetrable and thus not affected by knowledge or expectations, here we asked whether the threshold of visual motion is affected by congruent or incongruent auditory motion. Participants saw a briefly presented random dot kinematogram. Concurrently they either heard no sound or rising or falling auditory motion. We varied the ratio of dots moving randomly to dots moving vertically (up or down) using an adaptive staircase, and participants reported whether the dots were moving up or down. We found that visual motion was more detectable in the presence of auditory motion than in its absence. However, the direction of the auditory motion had no effect. We will also report on the effects of visual motion on the threshold of auditory motion.

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(2014)

Conceptual Priming With Pictures and Environmental Sounds. YONGJU KIM, *Korea Military Academy*, ANNE M. PORTER, KATHRYN WEATHERFORD and PAULA GOOLKASIAN, *University of North Carolina at Charlotte*—Two experiments were conducted to examine conceptual priming within and across modalities with pictures and environmental sounds. We developed a new multimodal stimulus set consisting of two picture and sound exemplars that represented 80 object items. In Experiments 1 and 2, we investigated whether categorization of the stimulus items would be facilitated by picture and environmental sound primes that were derived from different exemplars of the target items. The results demonstrated that the categorization of environmental sounds and pictures were facilitated in a similar way by conceptually related exemplars presented in advance, but only when a long inter-stimulus interval (1000 ms) was used. Additionally, conceptual cross-modal priming effects by picture and sound primes were asymmetric with systematic switch costs across modalities and with differences in the time-course of activation.

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(2015)

Assessing Stimulus Dependencies and Congruency as Contributions to the Development of Multi-Modal Objects. ZARA CHAN and BEN J. DYSON, *Ryerson University*—In addition to spatial and temporal factors, the binding of auditory and visual features may be facilitated by the degree of featural co-occurrence and correspondences between the



modalities. We extended a paradigm examining differences in responding to multiple features of the same/different object to same/different modality. We manipulated the degree of featural co-occurrence in Experiment 1 and featural co-occurrence and cross-modal correspondence in Experiment 2. In each case, performance was assessed under baseline, strong intra-modal featural co-occurrence, and strong inter-modal featural co-occurrence conditions. Experiment 1 showed a same modality effect, which modulated as a function of condition. Experiment 2 replicated the modulation of same modality responding as a function of featural co-occurrence, but correspondence did not robustly change the effect. We discuss the data in the context of the statistical learning literature and the potential conditions under which stimulus dependencies and correspondence might interact when bridging the senses.

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(2016)

Vocal Distortions Due to Age-Related Information.

MARILYN G. BOLTZ, *Haverford College*—Is the perception and memory of human voices influenced by facial information? This issue was investigated by asking participants to evaluate the acoustical characteristics of various middle-aged voices that were accompanied by younger, older, middle-aged, or no faces. The results revealed that, relative to the latter two control conditions, the presence of older and younger faces differentially influenced the perception of several vocal qualities, including those of tempo, rhythm, resonance, enunciation, and pitch control. A second experiment further revealed that facial information distorted the recognition of vocal tempi in an age-related fashion. As a set, these findings provide insight into the nature of intersensory cognition.

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(2017)

Visual, Auditory, and Audiovisual Right-Left Prevalence Effects.

MARY K. NGO, *California State University, Long Beach*, KATSUMI MINAKATA, *North Dakota State University*, KIM-PHUONG L. VU, *California State University, Long Beach*—Previous studies have shown right-left prevalence effects for unimodal auditory and visual stimuli. In the present study we examined whether the right-left prevalence occurs for audiovisual stimuli. We also examined whether auditory or visual dominance occurs in the two-dimensional stimulus-response compatibility context. Because the prevalence effect is often determined by the salience of the vertical and horizontal dimensions in the task environment, we included a condition in which the pitch of the auditory stimuli was mapped compatibly to the vertical dimension. We found a larger right-left prevalence effect for unimodal auditory than visual stimuli, replicating prior studies. Neutral audiovisual stimuli did not result in crossmodal facilitation, but did show evidence of visual dominance. The right-left prevalence effect was eliminated when the vertical pitch dimension was introduced to the audiovisual stimuli. However, the elimination of the effect was a result of a reduced horizontal compatibility effect rather than an increased vertical

compatibility effect. This finding indicates that vertical cues introduced in the task environment can reduce participants' reliance on horizontal coding.

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(2018)

Infants are Sensitive to Audiovisual Speech Synchrony.

KATHLEEN E. SHAW, ARIELLE RUBIN, JESSICA CASTAGNETTI and HEATHER BORTFELD, *University of Connecticut*—Speech perception is inherently multimodal. However, audiovisual (AV) sensitivities develop throughout childhood, suggesting that integration is experience-dependent (Hillock et al., 2011). Previous work has used brief stimuli (e.g., flash-beeps) when assessing sensitivity to AV-signals. The current study provides a more ecologically valid test of AV-perception by exposing infants to synchronous or asynchronous trisyllabic words. Infants were presented with both synchronous and asynchronous videos (audio preceding visual by 300 ms). Infants were split into younger (< 7-months) and older (> 7-months) groups, as infants frequently babble and focus on speakers' mouths at this time. We predicted that older infants, but not younger infants, would prefer synchronous AV-speech. Overall, older infants, but not younger infants, looked significantly less at asynchronous displays, $p < .05$. Results suggest infant sensitivity to AV-speech synchrony develops early and as infants become language producers as well as perceivers, they develop stronger preferences and sensitivity for temporally congruous speech signals.

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(2019)

Gestalt Processing and Working Memory in Haptic Perception.

KRISTA E. OVERVLIET, JOHAN WAGEMANS and RALF T. KRAMPE, *University of Leuven*—Recognizing objects or their 2D representations through haptic exploration requires extensive sensorimotor processing, intermediate integration of haptic features into a visual image and finally matching this image against stored object representations (Klatzky & Lederman, 1987). Compared with young adults older adults take more time or more frequently fail to recognize haptic 2D shapes. Working memory limitations constrain the integration of features into a coherent intermediate image during haptic processing which is generally slowed in older adults (Overvliet, Wagemans & Krampe, Panda, in press). In previous studies (Overvliet, Krampe, Wagemans, JEP:HPP, 2012) we showed that Gestalt grouping can make haptic perceptual processing more efficient. In the present study we had young and older participants perform haptic search tasks, in which certain conditions allowed Gestalt grouping of items. Older adults showed larger benefits of Gestalt grouping compared with young adults. We conclude that age-related performance declines due to central capacity limitations can be partly compensated for by making perceptual search processes more efficient through the usage of Gestalt grouping.

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• SPATIAL COGNITION II •

(2020)

The Role of Sense of Direction and Other Factors During Navigation in a Large-Scale, Unconstrained Environment.

ELISABETH J. PLORAN, *Hofstra University*, ERICKA ROVIRA, *US Military Academy*, JAMES C. THOMPSON and RAJA PARASURAMAN, *George Mason University*—Studies of spatial navigation in real world settings have been limited to neighborhoods, college campuses, and building interiors. These settings allow for navigation without the ability to see all locations simultaneously, thus resulting in a potentially truer test of an individual's overall knowledge of the area. However, these locations still have built-in structural components, such as roads or hallways, which may constrain and/or direct navigation. The current study assessed navigational skills within a large-scale forested environment that contained few pre-established paths. Participants were asked to find flags at specific coordinates within a six square mile area using only a map and compass. In addition, measurements of sense of direction, strategy, and working memory were taken in an attempt to identify how these cognitive abilities influence navigational performance. The results suggest a more complicated interaction among sense of direction, strategy, and working memory abilities during large-scale navigation. Email: Elisabeth Ploran, elisabeth.j.ploran@hofstra.edu

(2021)

Distraction Shrinks Space. JESSE Q. SARGENT, *Francis Marion University*, JEFFREY M. ZACKS, *Washington University in St. Louis*, JOHN W. PHILBECK, *George Washington University*, SHANEY FLORES, *Washington University in St. Louis*—Tracking the length of a walked path is important for navigation, and what you do while walking a path can affect memory for distance. Path features (e.g., turns, intersections, landmarks) often cause an increase in remembered distance, but performance of a concurrent task during path encoding can cause a decrease in remembered distance. We aimed to understand these contrasting effects. Blindfolded participants were guided along two legs of a right triangle. On some trials, one of the two legs contained features: car antennas mounted horizontally on stands that bent out of the way on participants' torsos as they passed. At the end of the second leg, distance memory was tested by either ratio estimation, or triangle completion. In the ratio estimation data, with and without visual access during encoding, and with and without a filled delay between encoding and response, path legs with added features were remembered as shorter than those without. When people form spatial memory representations with the intention of navigating in room-scale spaces, interfering with information accumulation can distort spatial memory. This may reflect the influence of memory for duration on memory for distance. Email: Jesse Sargent, jquents@gmail.com

(2022)

Spatial Biases in Depiction of Scenes With Implied Movement: Does Script Direction Matter? JYOTSNA VAID, *Texas A&M University*, ANATOLIY KHARKHURIN,

American University of Sharjah, KEEN S. LIEW and KAYOUNG KIM, *Texas A&M University*—Studies have found a directional bias in the facing of drawn objects: a leftward bias is reported in users of left-to-right written languages (Vaid, 2011). Script direction has also been found to influence the spatial placement of objects in a static scene (Vaid, Rhodes, Tosun, & Eslami, 2011) and aesthetic judgments for different movement trajectories (Maass, Pagani, & Berta, 2007). The present study examined whether script direction would influence the representation of objects in scenes with implied movement (e.g., a schoolbus arriving at a stop, a girl kicking a soccer ball). Participants were monodirectional (left to right) or bidirectional (LR and RL) readers. Both groups showed a rightward bias in the depiction of movement. In addition some differences were observed in the alignment of objects along a horizontal vs. vertical axis. Biomechanical factors and cultural variability in spatial schemas may obscure script directionality influences in the depiction of scenes with implied movement. Email: Jyotsna Vaid, jxv@psyc.tamu.edu

(2023)

Visual and Linguistic Measures of Spatial Coherence in Memory for Scenes.

STEVE BEIGHLEY, SARAH TORNETTA and HELENE INTRAUB, *University of Delaware*—Do temporal factors during scene acquisition affect the sense of surrounding space elicited by a view? Three scene-photos were presented either: a) once (10 s/picture), b) 10 times (1 s each time; total time 10 s/picture), or c) once (250 ms; 10 s SOA). Spatial qualities of the representation were assessed either with a linguistic task (free verbal description) or a quantitative boundary extension (BE) task. Continuous viewing (10 s) led to the greatest use of spatial terms, but also to the most expansive BE errors (false memory beyond the view-boundaries). Interrupted viewing (totaling 10 s) elicited fewer spatial terms, but also smaller BE errors. Reducing time to 250 ms similarly elicited fewer terms, but here, participants remembered seeing less of the view than before (boundary restriction). Spatial coherence of scene representation apparently increases with viewing time and impacts both linguistic description and spatial memory. Results are discussed in terms of a multisource model of scene representation. Email: Helene Intraub, intraub@udel.edu

(2024)

Its Your Turn: Enhancing Visually Induced Self-Motion Illusions (“Vection”) With Walking Motions in Virtual Reality.

JACOB B. FREIBERG and BERNHARD E. RIECKE, *Simon Fraser University*—Visual illusions have fascinated humans for centuries, especially embodied illusions such as self-motion illusions (“vection”). Here, we investigate if such visually induced self-rotation illusions can be enhanced by adding biomechanical cues. To this end, participants sat stationary atop a circular treadmill as they experienced circular vection induced by either visual cues, biomechanical cues, or both. Vection was induced visually using a wide field of view head mounted display showing simulated self-rotations in a naturalistic environment, and/or induced biomechanically from stepping along a carousel-like rotating floor (“circular



treadmill"). While visual and biomechanical cues alone were equally effective in inducing vection, combining them resulted in more intense self-motion illusions and earlier vection onset. The observed cross-modal benefit extends earlier findings for audio-visual and audio-biomechanical vection. Results further guide our development of an affordable yet effective self-motion simulation paradigm for psychological research and virtual reality applications.

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(2025)

Streamlining Sketch Map Analysis: The Gardony Map Drawing Analyzer. AARON L. GARDONY and TAD T. BRUNYÉ, *Tufts University*; US Army NSRDEC, HOLLY A. TAYLOR, *Tufts University*, GEORGE L. WOLFORD, *Dartmouth College*—Spatial cognition researchers frequently measure cognitive maps using sketch maps (Newcombe, 1985). However, sketch map analysis remains cumbersome and unstandardized. A commonly used analysis, bidimensional regression (BDR; Friedman & Kohler, 2003; Tobler, 1994), requires time-consuming extraction of coordinates from sketch maps and sketch maps must be complete, i.e. include the same number of landmarks as the target. Therefore BDR cannot be used with incomplete maps, yet memory is often incomplete. We present a publically available sketch map analysis application that addresses these concerns, the Gardony Map Drawing Analyzer (GMDA). GMDA's easy-to-use graphical interface scores sketch maps using both novel measures tolerant to incomplete maps, as well as traditional BDR. Validation experiments demonstrate GMDA is sensitive to cognitive map differences for both short- and long-term environment exposures. Further, we compare our novel measures to BDR, demonstrating that in combination the measures yield a more complete psychometric picture of sketch map accuracy.

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(2026)

Examining Interaction Between Reference Frames Using a Bias Distribution Analysis. WHITNEY N. STREET and RANXIAO FRANCES WANG, *University of Illinois at Urbana-Champaign*—Previous research showed competition among reference frames in spatial attention and language. The present study developed a new bias distribution analysis to examine reference frame interactions in spatial memory. Participants viewed virtual colored pole arrays and were instructed to remember them either from their own perspective or from the direction aligned with the rectangular floor. Then they made judgments of relative directions from the encoding perspective. The peak(s) in their signed error distributions indicates the actual perspective(s) taken for the judgments. A higher proportion of participants showed peaks at the encoding perspective in the self-perspective condition than the floor-axis condition, suggesting the self perspective was easier to learn. Moreover, those successfully taking the floor-axis perspective showed systematic bias toward their own perspective, while those taking their own perspective

showed no systematic bias. These results suggested automatic processing of the self-perspective while taking the floor-axis perspective but not vice versa.

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(2027)

Educating Students About the Importance of Spatial Ability in the STEM Fields. BRANDI A. KLEIN, *Missouri University of Science and Technology*—The purpose of this study was to examine whether educating students about spatial ability and its importance to the STEM fields would affect their willingness to participants in spatial ability training. Participants were either given information pertaining to spatial ability, its importance to STEM fields, and research evidence on the effectiveness of training (high information), or information that contained the definition of spatial ability and that it can be trained (low information). Results indicated that participants in the high information condition were significantly more likely to believe that spatial ability is important, to be willing to sign up for spatial ability training, and to want spatial ability training to be available for their children. Participants with low spatial ability were significantly more willing to sign up for spatial ability training; however, high and low spatial individuals equally believed that spatial ability is important and that training should be available.

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(2028)

What Predicts Understanding of Topographic Maps? STEVEN M. WEISBERG, NORA S. NEWCOMBE and THOMAS F. SHIPLEY, *Temple University*—Students often misinterpret topographic maps (Clark et al., 2008), but what cognitive mechanisms underlie this difficulty? We created a topographic map assessment to investigate what factors predict topographic map understanding. Spatial ability (Hidden Figures Test [HFT], Spatial Orientation Test [SOT]), navigation ability (Santa Barbara Sense of Direction [SBSOD]), experience with maps, and basic demographic variables constituted our variables of interest. We found a main effect of gender—males consistently outperformed females, $t(78) = 2.81, p = .006, d = 0.64$, although more males reported experience with topographic maps. Performance on the assessment was significantly correlated with HFT and SOT, but not SBSOD. Intriguingly, participants who used the word "elevation" in their written descriptions of maps significantly outperformed participants who did not. However, an intervention designed to guide attention to 3D structure by highlighting alignable differences using structure-mapping theory (Gentner & Markman, 1983) showed no effect in males or females.

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(2029)

Macro-Reference Frame Selection. ZACHARY D. SIEGEL, LORI A. SJOLUND and JONATHAN W. KELLY, *Iowa State University*, MARIOS N. AVRAAMIDES, *University of Cyprus*—Previous research has shown that relationships between multiple spatial layouts are coordinated by macro-

reference frames, whereas within-layout relationships are coordinated by micro-reference frames. This project explored the relationship between micro- and macro-reference frames, as well as the influence of intrinsic layout properties on macro-reference frame selection. Participants learned a layout of 16 objects as a unified group or as multiple groups with aligned or misaligned micro-reference frames. Performance on a subsequent perspective-taking task was used to evaluate reference frame organization. Learning the layout as separate groups resulted in selection of a macro-reference frame along the whole-layout symmetry axis regardless of micro-reference frame alignment, indicating that macro-reference frame selection is independent of micro-reference frame organization. Follow-up work indicated that macro-reference frame selection is determined by an interaction between egocentric experience, intrinsic properties of the whole layout, and relationships between sub-groups of the whole layout.
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(2030)

Sex Differences in the Weighting of Metric and Categorical Information in Spatial Location Memory. MARK P. HOLDEN and ELIZABETH HAMPSON, *University of Western Ontario* (Sponsored by Albert Katz)—According to the Category Adjustment model, location memory involves the Bayesian combination of fine-grained and categorical information, with each cue weighted by its relative certainty. However, individuals may differ in terms of their certainty about each cue, relying more or less on metric or categorical information. To date, though, very little research has examined individual differences in the relative weighting of these cues in spatial location memory. Here, we address this gap in the literature. Participants were asked to recall point locations in uniform geometric shapes, and in photographs of complex, natural scenes. We analyzed error patterns for evidence of a sex difference in the relative use of metric and categorical information. As predicted, women placed relatively more emphasis on categorical cues, while men relied more heavily on metric information. Location reproduction tasks showed a similar effect, implying that the sex difference arises early in spatial processing – possibly during encoding.
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(2031)

Effects of Perspective and Orientation on Age-Related Changes in Spatial Learning. NAOHIDE YAMAMOTO, *Cleveland State University*, GREGORY J. DEGIROLAMO, *University of Nebraska-Lincoln*, MICHAEL J. FOX, *Cleveland State University*—It has been shown that abilities in spatial learning and memory are adversely affected by aging. The present study was conducted to investigate whether increasing age has equal consequences for all types of spatial learning or impacts certain types of spatial learning selectively. Specifically, we contrasted two types of spatial learning: (a) exploratory navigation in a ground-level (i.e., route) perspective with varying orientations and (b) map reading in an aerial (i.e., survey) perspective in a fixed orientation. In an experiment, younger and older adults learned locations of landmarks in virtual environments either by navigating

in them in the first-person perspective or by seeing bird's-eye views of the environments. Results showed that older participants acquired less accurate memories of the layouts of landmarks than younger participants when they navigated in the environments, but the two groups did not differ in spatial learning performance when they viewed the environments from the aerial perspective. These results suggest that spatial learning through exploratory navigation is particularly vulnerable to adverse effects of aging, whereas elderly adults may be able to maintain their map reading skills relatively well.

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(2032)

Navigation Ability Predicts the Spatial Organization of Free Recall. STEVEN A. MARCHETTE, JACK RYAN and RUSSELL A. EPSTEIN, *University of Pennsylvania*—Space provides a scaffold for encoding broader experiences with the world; however, individuals vary greatly in the quality of their spatial representations. Consequently, individuals might differ in the degree to which the spatial organization of the physical world (i.e. proximity) guides free recall. To test this idea, we asked participants to freely recall the names of familiar places that fit categorical prompts (e.g. foodtrucks) and then related performance to self-report measures of navigational ability. Better navigators recalled more places in response to our prompts; moreover, those places spanned a greater physical area. In addition, navigation ability predicted the degree to which order of recall reflected real-world proximity among retrieved places. These results suggest that individuals with better sense-of-direction (1) establish cognitive maps that make a broader range of the physical world available in memory and (2) rely more heavily on these maps to guide memory retrieval.

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(2033)

Time Flies When You Spatially Adapt to the Right. HUNTER TRICE and BEN EMERZIAN, *University of California, Davis*, WILLIAM PRINZMETAL, *University of California, Berkeley*, EVE A. ISHAM, *University of California, Davis*—Traditionally, space and time are considered related but not necessarily dependent entities. However, some behavioral studies and clinical observations in neglect patients are converging on the perspective that time perception may have a spatial component. To test this, we conducted two studies in which the participants judged the duration of a visual event (systematically varied at 1600,1800,2000,2200,2400 ms) before and after a spatial adaptation session. In Exp.1, the participants wore prismic goggles that shifted their visual field 30 degrees to the left or the right of normal vision. During Exp.2 adaptation, participants performed a target detection task. To induce a spatial bias, the target appeared more frequently (75%) on one side of fixation. The results from both experiments showed an underestimation and overestimation of temporal duration after a rightward and leftward bias, respectively. These findings provide evidence the processing of temporal information involves a spatial component.

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• ASSOCIATIVE LEARNING I •

(2034)

Fear Conditioning and Memory Intrusions. CHRIS BALL and SONGHEE KANG, *College of William & Mary*—Flashbacks are a common symptom of PTSD. Our study combines the fear conditioning methodology (learning approach) with the traumatic film methodology (cognitive approach) to test a new methodology for examining memory intrusions that incorporates the strengths of both methodological approaches. A differential conditioning procedure utilizing short video clips and a 90db auditory startle probe was used to measure individual differences in fear conditioning. Participants recorded the number of memory intrusions that related to these video clips and completed the Anxiety Sensitivity Index (ASI-3). We found that individual differences in fear conditioning related to the number of memory intrusions reported by participants and their scores on the ASI-3. In future research, we will use this methodology to compare different theoretical explanations for factors that facilitate or inhibit the reporting of memory intrusions.

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(2035)

Non-Hippocampal Learning of Novel Associations and Re-Learning of Previously Known Associations: Evidence From a Training Study With an Amnesic. EMMA GREGORY, BARBARA LANDAU and MICHAEL MCCLOSKEY, *Johns Hopkins University*—Damage to the hippocampus and surrounding medial temporal (MTL) structures profoundly impairs one's capacity to learn new associations. However, little is known about learning of novel associations in the extreme case of complete destruction of the hippocampus. Moreover, essentially nothing is known about whether such learning of novel material differs from re-learning of previously known information. We examined new learning and re-learning of concept associations in LSJ, a newly identified amnesic with virtually no remaining hippocampus, and substantial bilateral damage to the MTL. LSJ was trained on 12 stimulus triads involving a commercial logo, company name, and product category (e.g., Audi logo-'Audi'-car) in more than 80 sessions across six months. Half of the triads involved novel associations and half involved associations that were pre-morbidly familiar. The results show that LSJ learned, albeit very slowly, triads of both types. These findings address the nature of non-hippocampal learning for both acquisition of new information and re-learning of previously-known information.

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(2036)

Boundary Conditions on Retrospective Revaluation in Humans. CHRISSY M. CHUBALA and RANDALL K. JAMIESON, *University of Manitoba*—We report a systematic examination of retrospective revaluation in humans. In the experiments, participants learned that pairs of cues cause an outcome (e.g., AB+). Retrospective revaluation was observed when new information about a single cue (e.g., A+ or A-) forced participants to change their judgments about the predictive validity of the associated cues. We identify five

empirical constraints on the core phenomenon: (1) a chain of revaluation can be extended to the third but not the fourth order of association; (2) the strength of the effect wanes with increasing order of association; (3) participants only revalue cues when they are encouraged to consider compound cues elementally; (4) the order in which cues are presented impacts learning; and (5) revaluation traces linearly through the chain of associations, independent of the primacy and recency of contingencies in memory. A competent theory of retrospective revaluation should accommodate all five empirical constraints.

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(2037)

The Electrophysiological Correlates of Sequence Learning in Children With Dyslexia and Children With Typical Reading. ANNE M. WALK, *Saint Louis University*, CHRISTOPHER M. CONWAY, *Georgia State University*—Sequence processing is important for functioning in everyday life (Lashley, 1951) and especially for processing language, including reading (Eden, Stein, Wood, & Wood, 1995; Folia et al., 2008; Howard, Howard, Japikse, & Eden, 2006). To date, little is known about the neural correlates underlying sequencing and reading in populations with a reading disorder. In the present study we used event related brain potentials (ERPs) to investigate sequence processing in typically developing children and children diagnosed with dyslexia. Participants completed a probabilistic sequence learning task involving non-linguistic visual stimuli while wearing an electro-sensor net. The results showed that while the neural components observed in the two groups were similar, the responses were more robust in the typically developing children in terms of wavelength and scalp distribution. These initial findings indicate that the sequence processing mechanisms of children with dyslexia may be less developed, which could in part explain their reading difficulties.

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(2038)

Reward Bolsters Implicit Learning. MICHAEL V. FREEDBERG, JAEYONG LEE and RICHARDE. HAZELTINE, *The University of Iowa*—Although reward has been shown to bolster various forms of learning, it is unknown if rewards can be used to improve implicit motor skill learning. To address this question, we used a chord-learning task and compared performance of rewarded and unrewarded chords; rewarded chords were followed by points necessary to complete the block and unrewarded chords were not. Following eight blocks of training, participants entered a probe phase without rewards. A post-experiment task measured explicit awareness. Participants who did not gain explicit awareness of which chords were rewarded showed significantly shorter response times for rewarded chords than unrewarded chords (1148ms vs. 1221, $p < 0.05$, $d = 0.56$). This pattern was not observed for participants who gained explicit knowledge. Both groups showed no difference between rewarded and unrewarded chords when rewards were revoked. These data suggest a role for reward in supporting learning beyond awareness.

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(2039)

Do Concurrently Presented Tones Enhance Sequence Learning in Humans? Testing a Prediction of the RASRN model. FAYME YEATES, *University of Exeter*, FERGAL W. JONES, *Canterbury Christ Church University*, ANDY J. WILLS, *University of Plymouth*, IAN P.L. MCLAREN, *University of Exeter*—Human sequence learning under incidental conditions has, until recently, been successfully modeled using the augmented simple recurrent network (SRN, Cleeremans & McClelland, 1991). Yeates, Jones, Wills, McLaren and McLaren (2013) predicted human performance on a serial reaction time task of implicit sequence learning with the augmented SRN and found that humans did not perform as predicted. After altering the model to account for these findings, the revised augmented SRN (RASRN) was used to predict performance on a similar task, presented here, whereby participants responded to on-screen stimuli that followed a sequential rule. The participants also heard concurrent tones that either matched the on-screen stimuli, the previous on-screen stimuli, or random tones that did not relate to the sequential rule. Thus, the predictions of the revised model were tested and the implications for the RASRN as a model of sequence learning are discussed.

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(2040)

Automatic Attentional Mechanisms in Learned Predictiveness. LAUREN T. SHONE and EVAN J. LIVESEY, *University of Sydney*—Learned predictiveness (LP) is a bias in learning towards cues with prior predictive utility. In a typical LP experiment, predictive validity is first manipulated such that cues are either predictive or non-predictive of a set of outcomes. In a subsequent and seemingly unrelated task involving novel outcomes, new learning is biased in favour of the previously predictive cues. This bias has been interpreted as a shift in attention that operates according to the mechanisms of associative competition. However, it is unclear which of the variety of cognitive mechanisms associated with selective attention best characterise the effect. This study examined the LP effect using novel cognitive tasks that involve competition for stimulus processing. Persistent differences in stimulus processing between previously predictive and non-predictive cues, in tasks that involve direct manipulations of the cognitive control of selective attention, suggest that the LP effect is based on relatively automatic attentional biases.

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(2041)

The Task-Switching Pigeon: Associative Learning in a Task-Switching Paradigm. CHRISTINA MEIER, STEPHEN E.G. LEA and IAN P.L. MCLAREN, *University of Exeter*—Task switching, the ability to perform multiple tasks on the same stimuli in rapid alternation, is generally thought to require executive control of behaviour. Alternatively, it might be based on forming cue-stimulus-response associations. Attempts to elicit an associative approach to task switching in humans result in minimal switch costs (better performance in trials repeating the same task as in the previous trial than in those in which the task changes) and a large effect of stimulus

congruency (advantage for congruent stimuli requiring the same response in all tasks compared to incongruent stimuli to which the correct response depends on the task). This is a different pattern to the effects found in conventional task-switching paradigms, i.e. substantial switch costs and moderate congruency effects. Pigeons, in a task-switching paradigm involving go-left/go-right discriminations between grating patterns, did not show switch costs. Their performance was only influenced by stimulus congruency, similar to humans presumed to have learned associatively. We present further analyses of these effects, which support the possibility that task switching might be performed independently of executive control.

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(2042)

On Some Limits of Inter-Trial Contextual Cueing Effects. CYRIL THOMAS and ANDRÉ DIDIERJEAN, *University of Franche-Comté*, FRANÇOIS MAQUESTIAUX, *University of Paris Sud*, ERIC RUTHRUFF, *University of New Mexico*, ANNABELLE GOUJON, *University of Provence*—Since the first contextual cuing study of Chun and Jiang (1998), numerous studies have investigated various aspects of the learning of contextual regularities while searching for a visual target. However, in most of these studies, the contextual cueing is an intra trial effect: regularities of distractors predict the position of the target in the same trial. Ono, Jiang, and Kawahara (2005) demonstrated that contextual cueing can sometimes also occur inter-trial. In their study, the distractor positions on trial N predicted the target position in trial N+1. In our study, we first replicated Ono et al.'s (2005) finding. After this successful replication, we tested the temporal limits of this effect. For example, does this effect extend to an N to N + 2 association? In all of our experiments, learning was unsuccessful.

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(2043)

The Effects of Overlearning and Distributed Practice on Long-Term Memory Retrieval. KATHERINE E. BERCOVITZ, *Harvard University*, PATRICIA M. SIMONE and MATTHEW C. BELL, *Santa Clara University*—Distributed practice has been widely demonstrated to boost memory performance in younger adults. Similarly, younger adults have benefited from overlearning, the deliberate overtraining of a task past a set criterion. The present study investigated the interaction of these two learning strategies on verbal memory. In a within-subjects study, 20 young adults (Mage= 19 years) learned weakly-associated English/English word pairs that were randomly assigned to four conditions, designating each word as either massed/spaced and overlearned/controlled. We found that overlearning facilitated learning of the spaced words, but not of the massed words. This finding was contrary to our prediction that overlearning would boost massed performance to the level of spaced performance. Surprisingly, we did not see the traditional spacing benefit for words in the control condition. This finding suggests that overlearning combined with spacing blocks the learning of words (both massed and spaced) not studied with overlearning methods.



Future studies should investigate the interaction between distributed practice and overlearning to understand the parameters under which overlearning eliminates the spacing benefit.

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(2044)

Eye Movements to Blank Spatial Locations Influences Memory Retrieval for Auditory Information. AGNES SCHOLZ, *Chemnitz University of Technology*, KATJA MEHLHORN, *Carnegie Mellon University*, JOSEF F. KREMS, *Chemnitz University of Technology*—While remembering auditory presented information, people fixate on blank locations if task irrelevant visual stimuli previously occupied that region of space. This so-called ‘looking at nothing’ phenomenon is said to follow information retrieval from an integrated memory representation. However, it is unclear, whether it influences memory retrieval. To clarify this, participants listened to four sentences, each associated to one of four locations on the screen. Subsequently, they had to verify an auditorily presented statement about one of the sentences, by retrieving the related information from memory. During retrieval, participants could either gaze freely, or had to look at a fixation cross associated with the to-be-retrieved information or in another location. Results suggest that memory retrieval influences eye movement behavior. Manipulating gaze behavior showed that eye movements can directly influence memory retrieval suggesting a tight link between eye movements and memory retrieval for abstract visual and linguistic information.

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(2045)

Cognitive Control and Object Recognition in Highlighting. MATTHEW J. WEBER and SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Highlighting, also known as the inverse base rate effect, is a systematic distortion of association strengths arising from learning cue-response associations distributed unevenly in time. Behavioral and computational evidence indicates that highlighting arises from a redistribution of attention over the cues. We investigated the neural underpinnings of this effect using functional MRI; cues were pictures drawn from semantic categories known to engage object-selective regions of the ventral visual stream (bodies, chairs, faces, locations). We find that the right dorsolateral prefrontal cortex is more engaged by the processing of highlighted cue-response associations relative to associations learned without preconditioning, a result evocative of previous neuroimaging studies on associative learning. In addition, both fusiform gyri are less active for the newer associations, potentially a signature of the reduced association between old cues and new responses characteristic of highlighting. Our work adds to the evidence that cognitive control shapes object-recognition operations even in simple associative paradigms.

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(2046)

The Effects of Familiarity and Novelty on Preference Judgments: Manipulation of Exposure Frequency and Background Information. KEN MATSUDA, *Yamaguchi University*, TAKASHI KUSUMI, *Kyoto University*, NAOHIRO HOSOMI, ATSUSHI OSA and HIDETOSHI MIIKE, *Yamaguchi University*—This study examined the how the mere exposure effect can be influenced by familiarity and novelty resulting from manipulation of the presentation method of background information. We used automobile images as stimuli. In pilot studies with a sample of 150 participants, we measured preference for automobiles and natural landscapes and matching each other, and then selected neutral stimuli. During the learning phase, we displayed the stimuli successively for 3 seconds, manipulating background information (same and different) and exposure frequency (3, 6, and 9 times). In the judgment phase, 18 participants judged automobiles in terms of preference, familiarity, and novelty on 7-point scale. The results showed that as the number of times the stimuli were presented increased, the preference for automobiles increased in the different background condition and decreased in same background condition. This increase in preference may be due to the increase in familiarity caused by higher exposure frequency and the novelty resulting from background changes per learning session. Therefore, adding novel features in each learning session facilitates the occurrence of the mere exposure effect.

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(2047)

Modeling a Reaction Time Variant of the Perruchet Effect in Humans. AMY MCANDREW, FAYME YEATES, FREDERICK VERBRUGGEN and IAN P.L. MCLAREN, *University of Exeter*—In this experiment, participants were presented with a single conditioned stimulus followed by one of two outcomes (unconditioned stimuli; USs); to which participants had to make instrumental responses. We recorded reaction time (RT) and participants rated their expectancy that one of the USs (US1) was going to occur. We found that US1 expectancy correlated negatively with RT on US1 trials. Over successive runs of reinforcement, when participants rated US1 as less likely to occur they were slower to respond to US1 (lower ratings, higher RTs). When we calculated US2 expectancy, this correlated positively with RTs. Thus, across runs of reinforcement, participants responded quicker to US2 when considering US2 less likely (low rating, low RT). A dual processing system explanation of learning is offered to explain these results. In support of this, we successfully modeled our US2 RT data using a modified version of the augmented simple recurrent network.

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• EYEWITNESS MEMORY AND IDENTIFICATION •

(2048)

Lineup Composition and Decision Strategies in Eyewitness Identification. MOLLY B. MORELAND, CANDACE RIM and STEVEN E. CLARK, *University of California, Riverside*—Clark, Erickson, and Breneman (2011) generated eyewitness identification response probabilities for relative and absolute decision rules using a computational model. These simulations showed an accuracy advantage for absolute judgment strategies for lineups with foils matched to the suspect. The present study provides an empirical test of the model's predictions. Participants viewed lineups that differed in suspect guilt or innocence and foil selection method. The innocent suspect either appeared in suspect-matched lineups (the foil selection method used by police), or perpetrator-matched lineups (a method used in eyewitness identification research). Lineup instructions directed witnesses to use an absolute or relative judgment decision rule. Results showed that suspect identifications were higher with relative compared to absolute instructions for all lineup types. Plots of receiver operating characteristic curves suggest a very small advantage for absolute decision rules with suspect-matched foils.
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(2049)

A Hybridization of Simultaneous and Sequential Lineups. TRENT TERRELL, *University of Mary Hardin-Baylor*—Much research has documented the relative benefits of the use of simultaneous and sequential lineups to facilitate identification of suspects by eyewitnesses. Though most researchers have concluded that sequential presentations reduce the possibility of false identification without significantly threatening the chance of correct identification, the validity of the sequential superiority effect has been called into question. The present research describes an initial attempt to combine the characteristics of simultaneous and sequential presentation in a hybrid format we call “slideshow.” Witnesses view one photograph at a time (like a sequential lineup), but do so in a continuous loop of the photographs, allowing them to see the faces for as long as they need to before making an identification (like a simultaneous lineup). Initial results reveal comparable rates of correct identification when compared with simultaneous presentation, and also comparable rates of false identification when compared to sequential presentation. We hope further research will demonstrate that this hybrid combines the benefits of both traditional lineup types.
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(2050)

Are Showups Ever Better than Lineups? WETMORE A. STACY, *University of Oklahoma*, CHARLES A. GOODSSELL, *Canisius College*, JEFFREY S. NEUSCHATZ, *The University of Alabama in Huntsville*, SCOTT D. GRONLUND, *University of Oklahoma*—Showups – when a single suspect is presented to an eyewitness – are thought to be a more suggestive procedure than traditional lineups by the US Supreme Court and social science researchers. The present experiment examined the

impact of retention interval on showup identifications, because immediate showups might be no worse than, and perhaps even better than, a lineup conducted after a delay. Participants viewed a mock-crime video and then were presented with a showup or lineup, either immediately or after a 48-hour delay. The showups and lineups included the perpetrator, a similar looking innocent suspect or a non-similar looking innocent suspect. Fairness of the lineups also was varied. ROC (Receiver Operating Characteristic) analyses revealed that a showup never resulted in better identification accuracy than a lineup.
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(2051)

Eyewitness Memory Quality on Lineup Identification Performance. CHARLES A. GOODSSELL, RYAN M. MCADOO and JENNIFER T. KEPPLER, *Canisius College*—There is a national movement to conduct lineups in a sequential manner (i.e., view faces one at a time). Gronlund, Carlson, Dailey, and Goodsell (2009) raised concerns about the robustness of the sequential lineup advantage regarding lineup fairness and suspect position. One additional variable that was not explored in that study, quality of memory, is hypothesized to interact with the sequential lineup advantage (see Lindsay et al., 2009). In the present experiment, participants viewed one of two similar mock crime videos and then tried to identify the suspect from a lineup. We varied whether the perpetrator was in the lineup, presentation method (simultaneous or sequential), the position of the suspect (2nd or 5th) and memory quality (good view vs. bad view of perpetrator). We used ROC analysis, which is a superior technique for comparing different lineup procedures (see Wixted & Mickes, 2012). With a better memory, results supported that late positioning in the sequential lineup was equivalent to the simultaneous lineup; with a poorer memory, late positioning harmed sequential performance.
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(2052)

Identifying the Guilty Suspect From a Lineup: Does Crime Severity Matter? BRENT M. WILSON, EDMUND FANTINO and STEPHANIE STOLARZ-FANTINO, *University of California, San Diego*, LAURA MICKES, *Royal Holloway, University of London*—Likelihood ratios have been widely used to measure eyewitness memory accuracy with lineup procedures. However, a more appropriate method is receiver operating characteristic (ROC) analysis (Wixted & Mickes, 2012). When ROC analysis is performed, surprising findings emerge; for example, simultaneous lineup procedures yield better discriminability than sequential lineup procedures. Conflicting findings exist in the literature regarding memory for the perpetrator of severe versus nonsevere crimes. Some research has shown a higher hit rate for more severe crimes than for less severe crimes, but these studies used only target-present lineups, which provides just a glimpse into the issue. Other research, however, has shown reduced memory for the perpetrator when a weapon is involved, which by definition makes the crime more severe. ROC analysis has not been used in these investigations. Memory for the perpetrator of severe



crimes may not be better or worse. Rather, varying degrees of crime severity may encourage a more liberal or conservative response criterion. We investigated these conflicting findings and tested different hypotheses using ROC analysis.

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(2053)

Can People be Lead to Not Believe in the Occurrence of Witnessed Event Details? TANJEEM AZAD and D. STEPHEN LINDSAY, *University of Victoria*—We studied the effect of suggested invisibility on memory for a witnessed event. 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. A follow-up study examined subjective confidence accompanying this suggested invisibility effect. Findings replicated the pattern in the first experiment. In addition, a small proportion of previously witnessed details erroneously suggested to have not been seen were apparently believed to have not been visible in the witnessed event and subjects expressed high subjective confidence in their beliefs relative to control details.

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(2054)

Individual Differences in Working Memory Capacity and Eye Witness Identification. W. MATTHEW COLLINS, JONATHAN B. BANKS and RACHEL BERGER, *Nova Southeastern University*—Previous research has suggested that those with higher working memory capacity appear to be less susceptible to false memory because they are better able to actively maintain task goals in the face of potentially interfering information (Watson, Bunting, Poole, & Conway, 2005). The current study examined whether working memory capacity affects accuracy in an eye witness identification task. Participants watched a video of a bank robbery and were later asked to pick the culprit from a lineup. They also completed measures of working memory capacity, sustained attention and speed of processing. Results indicated that individual differences in working memory capacity, sustained attention and speed of processing had no effect on whether subjects were accurate at identifying the culprit in the lineup.

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• RECOGNITION MEMORY I •

(2055)

The Dimensionality of Recognition Memory: A State-Trace Analysis of the Effects of Dividing Attention. MICHAEL L. GRIFFIN and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—Dual-process models of recognition memory are popular in part because of the transparent explanations they provide for empirical

dissociations, including those between memory for items and memory for contexts in which they occur. Attention is one variable that reveals such a dissociation: when attention is divided at encoding, memory for context appears to be more dramatically impaired than item memory. However, empirical dissociations, even double dissociations, can be found when just one latent process underlies performance. State-trace analysis offers an alternative means of assessing the number of latent variables underlying recognition memory. Also, unlike the dissociation approach, it has the desirable characteristic of treating the dependent variables as having ordinal, but not interval, measurement characteristics. In two experiments, memory for items and context were measured under full and divided attention across four levels of study time. The state-trace plots suggested a common latent variable underlying the two attention conditions, suggesting that a single memory process is sufficient to explain the data.

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(2056)

A Direct Test of the Independence Assumption in Dual-Process Recognition Models. JAMES E. OLCHOWSKI and JEFFREY J. STARNES, *University of Massachusetts Amherst*—Dual-process models assume that people can recognize items by either recollecting qualitative information about the learning event or assessing a quantitative familiarity signal that tends to be stronger for more recently encountered items. Many theorists additionally assume that recollection and familiarity are independent; that is, the studied words for which recollection succeeds are equally familiar to the words for which it fails. This assumption underlies the validity of several popular procedures designed to measure the two processes, including the Remember-Know procedure and the dual-process model of Receiver Operating Characteristic (ROC) functions. To test the independence assumption, we had participants study lists of word pairs. At test, they made a speeded recognition judgment (respond in less than 800 ms) to assess familiarity, and then they attempted to recall the word paired with the test item to assess recollection. We evaluated the relationship between speeded recognition and cued recall across individual test trials.

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(2057)

Violations of the Conditional Independence Assumption of Discrete State Models of Recognition Memory. TINA CHEN, JEFFREY J. STARNES and CAREN M. ROTELLO, *University of Massachusetts*—Signal detection models of recognition memory posit that test items vary in memory strength; strengths above a criterion elicit an “old” response. In contrast, discrete state models assume that test items result in distinct internal states: they are either detected or not, and the probability of an “old” response depends on the state-response mapping parameters. These parameters are theoretically independent of the probability that an item yields a particular state (i.e., both strong and weak items that are detected as old have the same probability of producing a highest-confidence “old” response). We tested this strong claim by presenting nouns one, two, or four times within list.

To maximize the strength of some items, “super strong” items were repeated four times and encoded in conjunction with pleasantness, imageability, anagram, and survival processing tasks. Confidence ratings from the recognition test and model fit comparisons will be presented.

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(2058)

Limits on Criterion Flexibility in Recognition Memory.

JUSTIN KANTNER, *University of California, Santa Barbara; U.S. Army Research Laboratory*, JEAN M. VETTEL, *U.S. Army Research Laboratory*, MICHAEL B. MILLER, *University of California, Santa Barbara*—When an old-new recognition judgment must be based on ambiguous memory evidence, a proper criterion for responding “old” can substantially improve the odds that one will nonetheless make a correct decision. Recognizers can set task-appropriate liberal/conservative criteria and shift adaptively under changing test conditions, but recent evidence suggests that they will not – or cannot – shift sufficiently when large shifts are required to optimize accuracy. We tested this resistance to extreme shifting with a recognition paradigm in which old-new discrimination was minimal and shifts were necessary to adapt to changing target probabilities, to maximize monetary gain, or, in a “security patrol” scenario, to avoid critical misses (letting dangerous people go free) or false alarms (harming innocent people). Critical errors were frequent, equally prevalent across sources of motivation, and only moderately reduced by feedback. Inadequate criterion shifting appears to be a pervasive human phenomenon, even when errors are consequential and easily avoided.

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(2059)

Exploring the Representational Bases of Recollection and Familiarity-Based Recognition.

STEPHEN DOPKINS, KATY VARNER and DARIN HOYER, *George Washington University*—The hit rate for episodic recognition is decreased when the test item shares superficial features with a prime item (the DHR effect). The false-alarm rate is increased when the test item shares superficial features with a prime item (the IFAR effect). We summarize evidence that the DHR and IFAR effects reflect recollection and familiarity-based recognition respectively. In addition we interpret the implications of the following results, obtained with artificially constructed nonsense words, for the representations underlying recollection and familiarity-based recognition: Repeating a feature in many prior items decreases the impact of the feature for the DHR but not the IFAR effect. Repeating a conjoined pair of features in many prior items increases the impact of the features for the IFAR but not the DHR effect. Presenting a feature in a novel featural context increases the impact of the feature for both the DHR and IFAR effects.

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(2060)

Direct Access to Mnemonic Signals: In Support of the Continuous Dual-Process Model of Recognition Memory. CHEN DID-BARNEA and YONATAN GOSHEN-

GOTTSTEIN, *Tel-Aviv University*—According to dual-process theories, recognition memory comprises Familiarity and Recollection. The most dominant dual-process theory maintains that recollection is an all-or-none process available for only some of the studied items (Yonelinas, 2001). A recent theory, the Continuous Dual Process model (Wixted & Mickes, 2010), suggests that recollection is a continuous process available to some degree for all items. To differentiate between the models, we used a variation of the independent-scales methodology of the remember-know task (Higham & Vokey, 2004). In a recognition test, participants were asked to rate the degree of both familiarity and recollection using continuous scales, in addition to completing a source memory test. Results revealed a high correlation between recollection ratings and source-memory accuracy as well as a correlation of both recollection and familiarity ratings with recognition accuracy. These findings suggest that continuous recollection and familiarity signals can be directly accessed, thereby supporting the CDP model.

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(2061)

Continuous Recollection Without Unitization or Familiarity.

CHAD DUBE, LISA PAYNE and ROBERT SEKULER, *Brandeis University*, CAREN M. ROTELLO, *University of Massachusetts Amherst*—Major theoretical accounts of recognition memory agree that a continuous memory signal contributes to responses. They differ in whether the recollection component of the signal is better described by a discrete-state or continuous model (Mickes, Wais, & Wixted, 2009). To adjudicate between the accounts, we manipulated attention to an auditory attribute of the encoding event surrounding each stimulus in a recognition memory task. The contributions of attention at encoding and recollection at test were assessed using EEG oscillations and cognitive modeling. Results showed 1) with attention under control, recollection was best-characterized as continuous, and 2) this continuous recollection was misinterpreted as discrete-state recollection by the dual-process signal-detection model (Yonelinas, 1994). The effect could not be accounted for by unitization or the combined effects of continuous and discrete-state processes. Attention-related alpha-band oscillations at encoding predicted changes in accuracy and ROC form at test, suggesting ways to sharpen analyses of recognition data.

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(2062)

Recognition Memory for Familiar and Unfamiliar Words: Is it All a Matter of Confidence?

KERRY A. CHALMERS, *The University of Newcastle*—Evidence for single versus dual process theories of recognition memory was examined in both a traditional 2-phase (study, test) paradigm and a 3-phase (familiarization, study, test) paradigm. Participants made either Remember/Know or Sure/Unsure judgments at test. Word frequency was manipulated to investigate whether confidence and Remember/Know judgments are similar for familiar (high-frequency) and unfamiliar (very low-frequency) words. Evidence for a confidence-based account



was found in the 2-phase paradigm. In the 3-phase paradigm, results for familiar but not unfamiliar words were consistent with the view that the Remember/Know procedure taps confidence. Implications of these findings for single and dual process theories of recognition memory are discussed.
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• IMPLICIT LEARNING AND MEMORY •

(2063)

Permanent Nature of Perceptual Implicit Memory. TAKAFUMI TERASAWA, *Okayama University, Japan*, TETSUYA YOSHIDA, *Tokoha University, Japan*—Using an indirect recognition procedure (Terasawa & Ohta, 1993), we conducted an experiment to examine implicit memory for random tone sequences. The procedure involved two sessions and the second session was a general recognition experiment consisting of learning and a recognition test phase. The effects of the learning during the first session were examined based on the recognition performance in the second session. The interval between the sessions was 12 weeks. In each session, undergraduates were required to rate their liking for each of the sequences presented. In the second session, they were required to respond to an old-new recognition test about the items just presented in the second session. The distractors in the test consisted of stimuli presented or not presented in the first session. Analyses of the false alarms showed an effect of the presentations in the first session. This result indicates an effect of long lasting implicit memory for tone sequences, that is, permanent nature of sensory memory (also see Ueda & Terasawa, 2010; Nishiyama & Terasawa, 2013).
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(2064)

Statistical Learning of New Relationships Depends on Predictive History. GHOOTAE KIM, JARROD A. LEWIS-PEACOCK, KENNETH A. NORMAN and NICHOLAS B. TURK-BROWNE, *Princeton University*—By extracting regularities, our brains can automatically predict what should appear in a given environment. However, environments can change over time, resulting in exposure to novel regularities. Here we explore how the reliability of an item's predictions in one context (predictive history) affects the formation of novel associations with that item in a new context. Subjects categorized faces and scenes that were presented in a continuous sequence. Some images were arranged into pairs, where the first image was always followed by the second across three repetitions (A-B/A-B/A-B). This 'predictive' condition was contrasted with a 'non-predictive' condition, where the first item was similarly repeated but was not predictive (C-D/C-E/C-F). After these repetitions, the items were re-arranged into novel regularities (predictive: A-G/A-G/A-G; non-predictive: C-H/C-H/C-H). Although these pairs were now identical, only the new pairs from the predictive condition were learned, suggesting that statistical learning uses predictive history to efficiently guide new learning.
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(2065)

Encoding Specificity for Conceptual Repetition Priming. EUGENIA MARIN-GARCIA, *Massachusetts Institute of Technology; Basque Center on Cognition, Brain and Language; Ikerbasque*, JOHN D. E. GABRIELI, *Massachusetts Institute of Technology* (Sponsored by Anthony Wagner)—We examined encoding specificity for conceptual repetition priming involving judgments about whether words were the names of objects that were natural or manmade and relatively smaller or larger in size. In Experiment 1, participants made one kind of judgment for words at study and then four kinds of judgments for new and old words at test. There was significant priming only when both the judgment and the response were identical at study and test. In Experiment 2, participants made two kinds of judgments at study (animacy or size), but just one per word. There was transfer from one kind of judgment at study to another at test, suggesting that participants applied both kinds of conceptual analysis to all words at study. In Experiment 3, simply reading words aloud without judgments at study did not result in reliable priming for judgments of repeated words at test. These experiments suggest that conceptual judgment priming has remarkable encoding specificity, but that study-phase awareness of more than one conceptual categorization produces transfer at test.
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(2066)

The Development of Visual Statistical Learning at the Categorical Level. KATRINA J. FERRARA, BARBARA LANDAU and SOOJIN PARK, *Johns Hopkins University*—The visual environment has massive spatial and temporal regularities that can be extracted through statistical learning. Infants can detect the covariance between simple shapes (Fiser & Aslin, 2002), and adults learn regularities over complex real-world scene categories (Brady & Oliva, 2008). The present research investigates the scope of visual statistical learning in children. In Experiment 1, we asked whether 6-year-olds extract statistical regularities from triplets of specific objects (e.g. ball-pencil-cup) or scenes (e.g., forest-kitchen-beach). In Experiment 2, we asked whether learning can occur at the categorical level, generalizing beyond individual images (e.g., different exemplars of forest-kitchen-beach). Children and adults showed robust statistical learning for triplets of specific objects and scenes. Adults also showed learning at the categorical level for both objects and scenes, although accuracy was reduced. Children showed learning at the categorical level for objects, but fell below chance for scenes. This indicates that visual statistical learning at the categorical level is possible early in life. However, such learning may be modulated by visual complexity or pre-existing knowledge of visual categories.
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(2067)

Parallel Learning of Temporal Order and Sequencing of Natural Scenes Based on Unconscious/Conscious Processes: Evidence From Visual Statistical Learning. SACHIO OTSUKA, *Kyoto University*, CHRISTOF KOCH, *Allen Institute for Brain Science*, JUN SAIKI, *Kyoto University*,

JUN KAWAGUCHI, *Nagoya University*—We examined whether learning of temporal order and the sequencing of specific natural scenes is based on an implicit or on an explicit process using visual statistical learning, with direct (familiarity judgment) and indirect measures (RSVP test). In the familiarization phase, participants viewed a sequence of scenes consisting of triplets of natural scenes. In the subsequent RSVP test, participants were required to detect a target scene. Subsequently, participants carried out familiarity judgments. Both tests included the same (forward) order of scenes as those presented during the familiarization phase, and reverse (backward) order of scenes phase. The results of RSVP tests showed both the learning effect of temporal order in the forward condition and that of sequencing in the backward condition, even though we observed only learning of order in the familiarity test. Our findings suggest that learning of temporal order and of sequencing of scenes occurs as an unconscious process.

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(2068)

Incidental Learning Without Intent: Advancing the Artificial Grammar Learning Paradigm. ADAM J. DAILY and CHRISTINE CHIARELLO, *University of California, Riverside*—Artificial grammar learning (AGL) paradigms are used to study implicit learning. There is some speculation, however, about whether this learning is truly implicit. Often, subjects are instructed to memorize strings of letters to ensure that they are directing their attention toward the task, which raises questions about how non-directed the “implicit” learning is in such tasks. In the current study participants viewed letter strings generated by a finite state grammar and responded whenever the stimulus flickered, but were not instructed to remember the stimuli. In a subsequent test phase, subjects discriminated between grammatical and non-grammatical letter strings at better than chance levels. This provides more unambiguous evidence for implicit grammar learning. We will also discuss individual differences in learning associated with bilingual experience and degree of handedness.

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(2069)

Statistical Learning is Correlated With Language Performance: An Event-Related Potential Study. JEROME DALTROZZO, JOANNE A. DEOCAMPO, JULIE TRAPANI, SAM SIMS and CHRISTOPHER M. CONWAY, *Georgia State University*—Statistical learning is thought to be important for language development because language acquisition requires learning statistical regularities between a set of items. Previous work has revealed that visual statistical learning is associated with a positive, mid-latency ERP component (Jost et al., 2011). Here, we aimed at showing a direct association between the ERP correlates of statistical learning and language performance. Ten participants (7 females, 18-22 years) completed (1) two tasks of statistical learning (a more verbalizable version using colored circles and a less verbalizable version using Chinese characters) and (2) three language measures (sentence completion, grammar, and vocabulary). The statistical learning tasks showed a positive

event-related component between 500-700ms, replicating Jost et al. Most importantly, the effect of learning as measured by ERPs was correlated with the three measures of language performance, suggesting that language learning stems directly from neurocognitive mechanisms underlying statistical learning.

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(2070)

Modalities in Sequence Learning: Evidence for a Crossmodal Benefit. DENISE N. STEPHAN, *RWTH Aachen University*, ANNA DOVERN, PETER H. WEISS-BLANKENHORN and GEREON R. FINK, *Research Center Jülich*, IRING KOCH, *RWTH Aachen University* (Sponsored by Jochen Muesseler)—While most studies on sequence learning used unimodal (mostly visual) stimulus presentation, we examined the effect of crossmodal stimulus presentation on sequence learning. To this end, we used the serial reaction time task and compared performance between unimodal and crossmodal stimulus presentation. In unimodal conditions, all stimuli were presented either visually or auditorily, whereas in the crossmodal condition visual and auditory stimulus presentation alternated according to a fixed scheme. Throughout all groups three numbers were used as stimuli, either presented as digits or spoken words, and assigned to response keys. Sequence learning was indicated by reaction time disadvantages in random stimulus sequences compared to fixed repeated 6-element sequences (e.g., 3-1-2-1-3-2). The results show improved sequence learning with crossmodal compared to unimodal stimulus presentation. An interpretation of this benefit of crossmodal stimulus presentation will be discussed in terms of enhanced chunking in sequence learning.

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(2071)

The Effects of Phonological and Semantic Associations on Short-Term Memory. JESSICA P. TOLLEMACHE and GEORGINA A. TOLAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*, KERRY A. CHALMERS, *The University of Newcastle*—The patterns of forgetting were examined in terms of proactive interference by manipulating the phonological and semantic characteristics of list items under conditions of delayed recall. A cued recall task consisting of two blocks of four words was used to manipulate interference by including a foil in the first block of items that was related to the target in the second block of items. Forty participants were required to read these blocks of words silently and to then verbally shadow digits for either a 2-second or 4-second period before being cued for recall. As predicted, proactive interference was evident for all interference conditions. In particular the effects of proactive interference were stronger when the phonological characteristics of the interfering item were supported. Contrary to predictions recall performance did not differ between the two delayed conditions. It is suggested that this non-significant result occurred due to participants adopting compensatory rehearsal mechanism.

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(2072)

Searching Repeatedly: How Efficient Can Search Get? MARGIT HÖFLER, *University of Graz*, IAIN D. GILCHRIST, *University of Bristol*, MAGDALENA KRIEBER, ANJA ISCHEBECK and CHRISTOF KÖRNER, *University of Graz*—Searching the same display repeatedly improves search efficiency for larger displays (Solman & Smilek, 2012) but not for smaller ones (Kunar, Flusberg & Wolfe, 2008). We investigated whether this lack of improvement for smaller displays is due to such searches being already extremely efficient. Using a point-and-click task, participants searched 90 times in displays with three, six or nine letters. The displays remained stable throughout or changed for every search. As baseline, participants responded to the target without searching for it. This estimates the time necessary for planning and executing the manual response isolated from search processes. For stable displays, search efficiency increased with repetition for display sizes 6 and 9. For display size 3, search efficiency was close to baseline from the beginning and did not change over searches. This suggests that memory can improve efficiency in repeated search if performance is not already at its maximum.

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(2073)

A Model of Positive Sequential Dependencies in Judgments of Frequency. JEFFREY ANNIS and KENNETH J. MALMBERG, *University of South Florida*—Positive sequential dependencies occur when the response on the current trial n is positively correlated with the response on trial $n-1$. They are observed in a Judgment of Frequency (JOF) recognition memory task (Malmberg and Annis, 2011), and we developed a process model of them in the REM framework (Malmberg, Holden & Shiffrin, 2004; Shiffrin & Steyvers, 1997) by assuming that features that represent the current test item in a retrieval cue carry over from the previous retrieval cue. We tested the model with data that distinguishes between the number of times two given items were studied (frequency similarity) and the similarity between stimuli (item similarity), which was varied by presenting either landscape photos (high similarity), or photos of everyday objects such as shoes, cars, etc (low similarity). Two models of item similarity were tested by assuming that the item representations share a proportion of features and that the exemplars from different stimulus classes vary in the distinctiveness or diagnosticity. A comprehensive exploration of several variants of these models directly was conducted comparing BIC and SBRIC model selection statistics.

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(2074)

Attention and Repetition Priming in the Verb Generation Task. MATTHEW W. PRULL, *Whitman College*—Transfer-appropriate processing (TAP) and identification-production frameworks predict that repetition priming will be reduced by encoding-phase divided attention (DA) in implicit memory tasks that involve conceptual analysis of test stimuli and require responses that go beyond the identification of the test cue. This prediction was tested using the verb generation task. Verb generation priming was weakly affected by a number

classification distracting task at encoding that impacted recognition, was affected more by a more demanding mental arithmetic task, and was abolished entirely by a selective attention manipulation. Priming originating largely from a process unique to the verb generation task was also found to be attention-sensitive. DA affected priming equivalently for high-competition and low-competition items, against the identification-production framework which predicts greater DA effects on priming in high-competition conditions. The results fit comfortably within the TAP framework.

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(2075)

Memory for Emotional Faces: Are Angry Faces More Memorable Than Happy Faces? NATHAN HERDENER, ALISON BURROS and MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, PHILIP A. ALLEN, *University of Akron*—Previous studies have suggested that negatively valenced faces (e.g., angry faces) automatically capture attention away from other faces. The present study evaluated whether an attentional bias enhances memory of the negative emotional faces. Participants first performed a gender discrimination task on a face expressing either an angry or happy emotion, unaware that they would later be tested on their recognition of those faces. They then performed a 20-minute distraction task. Finally, they were given the recognition test, judging whether a face was shown earlier (old vs. new identity). We found enhanced memory of angry faces, relative to happy faces, when the exact same face picture – showing the same emotion – was used during the later recognition test (Experiment 1), but not when neutral faces were used at test (Experiment 2). This finding suggests that negative emotional expressions improve memory for that specific image, without improving general memory for that person's identity.

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(2076)

Number Set Aggregation Generates Implicit Means. PATRICK F. CRAVALHO, BRADLEY J. MORRIS and CHRISTOPHER A. WAS, *Kent State University*, AMY M. MASNICK, *Hofstra University*—Previous research (Cravalho, Morris, Was, & Masnick, 2013) suggests that people often recall individual numbers from sets smaller than four and aggregate properties of sets larger than four. We investigated whether this aggregating process implicitly generates approximate means. We report results of an experiment investigating memory for number sets. Participants saw a series of data sets that varied in size (4, 6, or 8 three-digit numbers) and variance (10% or 20% of the mean), were presented two numbers (a number from the set and the set mean), and were asked to select a set number or the set mean on 50% of trials respectively. Results replicated our prior finding that recognition accuracy decreases and false alarms increase as set size increases, suggesting that aggregating number sets results in approximate means. Selecting the set mean took significantly longer than number selection, suggesting differences in strategy use.

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• WORKING MEMORY II •

(2077)

Verbal Strategies, Aptitude, And Change Detection Performance In Visual Working Memory. LISA D. BLALOCK and LISA A. VANWORMER, *University of West Florida*—Within the visual working memory (VWM) literature, the use of articulatory suppression (AS) tasks to prevent verbal recoding of stimuli is inconsistent. Additionally, research using AS in VWM has shown conflicting results. Luck and Vogel (1997) showed no impact of AS on color change-detection performance, while other research showed reduced VWM performance with a verbal memory load (Morey & Cowan, 2005). The current study examined the role of verbal strategies in a color change-detection task as well as a flicker change-detection task using real-world scenes. Participants completed the change-detection tasks with and without an AS task. Additionally, participants were asked to report the use of verbal strategies and they completed a measure of fluid intelligence to determine how aptitude influences performance on VWM tasks with and without AS. Results are discussed in terms of the cognitive mechanisms underlying VWM performance, and methodological suggestions are made for future work in VWM.

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(2078)

Working Memory and Initial Performance Predict Second Language Vocabulary Acquisition. ALEXANDRA N. TRANI, ZACHARY M. SHIPSTEAD and RANDALL W. ENGLE, *Georgia Institute of Technology*—Working memory capacity predicts a range of cognitive abilities related to language including reading and language comprehension. There is still debate about the relationship between working memory capacity and second language acquisition. We addressed this issue by administering multiple measures of working memory capacity along with a variation of a paired associate task in which participants learned Arabic nouns through a series of four study-test blocks. After a delay, a surprise recognition test was presented to measure retention of the Arabic nouns. Data were collected from over 500 native English speakers not fluent in Arabic. We found that together, working memory capacity and performance on the first test block of the Arabic trainer make the best prediction of the number of Arabic nouns retained both at the end of training (i.e.: test block four) and after a delay.

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(2079)

Is Subjective Organization Related to Working Memory Capacity and Fluid Intelligence? TYLER L. HARRISON and RANDALL W. ENGLE, *Georgia Institute of Technology* (Sponsored by Nelson Cowan)—We know that there is a strong relationship between a subject's performance on multiple free recall trials and how they subjectively organize those words (e.g., Tulving, 1962). However, we do not know what cognitive mechanisms may explain individual differences in how subjects organize word lists. More specifically, we do not know whether cognitive abilities—like working memory

capacity (WMC) and fluid intelligence (Gf)—explain the relationship between subjective organization and free recall. We addressed these questions by administering multiple measures of WMC, Gf, and subjective organization to 129 subjects. What we found was that both WMC and Gf were related to subjective organization. However, there was a dissociation: Fluid intelligence was related to spontaneous usage of an organizational strategy while WMC was related to the implementation of that strategy. Furthermore, subjective organization predicted memory performance above and beyond WMC and Gf.

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(2080)

Individual Differences in Memory Search and Their Relation to Intelligence. KARL HEALEY, PATRICK CRUTCHLEY and MICHAEL J. KAHANA, *University of Pennsylvania*—Attempts to understand why memory predicts intelligence have not fully leveraged state-of-the-art measures of recall dynamics. Using data from a multi-session free recall study we examine individual differences in measures of recall initiation and post initiation transitions. We identify four sources of variation: one corresponding to primacy, another to recency, a temporal factor corresponding to transitions mediated by temporal associations, and a semantic factor corresponding to semantically mediated transitions. Together these four factors account for 83% of the variability in overall recall accuracy, suggesting they provide a near complete picture of recall dynamics. We also show that these sources of variability account for the bulk of correlation between memory and intelligence. The temporal-association factor was the most influential in predicting both recall accuracy and intelligence. We outline a theory of how controlled drift of temporal context may be critical across a range of cognitive activities.

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(2081)

Do Working-Memory Capacity, Mind-Wandering, and Openness Predict Creative Thinking? BRIDGET A. SMEEKENS and MICHAEL J. KANE, *University of North Carolina at Greensboro*—How do working memory capacity (WMC), mind-wandering, and openness-to-experience predict creativity? Creativity might benefit from the attentional control that high WMC enables (and reduced mind-wandering reflects), particularly in selectively searching memory and inhibiting accessible, uncreative ideas. However, unfocused and diffuse attention might also promote creativity: Mind-wandering, especially during incubation periods, may help access loosely relevant concepts that are remotely linked to commonplace ideas. Finally, openness-to-experience is known to predict creativity, but it may also moderate the WMC-creativity association. We tested these ideas from an individual-differences perspective, asking whether mind-wandering propensity during an incubation-period break from an alternative-uses task, WMC, and/or openness predict creative (divergent) thinking in the alternative-uses task. We found that, whereas incubation mind-wandering and WMC were unrelated to creativity (consistent with the Study 1 that we



reported at last year's Psychonomics), openness-to-experience – particularly its “fantasy” facet, which taps a general mind-wandering style – did predict creative, divergent thinking (but not in interaction with WMC).

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(2082)

Individual Differences and Simple Division: Use of Eye-Tracking as a Window on Mental Processing. MATTHEW G. HUEBNER, KELSEY J. MACKAY and JO-ANNE LEFEVRE, *Carleton University*—Are eye-movement patterns indicative of the strategies that people use when they solve simple arithmetic? Thirty-four adults solved basic division problems (e.g., 8/4; 56/8) with an emphasis on speed and accuracy. Participants also reported their solution strategies on a trial-by-trial basis. Two groups were created based on participants' self-reports: Retrievers used direct memory access to solve most large problems whereas Transformers used procedural manipulations (e.g., recasting, counting) on more than 50% of large problems. Retrievers and Transformers showed substantial differences in patterns of gaze duration and fixation count across interest areas (i.e., left operand, operation sign, right operand) and problem size. These findings show how eye-tracking technology can be used to validate and augment introspective methods of assessing cognitive processes during arithmetic problem solving.

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(2083)

Need for Cognition as a Predictor of Individual Differences in Cognitive Ability. JEFFREY S. CHRABASZCZ, *University of Maryland, College Park*, AMBER M. SPRENGER, *The MITRE Corporation*, SHARONA M. ATKINS and DONALD J. BOLGER, *University of Maryland, College Park*, GREGORY H. COLFLESH and MICHAEL F. BUNTING, *University of Maryland Center for Advanced Study of Language*, MICHAEL R. DOUGHERTY, *University of Maryland, College Park*—Previous research proposes that people differ in their need for cognition (NFC) – the tendency to engage in effortful cognitive activity. While this trait determines persistence in cognitive activity, the relationship of NFC to intelligence measurement in the context of other cognitive abilities, (e.g., working memory), is unknown. The goal of this research was two-fold: First, we examined the relative importance of NFC in predicting scores on Raven's Progressive Matrices, (RPM), relative to two working memory (WM) measures: A newly-developed measure, (shapebuilder) and a well-established measure, (reading span). After evaluating dominance of these predictors, we also evaluated both metric and ordinal moderation of the WM-Intelligence relationship by NFC. We found that shapebuilder strongly dominates both NFC and reading span and that NFC also dominates reading span in predicting variance in RPM. We also found that NFC mediates the WM-Intelligence relationship, but only when the NFCxWM relationship is tested with interval assumptions. When reducing these data to an ordinal scale, we find no moderation of this relationship.

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(2084)

Monkeys Show the Same Basic Mechanisms of Visual Short-Term Memory as Humans. DEEPNA T. DEVKAR and ANTHONY A. WRIGHT, *University of Texas Medical School at Houston*, WEI JI MA, *Baylor College of Medicine*—There has been disagreement about basic processes underlying visual short-term memory (VSTM) in humans. Studying these same processes in a nonhuman primate may help resolve this controversy. We tested two rhesus monkeys in a change detection task where they identified the changed item from a display of previously seen items. Sample displays contained 2-5 oriented lines were presented simultaneously, followed by a 1-s delay, and a test display containing two items with one item randomly changed to a new orientation. Accuracy varied with magnitude of change (10–90 degrees) and inversely with the number (2–5) of to-be-remembered lines. Performance was modeled according to four current models of VSTM – fixed item-limit, slots-plus-resources, equal precision, and variable precision models. Performance was best accounted for by the variable precision model, as had been previously shown for humans, suggesting that memory resource is distributed and variable across all items. The worst account was by the fixed-capacity, item-limit model, reinforcing a similar result from humans. Similar processing by monkeys and humans adds strong evolutionary support for the basic mechanisms underlying VSTM.

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(2085)

Working Memory Training Can Negatively Impact Recognition Memory Performance. LAURA E. MATZEN and MICHAEL HAASS, *Sandia National Laboratories*, MICHAEL TRUMBO, *University of New Mexico*—There has been a great deal of interest in working memory (WM) training, with some researchers arguing that WM training improves performance on fluid intelligence tests and others arguing that WM training does not transfer to other tasks. We compared WM training to mental imagery training and tested participants' performance on a variety of memory tasks before and after a three-week training period. For recognition memory tasks, the participants in the mental imagery training group showed improved performance after training. However, the recognition memory performance of the participants in the WM training group decreased after training. These results indicate that WM training can have negative effects on other types of memory performance.

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(2086)

Comparative Effects of Two Distinct Cognitive Training Programs. HARRY WILMER and KARA BLACKER, *Temple University*, WALTER SCHNEIDER, *University of Pittsburgh*, JASON CHEIN, *Temple University*—Previous research has demonstrated the possibility of improving various facets of cognition through training exercises designed to target specific components of working memory and executive function. The current research employed a newly created rule-learning training program and explored its effectiveness as a cognitive training paradigm. A common criticism of existing training

studies is the lack of a valid control group against which to compare the training regimen. Thus, the pattern of transfer from this rule-learning training program was compared to the transfer profile produced by an active working memory training group, and to a third no-contact control group. After 20 days of training, the rule-learning group evinced significantly improved performance on an untrained task-switching test, relative to the two other groups. The results encourage further exploration of the specific mechanisms that can be targeted by training, and further investigation of rule-learning training as a platform for cognitive enhancement. Email: Harry Wilmer, harry.wilmer@gmail.com

(2087)

Potential Mechanisms Underlying Working Memory Training and Transfer. NINA S. HSU and MARTIN BUSCHKUEHL, *University of Maryland, College Park*, JOHN JONIDES, *University of Michigan*, SUSANNE M. JAEGGI, *University of Maryland, College Park*—The potential malleability of working memory (WM) through training intervention challenges the long-standing assumption that cognitive abilities remain fixed over time. However, successful transfer after training has not been unequivocally observed, suggesting the interplay of a variety of factors. We hypothesized that the mechanisms underlying WM training and transfer to higher cognitive functions may rely on improved interference resolution and inhibitory control. In this study, participants trained on a visuospatial n-back task (NB), or an active control task (KT) for ten sessions. Relative to KT subjects, NB subjects improved on detecting lures on an untrained verbal n-back after five sessions, whereas improvements on a WM task with inhibitory control components (the AX variant of the CPT task) occurred only after ten sessions. These findings indicate a dose-response effect of WM training – while training can improve interference resolution relatively quickly, transfer effects on interference resolution and inhibitory control require additional training. Email: Nina Hsu, ninahsu@umd.edu

(2088)

Laboratory Versus Psychometric Assessment of Working Memory II. JOSEPH W. HARRIS and EMILY M. ELLIOTT, *Louisiana State University*, BENJAMIN D. HILL, *University of South Alabama*, ALYSE A. BARKER, *Louisiana State University*, ANNELIESE C. BOETTCHER, *University of South Alabama*—Psychologists conducting research in both basic and applied settings typically define working memory (WM) in the same way, yet use different methods to assess WM function. Previous research has demonstrated that laboratory and psychometric tests of WM share a significant correlation with one another (Shelton, Elliott, Hill, Calamia, & Gouvier, 2009), suggesting a high degree of shared variance. In recent years however, psychometric tests of WM have been modified. For example, the Wechsler Adult Intelligence Scale was revised and measures included in the working memory index were changed; a new Digit Span Sequencing test was included, and changes were made to the Arithmetic subtest as well (Wechsler, 2008). This research examines the relationship

among current psychometric and laboratory tests of WM and whether the current psychometric tests demonstrate a predictive relationship with general fluid intelligence. Email: Emily Elliott, eelliott@lsu.edu

(2089)

The Pros and Cons of Measuring Cognitive Ability Online. JEFFREY L. FOSTER, KENNY L. HICKS and RANDALL W. ENGLE, *Georgia Institute of Technology* (Sponsored by Elizabeth Loftus)—We developed online versions of several Working Memory Capacity (WMC) and Fluid Intelligence (Gf) tasks with two aims; making them applicable for online subject pools, and making them available for academic researchers. We asked if 1) people would perform similarly on the online and in-lab versions of these tasks, and 2) if the online versions would measure the same constructs—WMC and Gf—as the in-lab measures. We found that most of these tasks were good measures of WMC and Gf when administered online, but found problems with the verbal WMC tasks—most likely caused by the ability to “cheat.” These findings offer insight into the limitations of these easy-access online subject samples. We conclude by offering solutions to the limitations we found with verbal based working memory tasks, and discussing how these tasks can be used to conduct large-scale online research. Email: Jeffrey Foster, jeff.foster@gatech.edu

(2090)

Making Working Memory Measures Free and Universal for Psychological Assessment. KENNY L. HICKS, JEFFREY L. FOSTER and RANDALL W. ENGLE, *Georgia Institute of Technology* (Sponsored by Michael J. Kane)—The Complex Span paradigm is one of the most widely used methods of assessing Working Memory Capacity (WMC). While most of these tasks are freely available for download, their administration requires a Windows-based operating system and a paid license for specialized software. These requirements limit researchers’ ability to use some of the most validated instruments available for assessing individual differences in higher-order cognition. To address this issue we developed new versions of the traditional Automated Complex Span tasks. These new tasks can be deployed on OS X, Linux, and Windows. These tasks do not require any commercial licensing or administration costs to the researcher. To assess the validity of our new tasks we conducted a two session study, asking subjects to complete our original WMC tasks in the first session and our new tasks in the second session. We found that the new WMC tasks measured the same cognitive abilities as the original tasks. In short, our new tasks are universally compatible, free to administer, and retain the same psychometric properties of the original, well-established, WMC tasks. Email: Kenny Hicks, khicks6@gatech.edu

(2091)

Role of Left Dorso-Lateral Pre-Frontal Cortex in Cognitive Control for Emotional Stimuli. ANNA PECCHINENDA and FABIO FERLAZZO, *La Sapienza University of Rome*, MICHAL LAVIDOR, *Bar-Ilan University*—Selective attention



relies on working memory to maintain task-priorities (Lavie, 2010), as distractors interfere more under high memory load (deFockert et al., 2001). However, emotional distractors interfere regardless of memory load (Pecchinenda & Heil, 2007). As the left DLPFC is involved in working memory and attentional control, we investigated through the tDCS how its modulation affects attention, reducing interference from emotional distractors. Participants performed an interference task (responding to positive/negative words while ignoring emotional faces) under low/high memory load and anodal, cathodal or sham tDCS. Participants in the anodal group showed better performance at the memory task, but the same distractors interference, suggesting that the left DLPFC plays a role in improving working memory but that, when emotional stimuli are used, attentional control of task-relevant information is not sufficient. Likely, other brain areas (i.e., dorsal ACC) may be involved in later stages, linked to response related processes (Banich, 2000).

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(2092)

Impact of Emotion on Interference Resolution in Working Memory. EDA MIZRAK and ILKE ÖZTEKIN, *Koç University*—Previous research has shown that the presence of interference has less impact for emotional compared to neutral study material in working memory (e.g., Levens & Phelps, 2008). However, it is unclear how emotional content modulates the impact of interference in memory. Emotional content could directly affect the build-up of interference, leading to reduced levels of interference. Alternatively, emotional content could aid the controlled processes that resolve interference. The present study employed the response deadline speed-accuracy trade-off (SAT) procedure to independently test these hypotheses. Participants studied 3 item lists consisting of emotional or neutral images, immediately followed by a recognition probe. Results indicated a slower rate of accrual for interfering material (lures from previous study list) for emotional compared to neutral stimuli, suggesting a direct impact of emotion on the build-up of interference. These findings can provide an insight into the interactions of emotion and memory processes during interference resolution.

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• TESTING EFFECTS I •

(2093)

Retrieval-Based Learning: Exploring the Role of Retrieval Strategies Using Part-List Cues. PHILLIP J. GRIMALDI and *JEFFREY D. KARPICKE, *Purdue University* (Sponsored by Gregory Francis)—Retrieval practice is a powerful technique for improving memory. One idea for why retrieval practice is effective is that it promotes the development of retrieval strategies. This idea was examined in the present study by using a part-list cuing procedure. Providing part-list cues on a recall test typically impairs memory of the remaining words, because it disrupts the use of subjects' preferred retrieval

strategies. However, recall is typically restored when the part-list cues are removed because subjects can revert back to their original strategies. The present study examined the effects of part-list cuing following both retrieval practice and repeated study. Both learning conditions showed the typical negative effect of part-list cues. However, when the part-list cues were removed, recall was restored in the retrieval practice condition but not in the repeated study condition. The results support the idea retrieval practice promotes the development of retrieval strategies.

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(2094)

Testing & Transitive Inference. MILTON E. PICKLESIMER and NEIL W. MULLIGAN, *University of North Carolina at Chapel Hill* (Sponsored by Peter Ornstein)—To better understand how testing affects the abstraction of and flexible use of a knowledge structure, we conducted a study using the transitive inference paradigm. Subjects were taught a series of inter-related premises. Half of the subjects learned the premises through practice tests and the other half learned them through restudying. All subjects took a final test 1 week later that assessed their memory for the overtly learned premises and their ability to make inferences about associations that were not overtly taught. Half of the subjects in both encoding conditions also took this test a few minutes after initial learning. Interestingly, we found that performance on the inference problems was not strictly a function of encoding condition. This suggests that the abstraction of and flexible use of a knowledge structure is not strictly a function of testing or restudying.

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(2095)

When Less is More: Retrieval-Refined Representations Produce the Testing Effect. CHRISTIAN LUHMANN, *Stony Brook University*, ADAM CONGLETON, *Macquarie University*, XIAOLEI ZHOU, *Miami University*, SUPARNA RAJARAM, *Stony Brook University*—Intuition suggests that successful learning requires repeated, intensive studying. In contrast, empirical work has revealed the testing effect in which the mere act of retrieving previously studied material provides superior memory performance. Despite the wealth of evidence demonstrating the testing effect, the explanations for the phenomenon remain sparse. Here we present computational simulations, successfully reproducing the quintessential features of the testing effect itself and providing novel insight into its origins. Specifically, results suggest that repeated studying encourages multiple, conflicting organizations that can only support memory over short periods of time. Repeated retrieval, in contrast, encourages refined representations, encouraging learners to jettison conflicting material, but ultimately yielding more durable learning. Together, these findings have both psychological and educational implications.

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(2096)

Transfer Appropriate Processing in the Testing Effect. KIT W. CHO, MARY T. VELTRE and JAMES H. NEELY, *University at Albany, SUNY*—We obtained evidence for transfer appropriate processing in the testing effect by manipulating the type of cue subjects received in review and at the final test. Subjects studied single words (SUBTRACT) that were cued by one of two types of cues during the review phase: orthographic (S_B_R_CT) or semantic (ADD); another group of subjects restudied the targets. Two days later, all subjects completed a final cued recall test in which they were cued by: (a) the exact same cue presented during review, (b) the same type of cue (SU_T_A_T or MINUS), or (c) the opposite type of cue. Memory was highest when cued by the exact same cue, followed by the same type of cue, with the opposite cue yielding the lowest performance. Testing effects were obtained in all conditions except when subjects received orthographic cued recall during review and semantic cued recall at final test. Email: James Neely, jneely@albany.edu

(2097)

Initial Testing Shields Against Retrieval-Induced Forgetting. ATTILA KERESZTES and MIHÁLY RACSMÁNY, *Budapest University of Technology and Economics*—Testing can enhance learning but it might also induce forgetting of related memories, a phenomenon known as retrieval-induced forgetting (RIF). Research on RIF has shown that only retesting and not restudying leads to RIF (see Anderson and Levy, 2011). In two experiments we explored whether selective retrieval and selective restudy of memories induce forgetting of related memories with or without initial testing of the entire learning set. In Experiment 1, subjects studied cue-target associations, some of which were then either restudied or retested. RIF occurred on a delayed final test only when memories were retested and not when they were restudied. In Experiment 2, following the study phase of cue-target associations subjects were tested for all cue-target associations, then they selectively retested or restudied some of the targets. We found that taking the initial test as a baseline, despite the huge impact on practiced items, selective retrieval/study caused no decrease in final recall of related items. These findings suggest that initial retrieval of the learning set shields against the constraining effect of later selective retrieval, whereas selective restudy is insensitive to the effect of previous retrieval attempts.

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(2098)

Testing Eliminates Proactive Interference: Differentiation and Integration. CHRISTOPHER N. WAHLHEIM and LARRY L. JACOBY, *Washington University in St. Louis*—Testing originally learned information prior to presenting new competing information has been shown to counteract the deleterious effects of proactive interference. The present investigation was conducted to explore the mechanisms underlying these effects. One possibility is that testing differentiates sources of competing information. Another possibility is that testing increases the accessibility of original information allowing for effective integration with competing

information. Our experiments conformed to A-B, A-D paired-associate learning paradigms in which target words paired with cue words were changed between two lists (e.g., book – worm, book – study). The critical manipulation was whether List 1 pairs were tested or restudied prior to List 2. Differentiation was assessed by comparing performance on control items for tested and restudied conditions. Integration was assessed by a measure of recollection that pairs had earlier changed across lists. Results revealed that testing eliminated proactive interference through both differentiation and integration.

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(2099)

Subsequent Encoding is Potentiated by Successful Test of Studied, But Not of Self-Generated Items. MIHÁLY RACSMÁNY, ATTILA KERESZTES and PÉTER PAJKOSSY, *Budapest University of Technology and Economics*—Recent findings have demonstrated that unsuccessful tests can enhance subsequent learning, known as test-potentiated learning (Kornell et al., 2009). In two experiments we investigated whether testing of generated items (unsuccessful retrieval) can further enhance subsequent learning of new information. In Experiment 1, subjects either attempted to generate B targets to an A cue or studied A-B pairs, then studied A-C pairs. They were later assessed for B then C responses by receiving A cues. We found that failed tests enhanced subsequent learning, although the retention of self-generated B items was significantly better in comparison with studied items. Experiment 2 applied the same procedure with one exemption: following A-B study/generation and before A-C learning, subjects were either tested (cued recall) for B items or they restudied A-B pairs. We found that when B items were externally presented, testing in comparison with studying of B items potentiated the subsequent learning of C items. However, when B items were self-generated later testing and studying produced the same effect on subsequent learning. Our findings suggest that self-generated retrieval is a key factor in test-potentiated learning.

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(2100)

The Effects of Pretesting and Testing on Memory and Inferencing. MARISA CRISOSTOMO and DANIEL R. KIMBALL, *University of Oklahoma*—Based on previous research, pre-study questions alone and post-study questions alone improve direct memory for a text passage relative to having neither type of question. However, less is known about how the effects of pre-study and post-study questions combine and how they influence ability to inference and apply knowledge. In the present study, participants studied text passages as to which they were asked pre-study questions, post-study questions, both, or neither. The final test included direct memory questions and inference questions. We expected to observe pretesting and testing effects for previously tested material, but competing hypotheses predicted subadditive, superadditive, and additive effects of combining testing and pretesting. Based on previous research, we expected no effects or adverse effects of testing



and pretesting on presented material that had not been tested previously. There were competing hypotheses as to the effects of testing and pretesting on questions requiring inferences; enhanced domain activation and elaboration predicted positive effects, but the focusing of attention on specific facts predicted negative effects. Results will be discussed in terms of the theoretical bases for these hypotheses.

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(2101)

Effects of Repeated Retrieval on Young Children's Memory: Compared Repeated Studying. CHIE HOTTA, *Kansai University of Welfare Sciences*, HIDEITSUGU TAJIKA, *Kobe Shinwa Women's University*, EWALD NEUMANN, *University of Canterbury*—Research on human learning and memory has demonstrated that repeated testing promotes long-term retention of material compared to repeated studying. This phenomenon is called the testing effect which as a learning device has a powerful effect on long-term retention. Despite benefits of testing, there is little known about the effects of repeated retrieval in young children's memory. So, we examined whether the retrieval practice during learning for young children (5 year olds) could lead to retention after a few hours, compared to repeated hearing. The results showed that powerful effect on the importance of retrieval for learning. When children are tested on learning and remembering material successfully, they will retain it more in the future than when they repeatedly study it and are not tested.

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• SELECTIVE ATTENTION I •

(2102)

Looming Motion Fails to Capture Oculomotor Attention in Visual Search. JOANNA LEWIS and MARK NEIDER, *University of Central Florida*—Looming objects have been shown to capture attention in a visual search task. Previous studies, however, did not disambiguate between oculomotor and covert attentional mechanisms, evaluate different types of motion, or include non-looming control conditions. In two experiments we recorded eye movements while participants searched for an oval among distractor spheres (Lin, Fraconeri, & Enns, 2008) with apparent or smooth motion. Each trial included a looming target, distractor, or no looming object. With both types of motion, relative to looming absent trials, there was an RT benefit when targets loomed and an RT cost when distractors loomed. Surprisingly, participants made eye movements to looming targets, but rarely to looming distractors. With smooth motion, participants made fewer target fixations. Overall, search costs were associated with an increased number of fixations and less efficient scan paths. Our data suggest that looming distractors impair performance, but do not capture oculomotor attention.

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(2103)

Capture by Abrupt Onsets: Now You See it, Now You Don't. NICHOLAS GASPELIN and ERIC RUTHRUFF, *University of New Mexico*, MEI-CHING LIEN, *Oregon State University*—Can salient stimuli, such as abrupt onsets, capture attention? Some researchers consistently find that they can, regardless of the observer's current goals. Others consistently find they cannot, unless the observer happens to be looking for that kind of stimulus. Many researchers have attempted to explain this puzzling discrepancy, with limited success. The present research began with the observation that different camps tend to employ tasks with different target-finding properties: shape vs. color. In the present pre-cuing experiments, we directly compared these two tasks using identical stimulus displays, changing only the target-finding property. The results were striking: shape search produced large cue validity effects, whereas color-search produced negligible effects. Follow-up experiments suggested that search difficulty is the critical underlying variable. Competing theoretical interpretations of the effect of difficulty on capture effects are offered.

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(2104)

Task-Contingent Attentional Capture by Faces. SHIORI SATO and JUN I. KAWAHARA, *Chukyo University*—The present study investigated whether faces capture attention regardless of attentional set. Presenting a face as a distractor during a visual search has been shown to impair performance relative to when the face was absent, implying mandatory attraction of attention by faces. Given that attentional control is contingent on the observer's current goal (Folk et al., 2002), faces should not capture attention if they are irrelevant to the observer's attentional set. Faces were task relevant in previous studies demonstrating face-induced attentional capture; thus, we created a task in which faces were completely irrelevant to observer's set. Participants identified a target among nontargets of heterogeneous colors. A peripheral face image that appeared as a brief distractor before the onset of the target did not capture attention (Experiments 1–3). However, when observers searched for a complete face among nontargets consisting of face fragments, the distractor face image captured attention (Experiment 4). These results indicate that faces are not special in terms of attentional capture. Rather, the current behavioral goal determines whether faces capture attention, reflecting flexible top-down control of attentional deployment.

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(2105)

Individual Differences in Attention Capture. KIRK A. STOKES and KAREN M. ARNELL, *Brock University*—An individual differences approach was used to examine the reliability and generalizability of attentional control processes in various contingent and non-contingent attention capture tasks (spatial visual search, temporal RSVP search, involuntary spatial orienting). Each participant performed each task in two experimental sessions separated by 7–10 days. Reliable individual differences in attention capture were observed for each task, and these remained even after controlling for working memory performance. Indeed, neither working

memory scores from the operation Span (OSPAN) task nor self-reported attentional control (as measured with the Attentional Control Scale) were good predictors of individual differences in attention capture on any task. Also, attention capture was poorly correlated across attention capture tasks. The results suggest that attention capture is a reliable individual differences variable within a given task and context, but that attention capture is not a generalizable trait.

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(2106)

Contextual Similarity Effect in Negative Priming is Modulated by Attention to the Contextual Cues. HSUAN-FU CHAO, *Chung Yuan Christian University*—Negative priming refers to the delayed response to a probe target when a previous prime distractor is repeated as the target. It has been proposed that memory retrieval is one critical mechanism for the manifestation of this negative priming effect. Hence, it is expected that any factor that can modulate memory retrieval, such as the contextual similarity between prime and probe trials, should affect negative priming. However, evidence for the contextual similarity effect in negative priming is inconsistent. In the present study, I proposed a hypothesis that attended contextual cues are more likely to be incorporated into a distractor representation in comparison to unattended cues. As a result, attended cues are more likely to produce the contextual similarity effect. By manipulating whether contextual cues are abrupt-onset stimuli or not, the results indicate that attended cues, but not unattended cues, produced the contextual similarity effect in negative priming. Email: Hsuan-Fu Chao, hfchao@cycu.edu.tw

(2107)

The Flexible Nature of Attentional Control Settings. HAN SHIN KIM, SU JIN KIM and YANG SEOK CHO, *Korea University* (Sponsored by Addie Johnson)—Previous studies have shown that attentional control settings (ACSs) could vary flexibly as function of target uncertainty (e.g., Folk & Remington 2010). Two experiments were conducted to investigate the nature of ACS when participants searched for a target defined by color among a task-irrelevant color distractor and two achromatic distractors following a color cue. Each experiment had a distractor and a target in the target display. In Experiment 1, in which the target-defining feature was blue and yellow, and the non-target distractor was red, neutral green cue caused a cueing effect, as the target-color cues did. However, when the target-defining feature was blue and the distractor color was red and yellow, the neutral cue of green showed a negative cueing effect, as the distractor-color cues did. These results imply that ACS can be set in terms of the target color or distractor color to increase the task efficiency. Email: Yang Seok Cho, yscho_psych@korea.ac.kr

(2108)

Priming a Sequence: Visual Attention to Features and Associative Learning. DAVOOD GOZLI, *University of Toronto*, JOSHUA MOSKOWITZ, *Queen's University*, JAY PRATT, *University of Toronto*—In this study, we examine if attentional capture by color transients is affected by the

learned association between the colors and other expected task features. During an acquisition phase, participants responded to target stimuli (letters 'S' and 'H') and learned that each target is temporally followed by a color (red and green). Next, in a test phase, a letter identity cue signaled the likely target letter (80% validity) while we measured attentional capture by an uninformative color transient. The transient associated with the cued letter captured attention more strongly compared to the color transient associated with the uncued letter, and two further experiments revealed that the learned association between letters and colors drove this bias. These results indicate that activating one member of a learned stimulus pair can produce an involuntary bias toward the other member of the pair, even when the stimuli are from different featural dimensions.

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(2109)

Do Different Attentional-Capture Paradigms Measure the Same Underlying Cognitive Processes? DIANA F. PRICOP, MATTHEW R. YANKO, THOMAS M. SPALEK and VINCENT DI LOLLO, *Simon Fraser University*—Attentional capture occurs when a task-irrelevant stimulus involuntarily receives attentional priority. Many studies have attempted to determine whether capture is a result of bottom-up or top-down processes. These studies have used different paradigms, under the untested assumption that they measure the same processes. The present study takes a first step in testing this assumption by comparing two widely-used paradigms: Visual Search and Rapid Serial Visual Presentation (RSVP), to determine whether the results can be compared directly. We found a significant positive correlation between indices of attentional capture obtained with the two tasks, supporting the hypothesis that the Visual Search and RSVP paradigms are measuring similar underlying cognitive processes.

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(2110)

Real-World Distractibility Predicts Laboratory Performance on an Auditory Attention Task. SANDRA MURPHY and POLLY DALTON, *Royal Holloway, University of London*—Laboratory tasks measuring selective attention are strikingly different from the complex environment we live in, making it important to establish whether there is a relationship between task performance and everyday behaviour. We used the Cognitive Failures Questionnaire (CFQ; Broadbent et al., 1982) to provide a measure of everyday distractibility. We investigated the relationship between CFQ score and performance on an auditory attentional capture task, in which participants responded to a target sound whilst ignoring an irrelevant singleton distractor (presented on half of the trials). We found that CFQ score successfully predicted interference from the distractor; the higher the reported distractibility, the more errors were produced when the singleton was present. Although this relationship has been established in vision (e.g. Forster & Lavie, 2007), the current study is the first to reveal a link between performance on a laboratory auditory attention task and everyday distractibility.

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(2111)

Aging and the Primacy of Object Onset in Visual Change Detection. NAOHIDE YAMAMOTO and MARIA J. DONALDSON-MISENER, *Cleveland State University* (Sponsored by Benjamin Wallace)—It has been shown that onset of a new object in an environment is more effectively detected than offset of an existing object. The robustness of this primacy of object onset has been demonstrated in a number of different paradigms, but less is known about whether the same pattern persists throughout the adult lifespan. The present study addressed this issue by having younger and older adults detect object onsets and offsets in naturalistic scenes. Results showed that although older participants were slower and less accurate overall than younger participants in detecting changes, both age groups exhibited the onset primacy of similar magnitude. This finding suggests that visual and cognitive functions that enhance the detection of object onset undergo either global decline only or little alteration at all in aging, providing an important clue for understanding mechanisms that give rise to the onset primacy in change detection.

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(2112)

Inattentional Blindness in Simulated Driving Environments. JUSTIN M. ERICSON, MELISSA R. BECK, SCOTT A. PARR and BRIAN WOLSHON, *Louisiana State University*—Limits in attention can affect driver performance in detecting important target information. Past research (Young & Regen, 2007) has focused on attentional distractions that occur inside of the vehicle (e.g., cell phones) rather than outside the vehicle. However, information can be missed even when attention is directed outside the vehicle. As seen with inattentional blindness, when attentional resources are overloaded or not biased toward features of an unexpected target, the target can be missed even when attention is directed to the location of the target. This study used a driving simulator to examine the effects of environmental clutter, vehicle tracking, and target expectations (i.e. cross walk signs) to measure reactions to a critical target pedestrian entering the roadway. Results indicated that having a lower tracking load improves your ability to utilize environmental expectations to improve RT to critical targets, suggesting that attentional load in vehicle tracking negatively impacts driving performance.

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(2113)

Distinctiveness, Emotion, and Display Size in Change Detection in Faces. ERIC G. FREEDMAN, MICHAEL FARMER, SHELBY YEARY, MATTHEW MOLLOSEAU and TIFFANIE HILGENDORF, *University of Michigan-Flint*—The present study examines whether emotion or distinctiveness underlies the detection of change among faces. In a flicker paradigm, participants received 4, 6 or 8 faces that could be either emotional or neutral and distinctive or non-distinctive. The participants decided whether one of the faces had changed in either identity or emotional state. The distinctiveness of facial emotion was manipulated by having the minority of the faces be neutral or emotional. Increasing the display size

produced a relatively greater increase in errors and search time when a neutral face changed regardless whether neutral faces were distinctive. These interactions also showed that, as the display size increased, participants detected emotional faces faster and more accurately even when the emotional faces were not distinctive. Thus, individuals do not attend initially to facial distinctiveness but rather they primarily focus on the facial emotions. Implications for current cognitive and computational models will be discussed.

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(2114)

Mood Effects on Change Detection. ELIAS THEODOSIS and DAVID N. RAPP, *Northwestern University*—Mood can shape performance in domains ranging from visuospatial processing to problem solving. And in general, people in positive moods typically exhibit a broader focus of attention than do people in negative moods. In the current study, we examined whether mood influences the propensity to detect changes in stimuli. After completing a mood induction, participants read through a text twice with the goal of identifying whether the content in the second presentation contained a change. The second text potentially included a single word modification that was either semantically related or unrelated to the word it replaced. Participants overall had difficulty identifying changes that reflected similar semantic content. But the difficulty observed in these cases was most obvious for participants in a positive as compared to a negative mood. Although traditionally discussed solely with respect to cognitive factors, change detection is also moderated by affect.

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(2115)

Leaky Ignoring and Visual Mismatch Negativity in the Flanker Task. ABIGAIL L. NOYCE and ROBERT SEKULER, *Brandeis University*—In the Eriksen flanker task, subjects judge the direction of a central target while ignoring flanking items. Flankers whose directions are incongruent with the central target nonetheless interfere with processing. To investigate whether predictability of flanker orientation influences this congruency effect, we manipulated the direction of flanking items, creating “common” (90%) and “rare” (10%) directions. Congruent and incongruent configurations, and left- and right-pointing central targets were equiprobable. We recorded scalp EEG while the task was performed and measured the visual mismatch negativity (vMMN) evoked by rare flanker directions. Behaviorally, rare orientations enhanced the congruency effect: subjects responded faster when the rare flanker direction was congruent with the central target, but more slowly when it was incongruent. Further, individual subjects’ vMMN magnitude linearly predicts the degree of such enhancement. Unexpected distractors that leak through intentional ignoring enhance the congruency effect and contribute to the vMMN.

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(2116)

Perception of Temporal Order Throughout the Period of the AB: A Test of Two Hypotheses. HAYLEY E.P. LAGROIX, THOMAS M. SPALEK and VINCENT DI LOLLO, *Simon Fraser University*—Identification of the second of two targets (T2) is impaired when presented shortly after the first (T1). This attentional blink (AB) also occurs for perception of temporal order, causing order reversals. There are two accounts of order reversals: temporal integration (order is lost due to episodic integration) and prior entry (the relative strength of target representations determines which target is perceived as first). We presented three targets (T1, T2, T3), with T3 coming directly after T2. T1-T2 lag was varied to assess T2-T3 order reversals throughout the period of the AB. To test the two accounts, we manipulated the relative salience of T2 and T3. The probability of order reversals was significantly greater when T3 was more salient than T2. This result is consistent with predictions from the prior-entry account, but not with predictions from the temporal-integration account.
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(2117)

How Hand Posture Modulates Interference From Extraneous Information in a Flanker Task. NICOLE M. MURCHISON and ROBERT W. PROCTOR, *Purdue University*—In a previous study the interference produced by flanking distractor stimuli on keypress responses to a target stimulus was reduced when the participant's hands were placed around the target's location. This result was taken to show that visual attention can be focused on the within-hands region, facilitating processing of stimuli inside that region and inhibiting processing of those outside of it. Our Experiment 1 successfully replicated the findings using foot-press responses. Experiment 2 showed that the interference was not reduced when both the distractors and target were displayed within the hands. In Experiment 3, however, the interference was reduced when the distractor was the centrally located letter and the targets were the letters outside of the hands. This latter result suggests that the hands serve as a reference frame that assists selecting between distractor and target stimuli, regardless of which is located between the hands.
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(2118)

Suppressing the Capture of Attention Via Training. MARK W. BECKER, CHAD PELTIER and TAOSHENG LIU, *Michigan State University*—We investigated whether the capture of attention by a particular color could be reduced via training. During the training phase, we tracked eye movements as participants searched among Landolt Cs for one with a break on the right or left. The Cs appeared in four colors. For half the participants, each fixation on a red C resulted in a beep and a loss of money. For the other half, each fixation on a blue C produced these punishments. The training phase was straddled by a pre- and post-test comprised of the additional singleton task with three conditions: no-distractor, a blue singleton distractor, or a red singleton distractor. During the training phase, there was a small but highly reliable effect of participants making fewer fixations on the punished color.

This effect built up rapidly, yet participants did not become explicitly aware of the punishment contingency. The post-test also showed a small reduction in the RT cost caused by a distractor of the punished color. These results suggest that punishing attention to a feature can lower that feature's potency in the competition for attention, and the effect generalizes from the training task to an attentional capture task.
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(2119)

Reward-Associated Stimuli Trigger Movement Repulsion in Goal-Directed Action. JEFF MOHER, *Brown University*, BRIAN A. ANDERSON, *Johns Hopkins University*, JOO-HYUN SONG, *Brown University*—Previously rewarded target features persistently capture attention even in the absence of ongoing reward feedback. However, it is unknown whether reward-associated stimuli similarly attract motor movements. We asked observers to reach to red and green targets presented among distractors; each color was probabilistically associated with either high or low monetary reward for the entire training session. In a subsequent test phase, the frequency of reach movements towards perceptually salient distractors was reduced when the distractor appeared in a color that was associated with high rather than low reward in the preceding training phase. Instead, reach movements more frequently deviated away from the distractor when it appeared in the previously high-value color, particularly when the target and distractor appeared in the same visual hemifield. We propose reward learning amplifies the representation of reward-associated colors, triggering inhibitory mechanisms in selection-for-action when the previously high-value color appears as a distractor.
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(2120)

Does the Presence of a Weapon Capture Our Attention Automatically? TORU SHIRAKAWA and YUKIO ITSUKUSHIMA, *Nihon University*, MAKIKO NAKA, *Hokkaido University*—We aimed to examine whether weapons automatically capture attention or not by using eye fixations duration and memory performance as dependent variables. The experimental design was a 2 (prior knowledge about weapon focus effect (PK): given (PKG) vs. not given (PKNG)) x 2 (weapon (W): presence (WP) vs. absence (WA)) between-participants design. We conducted the two-way ANOVAs and the results of both dependent variables showed the same tendency. Concerning the target person, the interactions between PK x W were significant. The simple main effect tests showed that weapon focus effect occurred. Moreover, in WP condition, the participants in PKG condition remembered better and gazed at the target person longer than those in PKNG condition. Concerning the weapon and the non-weapon, the main effects of W were significant and weapon focus effect occurred. Judging from these results, attention processing for weapon may be automatic but that for target person may be controlled.
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(2121)

Feature-Driven Capture is Spatially Constrained, Not Global. CARLY J. LEONARD and STEVEN J. LUCK, *University of California, Davis*—While irrelevant, peripheral visual input clearly causes distraction in certain situations, it is much less clear how capture is mediated by different forms of attentional processing. Feature-based attention has frequently been discussed as a global phenomenon, in which a goal-relevant feature is selectively enhanced across the entirety of the visual field. On the contrary, spatial attention, by definition, refers to the prioritized processing of information at a particular location. In the current work, we examine this dynamic interplay between feature-based attention and spatial attention in capture. In most of the experiments, participants performed a task embedded in an RSVP stream at fixation and were presented with distractors at varying eccentricities that either matched or did not match the current target color. Overall, the results show that capture is sharply gated by feature-relevance, but also heavily modulated by distractor eccentricity from the current locus of spatial attention. Control experiments show evidence that this was not due to cortical magnification or poor color-processing in the periphery. While previous research shows that feature-based attention facilitates responses across the visual field, we show that the feature-driven distraction that occurs during capture is itself strongly spatially mediated.

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(2122)

Relative Effectiveness of Attention Capture Between Color Singleton and Working Memory. HIDEYA KOSHINO and JASON S. TSUKAHARA, *California State University*—We investigated how color singleton and working memory content affect distractor interference in a high and low perceptual load (PL) displays. In Experiment 1, participants were required to find a target (N or X) among five green letters with a response-related distractor of a color singleton (red). We found the same magnitude of compatibility effect between the high and low PL conditions. Experiment 2 was a dual task, in which we added a working memory component to Experiment 1, in which a memory item was either the same color as a target (memory match target) or as a distractor singleton (memory match distractor). Compatibility effects were greater for the high PL than for the low PL condition, regardless of the color of the memory item. How the effects of attention capture by singleton are modified by working memory will be discussed. Email: Hideya Koshino, hkoshino@csusb.edu

• COGNITIVE CONTROL I •

(2123)

Actors and Agency in the Mediated Sequential Simon Task. MICHIEL M. SPAPE and NIKLAS RAVAJA, *Helsinki Institute for Information Technology & Aalto*—Recent studies suggest we encode the experiences of others along with our own and thus extend our attention to incorporate their conflict episodes. A well known aspect of executive control

is that after responding to one conflicting trial, coping with repeated conflict becomes easier. Here, we combined these two observations and predict that the experienced control of another may help in coping with one's own conflict: We learn from others because they are seen as part of us. To test this, the Simon Task was adapted to include an avatar – an animated, visual representative of the participant – that was portrayed as if it were experiencing the conflict. Using a camera and kinesthetic modeling, we manipulated the degree to which the avatar's movements mirrored the participant's, and thus the amount of control or agency that could be exercised. Furthermore, the avatar was sometimes switched between trials, which affected subsequent conflict control, even though the avatar was completely irrelevant to the task. The findings underline the importance of actor and agency in sequential conflict tasks and demonstrate the practical benefits and limitations of using the Kinect for psychonomic research.

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(2124)

Eliminating the Simon Effect by Mere Instruction. MARIJKE THEEUWES, BAPTIST LIEFOOGHE and JAN DE HOUWER, *Ghent University*—Previous research has shown that responding to a non-spatial feature of stimuli (e.g., color) is faster and more accurate when the task-irrelevant stimulus position matches the spatial position of the correct response. It has been established that this so-called Simon effect can be eliminated or even reversed when combining a Simon task with an incompatible spatial-position task (e.g., press right for left stimuli; press left for right stimuli). The present study demonstrates that the Simon effect is eliminated even after presenting only the instructions of an incompatible spatial stimulus-response task without giving participants the opportunity to practice that task. Moderate practice of the incompatible task did not seem to add anything to the effect of the instructions. Finally, the instructions of a compatible spatial stimulus-response task did not seem to affect the Simon effect. The present results converge with previous findings suggesting that the Simon effect is highly malleable and emphasize the importance of merely giving instructions about stimulus-response mappings.

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(2125)

Inducing Proactive Control Using a Stroop Cueing Paradigm. MARIANA R. OLSEN and KEITH A. HUTCHISON, *Montana State University*—We tested whether participants can flexibly engage proactive control using a cued Stroop paradigm in which participants were given 80% predictive “easy” or “hard” cues indicating whether an upcoming stimulus would be congruent or incongruent, respectively. It was hypothesized that participants, especially those high in working memory capacity (WMC), would use the “hard” cues to engage top-down control to suppress word reading. This should lead to (a) smaller Stroop effects following “hard” cues and b) suppression of word-reading which would impair neutral item recall and recognition performance. Analyses confirmed that Stroop effects were reduced in the hard cueing condition, which was driven by

attenuated reaction times for incongruent trials. Also, cueing effects were greater for those with high WMC. No effects were found for recall or recognition. Future directions including ISPC effects and physiological measures are discussed.

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(2126)

The ISPC Effect and SOA Between Relevant and Irrelevant Stroop Dimensions. NART B. ATALAY, *TOBB Economy and Technology University*, MINE MISIRLISOY, *Middle East Technical University*—In this study we investigated the relationship between the Item-Specific Proportion Congruency (ISPC) effect and stimulus onset asynchrony (SOA) between relevant (color) and irrelevant (word) dimensions. The ISPC effect is demonstrated by a smaller Stroop interference for mostly incongruent items compared to mostly congruent items. The control of Stroop interference in the ISPC effect has been shown by signaling proportion congruency with the relevant dimension. We hypothesized that manipulating the onset of the relevant and irrelevant dimensions might also influence their capacity to signal proportion congruency. We used an overlapping set design. Stimuli consisted of a color patch with a color-word in the middle. SOA between the relevant and the irrelevant dimensions was -200, -100, 0, 100 or 200 ms. Results are discussed in relation to the underlying mechanisms of cognitive control processes in the ISPC effect. Email: Nart Bedin Atalay, nartbedin@gmail.com

(2127)

Color Naming of Non-Color Word Stroop Task as a Dual-Task. MICHAEL REYNOLDS, *Trent University*, CLAUDIO MULATTI and FRANCESCA PERESSOTTI, *University of Padova*, REMO JOB, *University of Trento*, ROBERTO DELLACQUA, *University of Padova*—The color-word interference task, a variant of the Stroop task, requires participants to name the ink-color (e.g., “red”) of non-color words (e.g., “cat”) while ignoring the identity of the words. The standard finding is that the time to name the ink-color is affected by factors known to affect how long it takes to read aloud the non-color word. Here, we propose that performance in this task is best understood using a dual-task framework. According to this account, the color-word interference task consists of an overt color naming task (word production) and a covert word reading task. Each of these processing streams contains processes that compete for access to the same resource limited system. Four experiments are reported testing the predictions of the dual-task framework using the so-called cognitive-slack logic. The dual-task framework successfully accounts for five effects in the color-word interference task. Email: Remo Job, remo.job@unitn.it

(2128)

Voluntary Task Switching Between Tasks of Unequal Strength. KAITLIN M. REIMAN and CATHERINE M. ARRINGTON, *Lehigh University*—During voluntary task switching when free to choose which task to perform on each trial, subjects select the weaker task (e.g. color naming with Stroop stimuli) with greater frequency. We explore the basis for this surprising finding using a modified Stroop where colored

patches and color words appear with varying SOA, allowing for the manipulation of stimulus availability. Choice patterns replicated the bias to perform color naming more frequently. Furthermore, current trial congruency did not influence this effect, but previous trial congruency did. Subjects were less likely to switch away from color naming, but not word reading, following an incongruent trial. Additionally, the effect of stimulus availability was greater for the weaker color naming task. Together these results support the interpretation that participants must more strongly maintain the goal to perform the weaker task and that the persistence of this control across trials influences task selection during volitional behavior.

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(2129)

You Can't Always Get What You Want: The Influence of Expectations on Voluntary Task Switching Performance. STARLA M. WEAVER and GLENN R. WYLIE, *Kessler Foundation Research Center*, MARINA SHPANER, *University of Vermont*, JOHN J. FOXE, *Albert Einstein College of Medicine*—A series of experiments assessed the influence of expectancy and preparation during voluntary task switching. Participants performed a modified double-registration voluntary task switching procedure in which participants specified the task they wanted to perform, were presented with a cue that, on the majority of trials, confirmed the choice, and then performed the cued task. On a small portion of trials, participants were cued to perform a task that did not match their choice. Trials on which cues unexpectedly failed to match the chosen task were associated with costs. These costs were particularly large when participants chose to switch tasks but had to unexpectedly repeat the previous task. The results suggest that when participants choose to switch tasks, they prepare for that switch in anticipation of the stimulus and the preparation is durable such that it cannot be readily undone. Email: Starla Weaver, sweaver@kesslerfoundation.org

(2130)

The Influence of External Stimuli on Task Selection for Tasks of Unequal Frequency. CATHERINE M. ARRINGTON and KAITLIN M. REIMAN, *Lehigh University*—The influence of external stimuli on task selection in a multitask environment was considered to examine the interplay of top-down and bottom-up control of volitional behavior. Subjects performed letter and number judgments in a voluntary task switching paradigm where they were free to choose which task to perform on each trial. Stimulus availability was manipulated through varying stimulus onset asynchrony between S1 and S2. Experiment 1 manipulated the frequency with which subjects were instructed to perform the two tasks: 50-50, 60-40, and 75-25. Experiment 2 used the natural variation in task frequencies occurring when subjects are given no instructions about how to choose between the two tasks. Across both experiments, the task performed less frequently showed a larger effect of external stimulus availability. These results suggest that when the top-down bias to perform a task is weak, that task is more influenced by the bottom-up factor of stimulus availability.

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(2131)

Below Baseline Suppression of Competitors During Interference Resolution by Younger But Not Older Adults.

M. KARL HEALEY, *University of Pennsylvania*, K.W. JOAN NGO and LYNN HASHER, *University of Toronto*—One of the most common causes of memory failures is interference between competing responses during retrieval. We and other researchers have suggested that selecting among competing memories requires the ability to suppress competitors, an ability which declines with age. Using a novel paradigm, we present evidence that in a single retrieval attempt, young adults suppress competitors to below baseline levels of accessibility. In addition, the extent of suppression predicts individual performance on a working memory span task. In sharp contrast, older adults do not show evidence of suppression in the face of competitors. The reduced ability to suppress with age may contribute to memory deficits as seen in the elderly. Email: Lynn Hasher, hasher@psych.utoronto.ca

(2132)

The Influence of Dance and Music Training on Task Switching in Children.

ANNALISE A. D'SOUZA, GALIT BLUMENTHAL, LINDA MORADZADEH and MELODY WISEHEART, *York University*—Background: Arts training (such as dance and music) involves considerable executive skills, such as attending to and switching between multiple processes. As a result, it may transfer to general improvements in cognitive abilities. Music training, for example, has been linked with better task switching performance, although findings are currently inconsistent on this effect. Objective: The following randomized controlled study investigated the casual effects of arts training (dance and music) on task switching. Method: Forty-eight children, aged six to nine, were randomly allocated to training groups. Participants received one month of training in either music or dance. Results: Pre-post improvements on both local and global switching performance were found on two measures of task switching, a color-shape task, and a quantity-identity task. Conclusion: Short-term training in the arts enhanced task switching performance for both arts domains, indicating rapid transfer for cognitive flexibility. A passive control group is warranted. Email: Annalise D'Souza, aadsouza@yorku.ca

(2133)

Stop It! Individual Differences in Working Memory Capacity Predict Performance in a Stop-Signal Paradigm.

A. EVE MILLER, JASON M. WATSON and DAVID L. STRAYER, *University of Utah*—Individual differences in working memory capacity (WMC) predict performance in a variety of opponent processing tasks (e.g., Stroop, Simon, antisaccade). The present study sought to determine whether WMC also predicted performance in a stop-signal task with 75% “go” trials and 25% “no-go” trials. Participants were required to respond on “go” trials and to withhold their response on “no go” trials when given a stop signal (Verbruggen, Logan, & Stevens, 2008). Results indicated that individuals with greater WMC had an elongated “point of no return” indicating they could receive a stop signal later than those with lower WMC and still successfully arrest their response. The results are

interpreted within an attentional control framework where individuals with greater WMC better maintain task goals and resist interference. However, the elongated point of no return suggests those with greater WMC are more flexible, with greater tolerance of and more control over relatively automatic responses.

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(2134)

Consumed by the Self: Electroencephalographic Evidence for Degraded Perceptual Processing During Self-Referential Judgement Tasks.

MELAINA T. VINSKI and ADRIANA WONG, *McMaster University*, JONATHAN SMALLWOOD, *Max Planck Institute*, SCOTT WATTER, *McMaster University*—Mind wandering behaviour necessarily degrades sensory processing of task features. Self-referential Judgement (SRJ) tasks recruit both the executive attention and default mode networks, a co-activation observed during mind wandering behaviour. The current work employs electroencephalography (EEG) to investigate whether self-referential processing suppresses perceptual and cognitive processing of auditory (Experiment 1) and visual (Experiment 2) stimuli. Participants were asked to rate whether a visually presented word adequately described them (Self condition) or their favourite professor (Other condition). Auditory (tone) or visual (picture) stimuli were presented between word presentation and the response probe. Results suggest that self-referential processing suppresses both the auditory attentional P300 component (Experiment 1) and the visual picture semantic N300/N400 component (Experiment 2) relative to other-referential processing. Findings provide novel evidence for degraded perceptual and semantic processing during self-reflection, and provide an alternative paradigm for investigating network activation associated with mind wandering behaviour.

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(2135)

Detecting Mind Wandering States by Receiving Supraliminal and Subliminal Cue-Stimuli.

TAKAHIRO SEKIGUCHI and SHO OTSUKA, *Tokyo Gakugei University*—The current study examined how individuals can realize a mind wandering state by focusing on the role of external cues as a prompt. Participants were asked to press a space bar on a keyboard when they found themselves in a mind wandering state while performing a go/no-go task. Three types of critical trials occurred randomly every 13–17 trials: supraliminal-cue trials where a visible cue-stimulus (red circle) appeared before the presentation of go/no-go targets; subliminal-cue trials where a cue stimulus (white circle) was presented for 10 ms before the targets; and control trials where no cue stimulus was presented. The results showed that participants detected mind wandering more often during the period of 12 trials after the presentation of both supraliminal and subliminal cues than during the period following control trials. This finding suggests that external cues prompted the detection of mind wandering regardless of the awareness of cue presentations.

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(2136)

Examining the Boundary Conditions Between Cognitive Control and Interference Derived From Stimulus-Based and Response-Based Conflict. JONATHAN TALL, ROBERT MATHEWS, SEAN LANE and DINA ACKLIN, *Louisiana State University*—Cognitive control is important for directing/focusing attention, actively maintaining representations, and mitigating the effects of interference (Braver, Gray, and Burgess, 2007). It is separated into proactively maintained processes and reactively initiated processes. The present work seeks to examine the role of these processes in handling stimulus-based (DO type 4; Kornblum, 1994) and response-based (DO type 3; Kornblum, 1994) sources of interference. Using a combined Spatial Stroop and Simon task, 2 measures of proactive processing (Error rates and RT facilitation) and reactive processing (Post-error slowing and conflict adaptation) are assessed in 4 conditions that differ in global context. Results highlight a complex interaction between measures and context.

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(2137)

Facilitating Effects of Positive Affect on Task Switching: Evidence From the Dimensional Change Card Sort Task. HWAJIN YANG, *Singapore Management University*, SUJIN YANG, *The Catholic University of Medicine*—Using the modified Dimensional Change Card Sort task, we examined the influence of positive affect on task switching by inspecting various markers for the costs, including restart cost, restart cost, and mixing cost. Given that the executive-control processes that underlie switching performance—i.e., inhibition or shifting—are distinct from the component processes underlying nonswitching performance—i.e., stimulus evaluation, resource allocation, or response execution—we hypothesized that if positive affect facilitates task switching via executive-control processes, rather than via component processes, positive affect would reduce both switch and restart costs, but not mixing cost, because both switch and restart costs rely on executive processes, while mixing cost imposes only minimal demands on executive processes. We found beneficial effects of positive affect on both restart and switch costs, but not on mixing costs. These results suggest that positive affect improves switching abilities via executive processes rather than via component processes.

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• SPEECH PERCEPTION I •

(2138)

The Development of Informational Masking. ROCHELLE S. NEWMAN, *University of Maryland*, GERALD D. KIDD JR., *Boston University*, FARAZ AHSAN and GIOVANNA MORINI, *University of Maryland*—Children have difficulty understanding speech in the presence of “noise”, particularly when the distractor consists of speech, which has the potential to cause informational masking (IM). We compared word identification in the presence of (i) no masker, (ii) a speech

masker, and (iii) a reversed-speech masker. Both maskers produce equal spectral overlap with the target signal, but differ in their potential for linguistically based IM. We predicted that younger children (4-years) would treat the reversed-speech masker as “speechlike” and thus would demonstrate more IM than would older children (8-years) or adults. Results: Adults showed a significant identification decrement only for the speech-masker (90% accuracy vs. 96% no-masker), not the reversed-speech masker (95%). Four-year-olds showed poorer performance in general, but a relatively greater effect of the reversed-speech-masker (no-masker: 82%; speech-masker: 48%; reversed-speech-masker, 60%). (Testing of 8-year-olds is still in progress.) Results support development of linguistically based informational masking beyond the preschool years.

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(2139)

Using Rhythm to Distinguish Languages: The Effect of Speaker Accent on Infant Language Classification. MELISSA PAQUETTE-SMITH and ELIZABETH JOHNSON, *University of Toronto*—Infants initially use rhythmic cues to tell apart languages. For example, an English-learning newborn distinguishes English from Spanish (a stress- and syllable-timed language) but not English from Dutch (both stress-timed) or Italian and Spanish (both syllable-timed). It is not until 5 months of age that infants can differentiate their native language from another rhythmically similar language, but 5-month-olds still cannot distinguish two rhythmically similar foreign languages (e.g. Italian and Spanish). All previous infant studies have used native language samples. Here, we re-examine English-learning 5-month-olds’ ability to distinguish Spanish and English using: 1) English and Spanish speech samples produced by a fully bilingual speaker (N=32), or 2) English and Spanish samples produced by a native Spanish speaker who spoke accented English (ESL) (N=22). English learners only discriminated the speech samples produced by the full bilingual, suggesting they could not distinguish Spanish from Spanish-accented English. These initial findings underscore the importance of considering real-world language variability in models of infant speech perception.

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(2140)

The Influence of Age-Related Declines in Inhibition on Audiovisual Spoken-Word Recognition. AVANTI DEY and MITCHELL S. SOMMERS, *Washington University in St Louis*—There is evidence to suggest that age-related declines in cognitive inhibition may contribute to impaired recognition of auditory spoken words. In the current study, we investigate whether such inhibitory abilities are also important for audiovisual (AV) spoken word recognition, and whether the contribution of this ability differs as a function of the underlying structure of lexical organisation. Measures of cognitive inhibition and AV word identification scores were obtained from normal-hearing young adults (n = 50) and older adults (n = 50). We observed that older adults demonstrated greater difficulty than young adults in identifying words with



many lexical neighbours (hard words) compared to words with few neighbours (easy words). Moreover, measures of inhibitory abilities predicted unique variance in AV word identification of hard words for old, but not for young adults. Measures of audibility also accounted for significant unique variance in performance. These results are interpreted within the framework of the Neighborhood Activation Model and the role of cognition in age-related differences in spoken word recognition.

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(2141)

Early Effects of Neighborhood Density of Spoken Words on Event-Related Potentials. CYNTHIA HUNTER, *University at Buffalo, SUNY* (Sponsored by Paul A. Luce)—All current models of spoken word recognition propose that sound-based representations of spoken words compete with, or inhibit, one another during recognition. In addition, certain models propose that higher probability sublexical units facilitate recognition under certain circumstances. Two experiments were conducted examining ERPs to spoken words and nonwords simultaneously varying in phonotactic probability and neighborhood density. Results showed that the amplitude of the P2 potential was greater for high probability-density words and nonwords across experiments, suggesting an early inhibitory effect of neighborhood density that is unaffected from-based task demands. In contrast, lexical inhibition effects were found in behavioral responses only in Experiment 2. The results are consistent with findings from previous studies using reaction time and eye-tracking paradigms and provide new insights into the time-course of lexical and sublexical activation and competition.

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(2142)

Exploring the Role of Coarticulation in Speech Perception: Anticipation, Integration, and Acquisition. SARAH T. OLSEN and CYNTHIA M. CONNINE, *Binghamton University, SUNY*—Three experiments examined the processing and acquisition of coarticulation in speech perception. In Experiment 1, eye movements to printed syllables were monitored as subjects heard vowel-consonant syllables ending in /s/ or /g/ that contained matching or mismatching coarticulation in the vowel. Results showed an early effect of anticipation and a later effect of integration. Experiments 2 and 3 investigated acquisition by exposing subjects to mismatching syllables in two different learning environments: one with only experimental stimuli mismatching (2), another with all stimuli mismatching (3). Experiment 2 showed no learning for the /g/-syllables, and incomplete learning for the /s/-syllables. Experiment 3 showed successful learning for /s/- and /g/-syllables. Taken together, the results support a system that continuously utilizes all variability in speech, and makes rapid adjustments with experience. Additionally, the amount of learning depends on the nature of the learning environment, and the strength of the coarticulation in the speech.

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(2143)

Short-Term Input Regularities Impact Cue Weighting in Speech Perception and Production. MATTHEW I. LEHET, MONICA LY and LORI L. HOLT, *Carnegie Mellon University*—Multiple acoustic dimensions signal speech categories, but these dimensions are not equally informative. Perception reflects dimensional regularities such that listeners perceptually weight more informative dimensions in phonetic categorization. Manipulating correlations between acoustic dimensions in short-term input leads to rapid adjustment of “perceptual cue weights”. The present study investigated whether this learning is also reflected in listeners’ own speech productions. In a word recognition task, the correlation between fundamental frequency (F0) and voice onset time (VOT) matched the canonical English relationship, then shifted subtly to the reversed relationship and then back. Brief, incidental exposure to the reversed correlation caused participants to down-weight reliance on F0 in perception. This was accompanied by a reduction in the degree to which F0 differentiated voicing categories in listeners’ own productions, indicating that statistical regularities of short-term speech input affect both speech perception and production, as evidenced via shifts in how acoustic dimensions are weighted.

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(2144)

Let Sleeping Dogs Lie: The Persistence of Co-Occurring Variability in Memories Supporting Speech Perception. APRIL PUF AHL, *Stony Brook University*, ARTHUR G. SAMUEL, *Ikerbasque; Basque Center on Cognition, Brain and Language; Stony Brook University* (Sponsored by Nicolas Dumay)—We have previously demonstrated that speech perception is sensitive not only to linguistic information (what word was said) and indexical information (how it was said, and by whom) but also to variability from co-occurring environmental sounds (e.g., a dog barking; Pufahl & Samuel, 2010 *Psychonomics*). In the present study, we demonstrate that these effects remain stable over long delays including sleep. Percent accuracy identifying filtered words paired with co-occurring sounds was sensitive to changes in surface characteristics, with a 6% performance cost when the voice changed from exposure to test and a 2% cost when the sound exemplar changed. Unsurprisingly, accuracy was 5% higher for word/sound pairs tested immediately after exposure versus after a delay. Critically, there was no evidence of sleep consolidation. Performance was comparable at delays of 12 hours with or without sleep, 24 hours, and 1 week. Implications for models of speech perception will be discussed.

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(2145)

Contextual Influences in the Sequential Integration of Speech. ADAM THOMAS and MARK A. PITT, *The Ohio State University*—The influence of memory on the perceptual grouping of the sounds that make up words is not well understood. This study examined which linguistic properties of words impact the sequential integration of speech. Perceptual segregation was induced in dichotic listening experiments by varying the strength of cues presented to each ear (e.g., /s/ in

“snail” mostly to the left ear and the remainder mostly to the right). In Experiment 1, nonwords were shown to segregate under segregation-inducing conditions more than words, though not as much as phonotactically-illegal nonwords. A follow-up experiment used gap detection to demonstrate that perceptual segregation actually occurred across ears. Gap detection was worse for items that were reported as streamed, and it was also worse for nonwords compared to words. Results demonstrate that multiple forms of linguistic memory influence the perceived grouping of speech sounds.

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(2146)

Incremental Processing of Function Words in Casual Speech. CHI-HYUN KIM and DELPHINE DAHAN, *University of Pennsylvania*—Speech comprehension is viewed as an incremental process in which the interpretation of a given word takes place as speech unfolds, within the context of what preceded it. However, much of what we know of this process has been established from the processing of content words uttered in read, and thus clear, speech. Here, we consider the interpretation of highly reduced prepositions such as ‘in’ and ‘on’ in casual speech. We tracked listeners’ gaze to photographic scenes containing various container and non-container items (e.g., a flask, a flag, a pail and a sheet of paper), as they listened to utterances describing a die being moved in relation to one of the objects (“The woman will put the die [in/by the flask; on/by the flag]”). Although the semantically constraining preposition ‘in’ alone did not cause listeners to anticipate an upcoming container, it did contribute to disambiguating its name (‘flask’) from its phonologically related, semantically incongruent competitor (‘flag’). The exact timing of this effect will constrain on-line speech-comprehension theories.

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(2147)

Social Priming and Speech Perception. KAY LIVESAY, *Linfield College*, SIERRA BROUSSARD, *University of California, Irvine*—Speech perception relies on auditory, visual cues and motor cues. Because speech is multimodal, visual cues can carry important information for the perception process. The Fuzzy Logic Model of Perception (FLMP) suggests that if one of these speech modes is altered, the perception of that speech signal should be altered in a quantifiable and predictable way. The current study attempted to reduce the confusability of confusable phonemes in the same viseme category (e.g., /ba/ and /pa/) through social priming of the concept of blindness. A by phoneme analysis revealed that one phoneme /fa/ showed a reliable decrease in RT when primed with a blindness schema. A possible answer lies in viseme neighborhood density. Low viseme density may lead to higher saliency of visual information. This means that /fa/ becomes more ambiguous because it is being identified mainly through its less distinctive auditory cues and not its salient visual cues.

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(2148)

Segmental Priming, Specificity, and Time-Course Effects in Long-Term Repetition Priming for Spoken Words. PAUL A. LUCE and CYNTHIA HUNTER, *University at Buffalo, SUNY*—We examined long-term repetition priming of spoken words and nonwords as a function of segmental overlap and variation in talker voice. We presented CVC words and nonwords in prime and target blocks in a lexical decision task. The targets were primed by stimuli that overlapped initially (CV-), finally (-VC), or in their entirety (CVC). The words and nonwords in each of the overlap conditions were also presented in the same voice or different voices. Although robust priming effects were obtained for words in the CVC overlap condition, neither the CV- or -VC overlap conditions produced significant priming, nor were any effects of specificity observed. In a second experiment in which we slowed processing by presenting pink noise to one ear, we obtained specificity effects for both words and nonwords. In addition, we obtained segmental priming effects for nonwords that were mediated by changes in talker voice.

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(2149)

Activation of Embedded Words in Spoken Word Recognition: the Effect of Position and Proportion. XUJIN ZHANG, *Stony Brook University*, ARTHUR G. SAMUEL, *Basque Center on Cognition, Brain and Language; IKERBASQUE; Stony Brook University*—How do listeners understand English words that have shorter words embedded in them? We tested six types of embedded words, crossing two embedded positions (initial vs. final; e.g., hamster vs. trombone) and three embedded/carrier word proportions (2/3 vs. 1/2 vs. 1/3; e.g., determine vs. hamster vs. fantasy). In auditory-auditory priming experiments, facilitation of lexical decision responses to targets (e.g., pig) associated with words embedded in primes (e.g., hamster) indexed activation of the embedded words (e.g., ham). In a control experiment, isolated primes (e.g., ham) primed their targets in all six conditions. Embedded in carrier words (e.g., hamster), these only produced priming for initial embeddings that constituted at least half of the carrier words. No priming was observed when the carrier words were compressed/expanded or when one segment in the carrier was replaced by noise. The results suggest that activation of embedded words only occurs under unusually good listening conditions.

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(2150)

A Causal Inference Explanation for Multisensory Speech Perception. JOHN F. MAGNOTTI, *University of Texas Medical School at Houston*, WEI JI MA, *Baylor College of Medicine*, MICHAEL S. BEAUCHAMP, *University of Texas Medical School at Houston*—During speech perception, humans integrate auditory information from the voice with visual information from the face. Multisensory integration increases perceptual accuracy only if the two cues originate from a common cause, a requirement largely ignored by current models of speech perception. We developed a generative model of multisensory speech perception that



includes this critical step of determining whether the auditory and visual information arise from a common cause. The causal inference model was compared with the most popular alternative approach, Gaussian curve-fitting. Thirty-seven participants performed a synchrony judgment task while viewing audiovisual speech that had varying asynchrony, visual cue intelligibility, and visual cue reliability. The causal inference model provided a better fit to the behavioral data with fewer free parameters than the Gaussian method. The causal inference model achieves this better fit by adding constraints derived from a principled analysis of how an optimal observer should solve the causal inference problem using the asynchrony and reliability of the cues.

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• PSYCHOLINGUISTICS II •

(2151)

Interaction Between Grammatical Role, Space, and Motor Response. TIMOTHY W. BOITEAU and AMIT ALMOR, *University of South Carolina* (Sponsored by Doug Wedell)—We conducted two experiments in which we tested the following hypothesis: grammatical role in transitive sentences primes spatial attention, which interacts with manual responses. Participants read eighty transitive sentences, presented word-by-word in the center of the screen. After the presentation of each sentence, a probe (either the subject or object of the previously read sentence) appeared to the left or right of fixation. In Experiment 1 participants indicated the gender of the probe by pressing a button with their left or right hand. Gender/hand pairing was a between subjects variable. In Experiment 2 participants indicated whether the probe was the subject or object of the previously read sentence. Response hand assignment was switched halfway through the experiment. Results from both experiments found a three-way interaction between grammatical role, side of presentation, and response hand, with left-side/left-hand pairing facilitating responses towards grammatical subjects and right-side/right-hand pairing facilitating responses towards objects.

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(2152)

How Temporal Information Associated With Verbs Constrains the Ability to Imagine Events. JEFFREY P. HONG, TODD R. FERRETTI, RACHEL CRAVEN and RACHELLE D. HEPBURN, *Wilfrid Laurier University*—Recent psycholinguistic research shows that grammatical aspect (imperfective, perfective) interacts with lexical aspect (activities, accomplishments) to influence language comprehension difficulty. In the present research, we examine the influence of these temporal constraints on people's ability to imagine events. Participants read sentences that contained either accomplishments (build) or activities (run) that were grammatically marked as ongoing or completed (I was running/I ran). Slow cortical potentials were recorded while participants imagined events described in the sentences for eight seconds. Results show that participants had less

difficulty imagining events when the temporal properties of the two forms of verb aspect matched (imperfective activities, perfective accomplishments) versus mismatched (perfective activities, imperfective accomplishments). Responses to questions about the imagined events also demonstrated that grammatical and lexical aspect influenced the content and temporal perspective of those events. This research provides novel neurocognitive and behavioral insight into how temporal information associated with verbs influences event representation.

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(2153)

Temporally Cueing Autobiographical Memory With Grammatical and Lexical Verb Aspect. ELISABETH LARSEN and TODD R. FERRETTI, *Wilfrid Laurier University*—This ERP research examined how temporal information associated with verbs influences autobiographical memory retrieval and maintenance. Participants read retrieval cues that were in imperfective (I was playing) or perfect (I had played) aspectual form. Some cues contained standard activities that do not have natural endpoints (playing), whereas other cues contained verbs that are activities when they appear without motion directed prepositional phrases but are accomplishments with endpoints when they do (swimming vs. swim to shore). Participants indicated memory retrieval and then maintained the memory in mind for 7.5 seconds. Analysis of slow cortical potentials revealed that participants had more difficulty retrieving memories elicited to perfective than imperfective cues, and that this difference was largest for "standard" activities. Further, once people retrieved a memory, the ease of holding it in mind was determined more by the inherent nature of the two verb types than by the grammatical aspect of the cueing events.

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(2154)

Age of Acquisition Effects and Morphology: A Contribution of Gender? CRISTINA IZURA and SHAKIELA 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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(2155)

The Emergence of Word Comprehension in Infancy: A Longitudinal Study. JUWAIRIA SOHAIL and ELIZABETH K. JOHNSON, *University of Toronto*—Evidence for word comprehension emerges in infancy, long before children can produce words or engage in meaningful conversations. Initially, early word comprehension was thought to be limited to names for socially relevant figures (e.g., mom and dad). However, more recent studies have shown that even 6-month-olds understand the words ‘hands’ and ‘feet.’ There is also some evidence that comprehension by 6-to 9-month-olds may extend to common household words, such as ‘cup’ and ‘ball.’ Here, we provide additional evidence that six-month-olds have started attaching object labels to objects. English-learning 6-month-olds (N=40) were presented with two side-by-side images (e.g. a ball and a shoe) while hearing a label for one of the objects (e.g., ‘look! A shoe.’). As a group, the infants looked reliably longer to the target than the distractor, supporting the notion that word comprehension begins in infancy. The effect, however, was relatively weak; not all infants displayed evidence for comprehension. We are currently following these infants longitudinally to see if performance in a word recognition task at 6 months predicts their word recognition performance at 14 months.

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(2156)

An ERP Investigation of Individual Differences and Word Experience on Learning Word Meaning. MICHAL BALASS, *Towson University*—Two studies were conducted to test the effects of word experience, (type of context, variability, and semantic constraint), and individual differences in comprehension on new word learning. According to the Word Experience Model (Reichle & Perfetti, 2003), and similar hypotheses (Ans et al., 1998) different word experiences elicit episodic memory traces of varying strength, thus affecting subsequent meaning processing and retrieval. Adult readers of varying comprehension, vocabulary, and lexical skills learned 120 rare English words in definitions or single sentence contexts of repeated or varied content; the single-sentence contexts varied in semantic constraint (low, medium, high). Readers completed meaning-judgment and sentence judgment tasks in which the N400, an indicator of semantic processing and retrieval, was recorded. Both studies indicated that variability of content yielded greater accuracy and larger N400 effects for the sentence judgment task. Repeated content showed more accurate responses and large N400 effects for the meaning judgment task for high constraint sentences. Regression analyses indicated that readers’ comprehension, vocabulary, and lexical skills are related to greater N400 effects.

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(2157)

Differential Time-Course for Prediction and Integration During Sentence Comprehension. TREVOR A. BROTHERS, TAMARA Y. SWAAB and MATTHEW J. TRAXLER, *University of California, Davis*—Previous studies have suggested that readers use language context to pre-activate

upcoming words in a text (DeLong et al., 2005). To date, it is unclear how these prediction mechanisms relate to the process of lexical access or discourse-level integration. In the present study, we used ERPs to examine the relative time course of these mechanisms. Participants read short passages in which the final word was either moderately predictable (50% cloze) or unpredictable. After each trial, participants indicated with a button press whether they had correctly predicted this final word. By separately averaging ERPs to predicted and unpredicted completions, we uncovered two temporally distinct subcomponents of the N400: an early prediction effect beginning 200ms post-stimulus, and a later negativity which correlated significantly with 1) sentence plausibility and 2) the word’s semantic relatedness to an alternative completion. We discuss implications for current accounts of prediction and integration during sentence processing.

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(2158)

EEG Investigation of Motor System Activity During Language Comprehension. JULIE CARRANZA, MATTHEW BACHMAN, *MICHAEL P. KASCHAK, EDWARD M. BERNAT, JOHN L. JONES and CASSIE STUTTS, *Florida State University*—EEG studies have demonstrated that generating motor responses and motor imagery causes desynchronization of the mu-rhythm (alpha frequency band). Van Elk et al. (2010) showed that the processing of verbs in sentences about action also leads to mu-desynchronization, providing another line of evidence that the motor system plays a role in language comprehension. We extended upon this work by examining EEG responses in the time-frequency domain to the processing of verbs in action sentences, and comparing this to the responses seen during the processing of the verbs in non-action sentences. The action/non-action differences in the alpha band were effector specific, with hand, face, and foot actions producing different EEG responses. Time-frequency analysis also revealed action/non-action differences in the theta band (extending into the delta band). These were also effector-specific, with earlier responses occurring for all three effectors, but later responses occurring only for hand and face actions.

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(2159)

Effects of Semantic Context on Memory for Nouns and Verbs Sharing the Same Root. JULIE L. EARLES, ALAN W. KERSTEN and BRETAGNE L. MORIARITY, *Florida Atlantic University*—Kersten and Earles (2004) demonstrated that changes in semantic context negatively impacted memory for verbs more than memory for nouns. The present research tested whether the same pattern would be observed even when nouns and verbs shared the same root form. Participants were presented with a series of transitive sentences. Some participants were instructed to remember the noun in each sentence (e.g., “Utter the answer”). Others were instructed to remember the verb in each sentence (e.g., “Answer the question”). In a later recognition test, a target word appeared either in the context of the same sentence in which it had appeared earlier or in a new context (e.g., “Discern the



answer” for participants in the noun condition or “Answer the door” for participants in the verb condition). Participants had significantly greater difficulty recognizing verbs in the presence of such context changes, whereas memory for nouns was relatively unaffected. The finding that the same root form behaves differently depending upon whether it is used as a noun or a verb suggests that verb meanings are inherently more flexible and subject to contextual influences than are noun meanings, perhaps as a result of verbs’ role as organizer of the sentence.

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(2160)

The Role of Inter-Word Spaces in English Compound Words: Insights From Individual Differences. KAITLIN FALKAUSKAS and VICTOR KUPERMAN, *McMaster University*—This study used eye-movements while reading to examine the role of inter-word spaces in English compound words. Previous studies (Inhoff et al., 2000, Juhasz et al., 2005) found an early processing advantage for typically concatenated compounds presented as spaced (earthquake seen as earth quake), and processing costs at later stages. This suggests facilitated segmentation of compounds into morphemes, followed by later integration difficulties. Unlike previous studies which used compounds highly biased towards one spelling variant, we utilized compounds from the full range of biases towards being spaced or concatenated (Kuperman & Bertram, in press). Our results replicated previous findings and add an unexpected discovery. The well-established early advantage in eye-movement durations for the spaced presentation is stronger in compounds that are less likely to be spaced. The results are explained in light of individual differences in exposure to printed text: more proficient readers are more hindered by unfamiliar written forms.

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(2161)

Phrases Don’t Behave Like Words: Phrase Frequency Effects in Recognition Memory. CASSANDRA L. JACOBS, GARY S. DELL and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*, COLIN BANNARD, *University of Texas at Austin*—While infrequent words (e.g., “hyena”) and phrases (e.g., “spotted hyena”) are difficult to understand and say, low-frequency words are remembered better in recognition memory, producing a mirror effect. Uncommon words receive more hits and fewer false alarms. We tested recognition memory for adjective-noun phrases varying in co-occurrence frequency (e.g., “alcoholic beverage” vs. “abandoned arenas”). Phrases did not show the mirror effect, but the more frequent a phrase was, the more hits and false alarms it attracted. We propose that word and phrase frequency differentially impact recognition memory because words are atomic, whereas phrase meaning is computed compositionally.

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(2162)

A Role for Memory Consolidation in Learning Novel Morphology. JELENA MIRKOVIC and GARETH GASKELL, *University of York*—Recent research in novel word

learning provides evidence for the involvement of memory consolidation processes in learning novel phonological forms. This evidence has been interpreted within the complementary learning systems framework (McClelland et al., 1995), which proposes that new memories are initially acquired by a hippocampally-based declarative system, and they are then gradually integrated into long-term neocortical stores. We will present results from two studies examining this framework in the context of learning novel morphological information. In both studies participants learned novel words with regular and irregular morphological forms. The novel words mimicked morphological systems found in natural languages, such that regular forms were of high type but low token frequency, and irregulars of high token but low type frequency. Participants’ generalization performance was tested immediately after learning and after a 24hr delay. Participants generalized using both regular and irregular mappings at both time points, but high frequency forms particularly benefited from consolidation. The implications of the findings for psycholinguistic models of morphological processing will be discussed.

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(2163)

Modeling Individual Differences in Sentence Comprehension in ACT-R. YINGYING TAN and RANDI MARTIN, *Rice University*—The role of working memory capacity in syntactic interference resolution was assessed through a computational approach by manipulating parameters plausibly related to capacity in the ACT-R (Adaptive Control of Thought-Rational) sentence processing model of Lewis and Vasishth (2005). Syntactic interference was manipulated by varying whether a noun phrase intervening between the subject noun and the main verb was another syntactic subject (high interference) or a prepositional object (low interference). As predicted, the model produced longer RTs in the high than low interference condition. Moreover, increasing the decay rate parameter (d) of the to-be-retrieved chunk increased the interference effect size ($RT(\text{High-interference}) - RT(\text{Low-interference})$). These results suggest that some portion of individual differences in sentence comprehension is due to differences in memory decay rate across individuals. Decay rate may relate to WM capacity in terms of the rate at which noise is added to activated representations outside the focus of attention.

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(2164)

Revisiting the Role of Stimulus Quality in Models of Cognitive Processing. ANDREW J. ASCHENBRENNER and DAVID A. BALOTA, *Washington University in St. Louis*—Dual process models have been developed in many binary RT tasks, including lexical decision (LDT, Balota & Chumbley, 1984) and memory scanning (Atkinson & Juola, 1974). The additive effects of stimulus quality (SQ) with word frequency in LDT and with set size in memory scanning have played prominent roles in developing these models. Interestingly, Yap et al. (2008) showed that while SQ and frequency are additive in mean RTs, this additivity appears to reflect possible

tradeoffs in components of the RT distribution when using pseudohomophone foils. This suggests SQ might influence a post-access check process, which may be modulated by individual differences including lexical integrity (Yap et al. 2009). The present study explores the additive effects of SQ with frequency in LDT and with set size in memory scanning to understand a) the similarity across the tasks in underlying RT distributions, and b) the modulatory role of individual differences.

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(2165)

The Hyper-Modular Associative Mind: A Computational Analysis of Associative Responses of Persons With Asperger Syndrome. YOED N. KENETT, RINAT GOLD and MIRIAM FAUST, *Bar Ilan University*—A main characteristic of persons with Asperger syndrome (AS) is deficits in flexibility, i.e., rigidity in thought. This rigidity can explain the poor comprehension of unusual semantic relations that require flexibility in processing. The aim of the present study was to explore the semantic organization in the mental lexicon in AS. A group of 19 AS persons and 50 matched controls were asked to generate free semantic associations to a set of 96 words. Network science tools were used to analyze the associations collected thus presenting the first computational analysis of semantic relations of persons with AS. Our analysis revealed that AS persons exhibit a hyper-modular semantic organization, in the sense that their mental lexicon is more compartmentalized compared to controls. We argue that this hyper modularity may underlie rigidity of thought expressed by AS persons and discuss its relation to deficits in semantic language processes that they experience.

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(2166)

The New Web-Accessible Japanese Jōyō Kanji Database. KATSUO TAMAOKA, *Nagoya University*, SHOGO MAKIOKA, *Osaka Prefecture University*, SANDER SANDERS, *Kumulus Centre*, RINUS G. VERDONSCHOT, *Nagoya University*—The official standardized list containing the jōyō (commonly used) kanji in Japanese has recently been revised by the Japanese government (2010). It now includes 2136 Japanese kanji, which serve as a basis for Japanese language education and also play an essential role in Japanese psycholinguistic research. In order to make the new detailed properties of the 2010 jōyō kanji available to researchers in psychology and linguistics, we have developed a new web-accessible kanji database based on the extensive Mainichi Newspaper corpus (2001-2010). The new database includes a wide range of important properties such as: kanji frequency, On- and Kun-reading frequencies, On-reading ratio, kanji productivity of two-kanji compounds, symmetry of kanji productivity, entropy, number of meanings, etc. A specially constructed easy-to-use web site (<http://www.kanjidatabase.com/>) has been developed to grant easy access to the database and allows for (1) easy selection of kanji from the database

following criteria which can be defined by the user, as well as (2) pasting of kanji (or even complete texts) and looking up specified properties from the pasted kanji in the database. Email: Katsuo Tamaoka, ktamaoka@gc4.so-net.ne.jp

(2167)

The influence of contextual diversity on eye movements in reading. PATRICK PLUMMER, *University of California, San Diego*, MANUEL PEREA, *Universitat de València*, KEITH RAYNER, *University of California, San Diego*—Recent research has shown contextual diversity (i.e., the number of passages in which a given word appears) to be a reliable predictor of word processing difficulty. It has also been demonstrated that word-frequency has little or no effect on response behavior when accounting for contextual diversity in isolated word processing tasks. In the current study eye-movements were monitored while subjects read sentences embedded with target words varying in word-frequency and contextual diversity. All first-pass and later reading times were significantly longer for words with lower contextual diversity compared to words with higher contextual diversity when controlling for word-frequency and other lexical properties. Furthermore, the standard word-frequency effect disappeared when controlling for contextual diversity. The results confirm prior findings and demonstrate that contextual diversity is a more accurate predictor of word processing speed than word-frequency within a normal reading task.

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(2168)

Effects of Animacy and Noun-Phrase Relatedness on the Processing of Complex Sentences. MATTHEW W. LOWDER and PETER C. GORDON, *University of North Carolina at Chapel Hill* (Sponsored by Mark Hollins)—Previous work has suggested that object-extracted relative clauses are easier to process when the head noun phrase (NP1) is inanimate and the embedded noun phrase (NP2) is animate compared to the reverse animacy configuration (e.g., Gennari & MacDonald, 2008; Traxler et al., 2002, 2005), with differences in processing difficulty beginning as early as NP2 (e.g., The movie that the director... versus The director that the movie...). Two eye-tracking-while-reading experiments were conducted to better understand the source of this effect. Experiment 1 showed that having an inanimate NP1 facilitated processing even when NP2 was held constant. Experiment 2 manipulated both animacy and the degree of semantic relatedness between NP1 and NP2. When NP1 and NP2 were not related, the animacy effect emerged at NP2. When NP1 and NP2 were related, this effect disappeared. The results indicate that meaningful relations between NPs, as well as NP animacy, serve as important cues during the processing of syntactically complex sentences.

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(2169)

Exploring Digging-In Effects in Lexical Ambiguity Resolution: Evidence From Eye Movements. MALLORIE LEINENGER, MARK MYSLÍN, ROGER LEVY and KEITH RAYNER, *University of California, San Diego*—Previous



research in syntactic ambiguity resolution finds evidence for “digging-in effects”: more costly ambiguity resolution as the parser becomes more committed to the wrong syntactic choice (Tabor & Hutchins, 2004; Levy et al. 2009). In the current study, we recorded eye-movements to test for evidence of digging-in effects in lexical ambiguity resolution. We asked if a reader would become more committed to a given interpretation of a homograph the longer they continued reading before encountering disambiguating information. We embedded moderately biased homographs in sentences with neutral prior context and either long or short regions of text between the homograph and disambiguation. We find no evidence for digging-in effects, as the length of intervening material had no effect on ease of disambiguation. Instead, we find only a main effect of meaning at disambiguation, such that disambiguating to the subordinate sense of the homograph is more difficult, consistent with predictions of the Reordered Access model (Duffy et al., 1988).

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• BILINGUALISM I •

(2170)

Recognition and Repetition Priming as a Function of Translation and Sentence Context. ELVA N. STROBACH, WENDY S. FRANCIS, IRIS PEREA and CARMEN MOTTA, *University of Texas at El Paso*—Translation is an encoding mechanism available only to bilingual and multilingual individuals. If translation requires conceptual access, then it is a deep encoding task and should lead to enhanced memory performance. In three experiments, we examined the effects of translation encoding, sentence context, and word frequency on recognition memory (Experiments 1 and 2) and word-stem completion (Experiment 3) performance. In Experiments 1 and 2, words translated at study were recognized more accurately than words read aloud at study. Sentence context did not benefit recognition in either experiment, even when the target word was made salient (Experiment 2). Low frequency words were better recognized than high frequency words. In Experiment 3, with the non-conceptual repetition-priming task of word-stem completion, translation of words at study did not enhance performance, and words presented in isolation showed more priming than words presented in a sentence context.

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(2171)

The Effects of Bilingualism on Cognitive Control and Flexible Thinking. CARLA B. FERNANDEZ, *The Pennsylvania State University*, EVANGELIA G. CHRYSIKOU, *University of Kansas*—Bilingualism can promote performance on executive function tasks involving attention, shifting, and inhibition. This advantage is typically reported in individuals who have acquired their second language during early childhood. However, few studies have examined this effect in those who have acquired their second language at older ages. Research further suggests that late bilinguals might be

at a disadvantage regarding verbal creativity relative to early bilingual and monolingual participants. The current study aimed to identify possible differences in performance on measures of executive control and flexible thinking, among early and late Spanish-English bilinguals and monolingual participants. Our results suggest that late bilinguals exhibit less conflict on measures of executive function relative to early bilingual and monolingual participants. Although language proficiency was critical for performance in verbal problem solving, bilingual status was associated with higher creativity scores. These results extend earlier findings by showing an advantage of late bilingualism not only for executive function, but also certain aspects of flexible thought.

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(2172)

Immersion in Elementary School Enhances Inhibitory Control. JOANNA BOVEE, KATHERINE A. BRILL-SCHUETZ, GARY RANEY and KARA MORGAN-SHORT, *University of Illinois at Chicago*—Several studies provide evidence of enhanced executive control for early bilinguals, especially on tasks requiring inhibitory control (e.g., Martin-Rhee & Bialystok, 2008). Whether such effects are evidenced in second-language learners and what type of experience is necessary to develop such effects are open questions. We administered an executive control task, the Simon task, to native English high school students who were enrolled in a Spanish class. A group of participants had also been enrolled in a partial Spanish immersion program (approximately 10 hours a week) throughout elementary school. When compared to non-immersion students, the immersion students evidenced a smaller Simon reaction time cost (difference between incongruent and congruent trials). This finding suggests that early exposure to a second language in an immersion environment can provide the benefits typically found in early bilinguals.

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(2173)

Prediction in a First and Second Language: The Role of Bilingualism and Cognitive Control. MEGAN ZIRNSTEIN, JANET G. VAN HELL and JUDITH F. KROLL, *The Pennsylvania State University*—In the native language, readers benefit when upcoming input can be anticipated, suggesting that the ability to predict upcoming words may reduce processing load. Little research has focused on how prediction might operate when reading in a second language. Past studies suggest that bilinguals’ ability to inhibit the language not in use may lead to cognitive control advantages in comparison to matched monolinguals. Recent ERP work also suggests that inhibition may be a mechanism that readers use to recover when predictions prove to be false. Our aim in the present study was to investigate the extent to which the bilingual experience may influence prediction during reading. Bilingual and monolingual participants read sentences while their EEG was recorded. ERPs were time-locked to target

words that varied in terms of their predictability. Critically, results from the sentence task were compared to performance on individual difference tasks measuring inhibitory control.
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(2174)

When Bilinguals Chose the Words They Speak: Evidence for Multiple Control Mechanisms. MARÍA CRUZ MARTÍN, *The Pennsylvania State University*, M. TERESA BAJO, *University of Granada*, JUDITH F. KROLL, *The Pennsylvania State University*—Previous research on bilingual production and comprehension suggests that there are multiple mechanisms of control in language selection. The present study explored the nature of the inhibitory mechanisms that underlie language selection in bilingual production and specifically whether there is evidence for both automatic and controlled selection processes. Relatively proficient Chinese-English bilinguals performed a picture naming task in language blocked or language mixed conditions under simple naming conditions or while performing a concurrent updating task. Preliminary results showed that the concurrent task affected performance differentially in the blocked and mixed conditions. Under mixed conditions that included the demanding updating task, bilinguals who were strongly L1 dominant were as slow to speak the L1 as the L2. The updating task did not eliminate the inhibition of L1 under mixed conditions. In contrast, introducing the updating task in the blocked conditions appeared to eliminate the inhibitory effect of L1 when it followed L2.

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(2175)

A sentence to remember: Language Switching in Sentences. MATHIEU DECLERCK and ANDREA M. PHILIPP, *RWTH Aachen University*—Whereas prior language switching studies have investigated the influence of language control in the context of single, usually unrelated, words, we set out to investigate language control within sentences in three experiments. The task required German-English bilingual participants to produce responses based on an alternating language sequence (L1-L1-L2-L2 etc.) and a fixed concept sequence. The concept sequence was either a sentence, which was syntactically correct in both languages, a sentence, which was correct in just one language or a non-sentence sequence. The results revealed smaller switch costs in a sentence sequence, which was syntactically correct in both languages than in the other sequence types. The other two sequences did not differ with respect to switch costs. These results were interpreted in terms of language control and bilingual syntax models.

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(2176)

Bilinguals Control Their First Language to Speak the Second Language. RHONDA MCCLAIN, ELEONORA ROSSI and JUDITH F. KROLL, *The Pennsylvania State University* (Sponsored by Annette de Groot)—The current study used event-related potentials (ERPs) in an extended blocked picture naming paradigm to investigate two aspects inhibitory control

in bilingual speech production. Relatively proficient English-Spanish bilinguals named pictures in English, their L1, and then in Spanish, their L2. In six subsequent blocks they named pictures in L1 only, but the pictures varied in whether they were old or new and whether they shared lexical or semantic properties with previously named pictures. ERPs revealed an N200 component, associated with response inhibition and conflict detection, when bilinguals produced in the L1 after speaking in their L2. The N200 was observed for several blocks of L1 naming that followed L2 naming but was not modulated by whether pictures were related to the lexical or semantic properties of previously named pictures, suggesting an inhibitory mechanism that is broad in scope and extended in time.

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(2177)

Lexical Resolution From Semantic Competitors in Monolinguals and Bilinguals. ASHLEY CHUNG-FAT-YIM, DEANNA FRIESEN and ELLEN BIALYSTOK, *York University*—Bilingual language processing is impacted by both cross- and within-language competition. Monolinguals also experience within-language competition, but this does not lead to the enhanced executive control reported for bilinguals. Therefore, we compared lexical resolution processes in monolinguals and bilinguals in a picture selection task performed with event-related potentials. In Study 1, participants selected the named picture from two alternatives that were related semantically, phonologically, or unrelated. Both groups were slower on related pairs, but the additional RT cost on semantically related pairs was smaller for bilinguals than monolinguals. Additionally, monolinguals exhibited attenuated N400s for semantically related pairs but bilinguals did not. Study 2 pursued these differences with a homogeneous group of French-English bilinguals performing the task in each language. In both languages, there was longer RT and no N400 attenuation for semantically related pairs, as for bilinguals in Study 1. These findings indicate that bilinguals experience constant interference, presumably from their other language.

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(2178)

Sentential Codeswitching in Low and High Proficient Spanish-English Bilinguals: A Behavioral and Neurocognitive Study. KAITLYN A. LITCOFSKY, *The Pennsylvania State University*, JANET G. VAN HELL, *The Pennsylvania State University*; *Radboud University Nijmegen*—Bilinguals often fluently switch between their languages. However, psycholinguistic research has shown that switching languages on single words incurs a cost related to inhibition of the dominant language. Sentential codeswitching has also shown switch costs, but the nature of this cost remains unclear. Sentential codeswitching was examined using behavioral self-paced reading and event-related potentials (ERPs) in highly proficient Spanish-English bilinguals. Reading times showed a switch cost asymmetry wherein it took longer to switch into the weaker than into the dominant language. Mirroring this, ERPs revealed a late positivity when switching into the



weaker language, and no effect into the dominant language. In highly proficient bilinguals, codeswitching seems to rely on sentence-level integration related to activation of the weaker language. Lower proficient Spanish-English bilinguals were subsequently tested using ERPs. Results from these bilinguals will elucidate whether and how proficiency modulates the nature of processing sentential codeswitches.

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(2179)

Cross-Language Phonological Activation: Evidence From Masked Onset Priming and ERPs. OLESSIA JOURAVLEV, STEPHEN J. LUPKER and DEBRA JARED, *University of Western Ontario*—The question investigated was whether there is a phonological cross-language masked onset priming effect for Russian-English bilinguals when the primes are in L2 and the targets are in L1, and whether such an effect is modulated by the orthographic similarity of primes and targets. In our experiment, primes and targets had onsets that overlapped phonologically, orthographically, both phonologically and orthographically, or did not have any overlap. Phonological overlap, but not orthographic overlap, between primes and targets led to faster naming latencies. In contrast, the ERP data provided evidence for effects of both phonological and orthographic overlap. Finally, the time course of phonological and orthographic processing for our bilinguals mirrored the time course previously reported for monolinguals (i.e., early activation of orthographic information followed by activation of phonological information) in the ERP data. These results provide evidence for shared phonological and orthographic representations at the sub-lexical level for a bilingual's two languages.

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(2180)

Inhibitory Control During Sentential Code-Switching: Evidence From fMRI. ELEONORA ROSSI, GIULI P.E. DUSSIAS, CAITLIN TING and JANET VAN HELL, *The Pennsylvania State University*—Switching between two languages engages brain areas involved in cognitive control (e.g., Abutalebi & Green, 2008). The majority of previous neurocognitive studies have predominantly examined single-word switches, typically in bilinguals who were not habitual code-switchers. We investigated the neural correlates of sentential code-switching (using fMRI) in Spanish-English habitual code-switchers (n=21). Participants read sentences either in Spanish or English only (without code-switches) or sentences that began in Spanish and switched into English mid-stream (either at a noun phrase or at a verb phrase), mirroring code-switching patterns found in naturalist corpora. Preliminary results show that areas involved in general cognitive control (e.g., pre-SMA) are recruited when processing sentences without code-switches. Specifically, significant activation in the cerebellum suggests that habitual code-switchers engage a wider control network to adapt inhibitory control processes according to task demands, as proposed by the bilingual adaptive cognitive control model (e.g., Green & Abutalebi, 2013).

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• REASONING AND PROBLEM SOLVING I •

(2181)

The Role of the Non-Specialized Hemisphere in the Creative Processing of Unconventional Stimuli. YOED N. KENETT, DAVID ANAKI and MIRIAM FAUST, *Bar Ilan University*—While cognitive capacities mainly require activation of the specialized hemisphere, previous research using creative linguistic stimuli suggests that the creative process exhibits strong involvement of the non-specialized right hemisphere. We investigated the importance of the participation of the non-specialized left hemisphere in the creative processing of unconventional visual stimuli. Participants performed central and split visual field unconventional visual recognition tasks, combined with measures of verbal and visual creative ability. We show that for a canonical right-hemisphere task of face recognition, conventional faces are processed better by the specialized right hemisphere while unconventional faces are processed better by the non-specialized left hemisphere. Finally, we show how only processing of unconventional face recognition in the non-specialized hemisphere is related to creative ability. These findings suggest that the processes underlying creativity are related to the general cognitive demand of processing unconventional stimuli and thus may contribute to clarifying the concept of creativity.

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(2182)

The Creative Executive: Analytic Cognitive Style Predicts Success in Making Remote Connections. NATHANIEL BARR, GORDON PENNYCOOK, JENNIFER A. STOLZ and JONATHAN A. FUGELSANG, *University of Waterloo*—The utility of executive processing in creative thinking remains unclear, with some purporting it helpful and others claiming it detrimental. We make use of Dual Process Theories, which conceptualize reasoning as an interplay between thinking that is autonomous (Type1) and that which is dependent upon the engagement of more controlled, executive processing (Type2) (Evans & Stanovich, 2013), to explore this issue. We demonstrate a novel relation between individual differences in the willingness to engage in Type2 thinking and the ability to make connections amongst remotely connected concepts in several tasks (i.e. Analogical reasoning and the Remote Associates Test). Although our primary focus is on creative connections, we also explore other indices of creative thinking and find that an analytical cognitive style relates to some (originality of ideas), but not others (cognitive flexibility, ideational fluency). We suggest that analyticity potentiates making creative connections by intervening to supplant less creative, intuitive responses.

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(2183)

Induced Creativity Improves Relational Transfer. MICHAEL S. VENDETTI, AARON L. WU, BARBARA J. KNOWLTON and KEITH J. HOLYOAK, *University of California, Los Angeles*—Creativity can be defined as, “novel generation fitted to the constraints of a particular task” (Mayer, 1999). Reasoning by analogy allows one to find a

relationship between two domains that is constrained by a shared relational structure. Given one domain, numerous domains may share the same relational structure but vary in the amount of featural overlap. Far analogies—those with fewer shared surface features—are rated as more creative than near ones (Green et al., 2012). We investigated whether generating answers to verbal analogies varying in semantic distance (near vs. far) would differentially induce a relational mind-set that would then transfer to an unrelated object-mapping task. After controlling for a measure of cognitive ability and response time, participants who solved far analogies produced more relational mappings on the transfer task ($M=.72$, $SD=.18$) as compared to those who solved near ones ($M=.46$, $SD=.23$), $F(1,50) = 8.48$, $MSE = .04$, $p < .01$. Solving far analogies, which requires focusing more attention on the underlying relational structure, improves transfer to a distinct analogy task. Different cognitive tasks may share common mechanisms for relational processing.

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(2184)

Near Rather Than Far Analogical Sources Leads to Success in a Design Competition. JOEL CHAN and CHRISTIAN D. SCHUNN, *University of Pittsburgh*—Generating creative ideas often involves drawing on sources of inspiration, both from memory and the external environment. Many theorists and creative practitioners hold that, to maximize creativity, one should prefer sources that are conceptually distant from one's target domain; however, empirical support for this claim is mixed, possibly due in part to truncated time scales and lack of statistical power. We address these methodological flaws with a large-scale in vivo study of the development of 2344 ideas for 12 different design challenges in a collaborative Web-based challenge platform. Tracing the success rate of ideas in relation to their conceptual genealogies, we find that preferring distant sources is associated with lower odds of success, compared to preferring relatively closer sources. This pattern was robust across the 12 challenges. The results challenge the primacy of distant sources for supporting creative idea generation.

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(2185)

What Difference Does a Year Make? Longitudinal Stability of Various Stylistic Individual Differences Measures. KATHLEEN M. GALOTTI, *Carleton College*—Data from a year-long longitudinal study of goal-setting and decision making of first-year college students involved the use of various individual differences measures. These included Need for Cognition, General Decision-Making Styles, Attitudes Toward Thinking and Learning, Planning Scale, and a new assessment instrument called the Academic Experiences Survey. One hundred forty nine entering first year students first filled out these instruments in October or January of their first year; then again in October or November of their second year. We describe the longitudinal stability of all of the individual difference measures studied and discuss implications for cognitive styles research paradigms.

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(2186)

Bird is the Word: Examining Verbal Protocols From the Raven's. ANDREW F. JAROSZ and JENNIFER WILEY, *University of Illinois at Chicago*—It is well established that individuals with higher working memory capacity (WMC) perform better on the RAPM. While many studies are uncovering what facets of WMC are critical for this relationship, more work is needed on exactly how WMC helps individuals on tests of intelligence. The present study explores the possibility that WMC impacts the strategies individuals use to complete intelligence tests. Previous work with eyetracking has demonstrated that individuals who solve more RAPM problems are more likely to use constructive matching than response elimination strategies. The current work extends earlier results by exploring the direct relation between strategy use and individual differences in WMC, using verbal protocols to gather further information about how individuals are attempting to solve the RAPM problems. Results are discussed both in terms of the impact of WMC on the strategies used, and the role of strategies in performance on intelligence tests.

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(2187)

Speaking Aloud Improves Ravens Advanced Progressive Matrices Performance. KIMBERLY TALBOOM, DOUGLAS RICE, B. HUNTER BALL and GENE A. BREWER, *Arizona State University* (Sponsored by Nash Unsworth)—The present study investigated whether college-aged students benefit from speaking aloud while performing a fluid intelligence task. Participants performed a battery of working memory and intelligence tasks both silently and while speaking aloud. Results showed that speaking aloud had no effect on working memory performance but a positive effect on performance on a fluid intelligence task. At an individual differences level, low working memory capacity participants benefited more from speaking aloud than high working memory capacity participants. There was also a positive correlation between working memory and fluid intelligence scores, further suggesting that the two constructs are related, but not identical.

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(2188)

Conflict, Metacognition, and Analytic Thinking. VALERIE A. THOMPSON and STEPHEN C. JOHNSON, *University of Saskatchewan*—In four reasoning tasks, participants ($N = 103$) gave a fast, intuitive answer, a feeling of rightness (FOR) judgment about that answer, and then a final answer. Half of the problems provided conflicting cues to judgment (e.g., valid but unbelievable conclusions); for the other half, the cues did not conflict. FORs for the conflict problems were lower than their non-conflict counterparts; in turn, the extent of analytic thinking engaged to reach the final answer was higher for the conflict problems. Participants whose FOR judgments were sensitive to conflict were also more likely to differentially engage analytic thinking for conflict problems. Participants also completed a standardized measure of IQ and the Actively Open-minded Thinking Questionnaire (Stanovich & West,



2007; 2008). The FORs of high-and low-capacity reasoners were responsive to conflict, such that FORs were lower for conflict relative to non-conflict problems. High-capacity reasoners made a greater distinction between conflict and non-conflict items on measures of Type 2 thinking, namely rethinking time and probability of changing answers. However, this rethinking time did not necessarily result in a greater proportion of normatively correct responses.
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(2189)

The Relationship Between Explicit and Implicit Processes in Insight Problem Solving. HIROAKI ADACHI, *The University of Tokyo*, SACHIKO KIYOKAWA, *Nagoya University*, TOSHIHIKO MATSUKA, *Chiba University*—In the present study, we investigated the relationship between explicit and implicit processes in insight problem solving using a geometric puzzle. In the experiment, participants were asked to solve the puzzle and to rate how close they were to the solution (i.e., warmth rating). The result showed that although successful participants' solutions gradually improved over time, their warmth ratings suddenly increased just before solving the puzzle. However, additional analyses showed that successful participants' explicit (warmth ratings) and implicit (arrangements of the puzzle) processes were positively correlated, suggesting that they might have noticed their progresses without realizing how close they were to the solution. In contrast, unsuccessful participants' solutions did not improve over time, and their warmth ratings were significantly lower than those of successful participants throughout the experiment. Unsuccessful participants' explicit and implicit processes were negatively correlated, suggesting they monitored their own problem-solving processes incorrectly.

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(2190)

Conditional Inferences Differentiate Mental Logic and Mental Models Predictions. DREW JOHNSON and JANET M. GIBSON, *Grinnell College*—We examined predictions of mental logic and mental model theories of reasoning in a multiple choice conditional inferences paradigm, where performance on the four types of conditional inferences was tested: modus ponens, modus tollens, affirming the consequent, and denying the antecedent. We framed the explanation for reasoning with affordance theory in two experiments. In Experiment 1, participants performed better on modus ponens problems than modus tollens problems and better on denying the antecedent problems than affirming the consequent problems. The possibility that reasoners use both mental logic and mental models was tested through an instruction paradigm; the effects of instruction on performance was evaluated in the context of affordance theory. A concrete example condition was used to test the affordance theory concept of "attunement to constraints" in logical reasoning. We suggest that performance on conditional inference problems can be affected by instruction but not in the way predicted. Future research should investigate people's usage of

cognitive resources to perform modus tollens inferences and examine effects of instructions on mitigating fatigue effects in modus tollens reasoning.

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(2191)

Executive Control Influences the Relation Between Working Memory and Mind Wandering. STEPHEN T. HAMILTON, CHUN SU and DEBRA L. LONG, *University of California, Davis*—The decoupling hypothesis (Smallwood & Schooler, 2006) holds that mind wandering (MW) reflects a resource trade-off between the external world and internally-generated thoughts: Individuals entertain off-task thoughts only when they have the requisite cognitive resources. This view predicts a positive relation between MW and working memory (WM). The executive control theory (McVay & Kane, 2009) views MW as a failure of the executive control system and is grounded in the view that WM reflects the ability to inhibit irrelevant information (Kane & Engle, 2004). This theory predicts a negative relation between WM and MW. Participants received WM-span tasks and a measure of executive control, the AX-CPT. They then completed a reading task in which they reported off-task thoughts. The study yielded a positive relation between WM and MW that was attenuated by top-down executive control, providing support for both perspectives.

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(2192)

Grant Funding Agencies. Information about various grant funding opportunities is available. Representatives will be present throughout the conference.



POSTER SESSION III

Friday Evening,

Sheraton Centre Toronto Hotel, Sheraton Hall

Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• VISION II •

(3001)

Incidental Expression of Visual Long-Term Memory in Online Perception. JUDITH E. FAN, J. BENJAMIN HUTCHINSON and NICHOLAS B. TURK-BROWNE, *Princeton University*—How does visual experience with an object influence its later perception? Here we examine this question by associating features with objects in long-term memory, and then testing how these memories bias subsequent perceptual judgments about the objects. Observers initially encoded a series of unique shapes that appeared repeatedly in a randomly chosen but consistent color, reporting this color each time using a delayed continuous estimation procedure. Each shape was presented again later, but was visually masked and rendered in a new, independently sampled color. In addition, half of these trials did not actually contain a shape, allowing us to measure the incidental expression of long-term memory in the absence of sensory information. Responses on these critical “invisible” trials revealed that observers anchored on the originally encoded color. This suggests that the visual system partially resolves perceptual uncertainty by reactivating memory for objects whose other features match the current stimulus.

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(3002)

Prevalence-Based Decisions in Visual Search. JEREMY D. SCHWARK and IGOR DOLGOV, *New Mexico State University* (Sponsored by Jeremy Wolfe)—Previous studies have shown that observers behave differently during visual search when a target is rare. The current set of experiments demonstrates that target prevalence influences the amount of evidence that observers need to make a decision about a target's presence. Findings show that decisions are made before sufficient perceptual evidence has been gathered when target prevalence is extreme, even under high prevalence. As trials become more difficult, target-present responses are increasingly made prior to target perception (Experiment 1). However, when a cue is introduced to assist target perception, this effect is suppressed (Experiment 2). Finally, target-absent responses can be made faster in low prevalence because less perceptual evidence is accumulated before a response is made. This perceptual evidence is dependent on object number, as the speed advantage for target-absent responses increases with set size (Experiment 3). The current study presents several challenges for models of visual search.

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(3003)

Pupil Size Reveals Template Construction and Target Detection in RSVP Search. MICHAEL C. HOUT, *New Mexico State University*, MEGAN H. PAPESH, *Louisiana*

State University, STEPHEN D. GOLDINGER, *Arizona State University*—In typical laboratory search experiments, participants look for single, unambiguous targets on every trial. Real-life visual search rarely affords such precision. Rather, people often search for multiple targets (e.g., grocery lists) with imprecise templates (e.g., “beer” versus Abita Amber). With imprecise targets, observers must construct target representations by compiling features from long-term memory. In this experiment, we monitored participants' pupil dilation during single- and multiple-target RSVP search, using precise and imprecise targets (pictures and words, respectively). Occasionally, participants searched for the same targets across multiple trials, allowing us to examine the role of memory in search. Although participants issued delayed behavioral responses, pupils “peaked” within 500-ms of target onset. Multiple-target search, and search for unique targets, yielded enlarged pupils, suggesting greater cognitive effort in more challenging trials. Pupil size is sensitive to the demands of RSVP search, and can reveal subtle processing differences masked by limiting analyses to response times.

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(3004)

Visuomotor Performance is Predicted by Event-Related Potentials (ERP) in a Rapid Serial Visual Presentation (RSVP) Protocol. TARIK BEL-BAHAR and ELIZA GENTZLER, STEPHEN ADAMO, LINGLING WANG, KRISTINA KRASICH, LAUREN HUGHES and GREG APPELBAUM and STEVE MITROFF, *Duke University*—We report results from an ongoing study examining brain circuits related to visual cognition via ERP and visuomotor performance metrics. ERP data was collected during an attentional-blink RSVP task wherein on each trial 18 numbers and one (T1) or two (T2) target letters were shown serially for 100 ms each (with 100, 300, 400, and 700 ms. “T2-lags”). Performance metrics were computed from a standardized battery that included visual sensitivity and visuomotor tasks. Examining only ERP trials where T1 and T2 were correctly detected, we observed T2-detection accuracy was predicted by P300 amplitude at occipito-parietal channels. ERPs also predicted better visuomotor performance, including scores on reaction time, go-no go, and near-far visual accuracy. These results suggest that occipito-parietal activation may index efficient visual processing and responding. Our findings extend the existing literature on ERP and visual cognition, providing a platform to explore how brain circuits may mediate visuomotor performance.

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(3005)

The Influence on Visual Perception of Visual Expertise and Non-Visual Knowledge. ROBERT WILEY and BRENDA RAPP, *Johns Hopkins University*—A long-standing question in vision concerns the contribution to visual perception



of the viewer's expertise with the stimulus domain and the role of non-visual factors, such as motoric or phonological knowledge. We examined these issues with a same-different judgment task on pairs of characters from the Arabic alphabet, following the procedure of Courrieu, Farioli, and Grainger (2004). Two types of participants performed the task: ones who had no previous experience with Arabic, and ones who were native speakers or advanced students. The same analyses were conducted for both groups. Comparisons of the principal components and hierarchical clusters derived from each group reveal clear effects of learning and experience on the visual perception of the letter shapes. The results demonstrate how knowledge of letter name/identity and motoric stroke patterns modify the perceptual space for even relatively simply visual objects.

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(3006)

Concurrent Relationships Between Prime Awareness, Identification, and Priming Effects in Metacontrast. STEVEN HAASE, *Shippensburg University*, GARY FISK, *Georgia Southwestern State University*, EMILY KLINE and NATHAN OSTER, *Shippensburg University*—Our research explores prime awareness in a metacontrast-masked priming paradigm. Many investigators assume that metacontrast-masked primes cannot be consciously identified. Here, concurrent, trial-by-trial assessment of prime identification, prime awareness, and target RT priming effects provide rich data for addressing this controversy. Overall prime identification was well above chance for 40 ms and 67 ms prime-target SOAs. Across the three SOAs, prime identification was better in the incongruent condition in the 40 ms and 67 ms experiments; whereas, participants in the 27 ms SOA had better prime identification in the congruent condition, perhaps influenced by perceived target direction. Prime identification and target RT priming were related only in the 40 ms SOA condition ($R^2 = 0.23$). At the longer 67 ms SOA, more distinct prime percepts may have inhibited target RT priming effects. Lastly, prime awareness-identification functions covaried as SDT predicts: longer SOAs result in higher prime awareness and identification. At the 27 ms SOA, above-chance prime identification was only obtained at the highest awareness rating. We conclude that metacontrast-masked primes must be consciously experienced to produce priming effects.

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(3007)

Texture Gradients Facilitate Visual Object Recognition: Evidence From Priming. MARTIN ARGUIN, *Université de Montréal*, IAN MARLEAU, *Centre Montréalien de Réadaptation*—The contribution of texture gradients to visual object recognition was assessed in a primed object recognition task. Participants studied synthetic 3D objects covered with a rich achromatic texture. They then performed a recognition task with targets preceded by partial object primes. Prime texture either matched the 3D orientation of the surfaces displayed (3D primes) or corresponded to a flat surface perpendicular to the line of sight (2D primes). The neutral prime was a textured sphere. Significant priming effects were found on response times (RTs) to familiar objects. With

matching primes, the shortest RTs occurred with 3D primes, followed by 2D and then by neutral primes. With unrelated primes, the only effect was with 3D primes, which led to longer RTs than neutral primes. The greater impact of 3D primes over 2D primes in the recognition of familiar objects indicates a significant contribution of texture gradients to visual object recognition.

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(3008)

Use of Visual Features in Shape Recognition by Pigeons. MUHAMMAD A. QADRI and ROBERT G. COOK, *Tufts University*—Human shape recognition theories and computer vision algorithms place heavy emphasis on cotermination or vertices of objects. Previous pigeon results, however, have suggested that the avian visual system may rely more on edges to recognize objects. In the current experiment, four pigeons were trained in a choice task to discriminate simple geometric objects that were controlled by a genetic algorithm. Using conditions optimized for shape recognition, the stimuli were then degraded and manipulated to determine the properties that controlled the pigeons' visual performance and attention. The results indicate that the avian visual system preferentially uses vertices to identify objects over a broad range of variability, but their attentional focus emphasizes local parts over global organization. This suggests the relative salience of the different features for shape recognition are similar between birds and humans, but they differ in their use of the features available from the different spatial scales present in the stimuli.

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(3009)

Mapping the Core Factors of Visual Perceptual Performance. LAWRENCE G. APPELBAUM, TARIK BEL-BAHAR, LINGLING WANG, LAUREN HUGHES, KRISTINA KRASICH and STEPHEN R. MITROFF, *Duke University*—Vision is the building block of much of human cognition. In the present research we describe core performance factors that capture visual cognitive abilities across a wide range of perceptual (static and dynamic visual acuity, contrast sensitivity, depth perception), visual-motor (eye hand coordination, go/no-go, reaction times), and working memory tasks, collected in a sample of 160 healthy college-aged individuals. Measured behavior on each task adhered to typically reported performance for similar types of tasks, and produced largely normal distributions. Across these tasks we observed 4 latent factors that describe variability in performance. These factors are interpreted as reflecting: visual-motor control, perceptual sensitivity, visual quickness, and visual-spatial working memory abilities. We observed an effect of gender on the visual-motor control factor, but not the other factors, with males performing better. Our data suggest that response speed and perceptual sensitivity are separable facets of performance, even when measured within the same task. These findings indicate an initial principled set of visual performance metrics that can be used to explore individual variability relating human visual cognition.

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(3010)

Déjà vu Experiences: Sensitivity to Configural Resemblance.

ERIKO SUGIMORI, *Waseda University*, TAKASHI KUSUMI, *Kyoto University*—Prior research has suggested that configural resemblance between a current scene and a remembered one may trigger déjà vu experiences. The present study examined whether there is a relationship between the frequency of reported real-life déjà vu experiences and sensitivity to a configural resemblance manipulation in the laboratory. We measured familiarity ratings and remember-know judgments of several scenes. Some scenes had been previously presented, some were similar to previously presented scenes, and the others were dissimilar. We also examined the characteristics of déjà vu experiences using questions about nostalgia and feelings of regret. Déjà vu tendencies were highly correlated with sensitivity to similarity, feeling of familiarity for similar scenes, and feelings of nostalgia. Our results suggest that sensitivity to configural similarity is a trigger for déjà vu states, that déjà vu is highly related to feelings of familiarity for novel scenes that are similar to previous ones, and that déjà vu and feelings of regret separately cause feelings of nostalgia.

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(3011)

Holistic Face Perception is Modulated by Experience-Dependent Grouping.

KIM M. CURBY, *Macquarie University*, ROBERT ENTENMAN, *Temple University*, JUSTIN FLEMING, *University of Rochester*—Evidence suggests basic perceptual grouping mechanisms can contribute to holistic face perception, indexed via the congruency effect, which diminishes when the backgrounds upon which face parts appear are misaligned and differently colored, discouraging their grouping into a cohesive object. The power of grouping cues can be influenced by experience. If this attenuation of holistic perception stems from disrupted “objecthood” of the face, it might be influenced by observers’ grouping experience. Here, participants first searched for a target among arrays of dual-colored, misaligned conjoined rectangle pairs or single rectangles, encouraging perception of the shapes as either polygons or as independent rectangles. When face parts subsequently appeared on polygons, they were perceived more holistically when the pre-task had encouraged grouping of the background components into polygons than as independent rectangles. This modulation by experience-dependent grouping is surprising given the proposed impenetrability of face perception and provides insights into the mechanisms underlying holistic face perception.

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• ACTION AND PERCEPTION II •

(3012)

Citizen Science/Galaxy Zoo: Determination and Cluster Analysis of Performance by Untrained Observers in the Classification of Galaxies. ALAN D. MUSICANT, DAVID J. HILLER, MIKE HEIN, JOHN WALLIN, NICOLE BRUNAS and ANDREW HUNT, *Middle Tennessee State University*—

Citizen Science uses the input of many non-experts to make meaningful contributions to science through the analysis of large datasets. The GalaxyZoo project solicits volunteers to classify galaxy morphologies. We examine how volunteers make visual classifications and we utilize eye tracker data to further explicate the process. We use four classification categories, all previously created by experts in the field. College students, with minimal training, were asked to classify a well characterized set of galaxy images. Cluster analyses indicate five distinct groups of participants. One group classifies all galaxy types accurately (generalists), while other groups’ typically classify one galaxy type well (specialists). Eyetracker information indicates that the generalists initially take longer to learn the classification, but advance to take less time than specialists.

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(3013)

Perception of Distance on Sloped Terrain: Effects of Optics and Effort.

ALEN HAJNAL, *University of Southern Mississippi*, DAMIAN G. KELTY-STEPHEN, *Harvard University*, DAVID A. BUNCH, *University of Southern Mississippi*—Past research suggests that visual space perception is determined by both visual information and effort (Proffitt & Linkenauger, 2011). Angular declination scaled to eyeheight has been proposed as the informational basis for distance perception (Ooi, Wu & He, 2001). In our present contribution we have shown that both optical and effort based variables predict perceived distance using a fairly new distance estimation method, rope pulling. Effort was operationalized using the time it took to visually inspect the target distance as related to intended effort, and the time it took to reproduce the distance by measuring out a corresponding length of rope as related to actual exerted effort. Results showed that an untrained group relied on the interaction of optical with effort-based variables but training elicited greater reliance on motor simulation. Results are discussed in terms of the debate between representational and direct approaches to perception and cognition.

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(3014)

Does Oculomotor Readiness Mediate Exogenous Capture of Visual Attention?

GREGORY H. MACLEAN, RAYMOND M. KLEIN and MATTHEW D. HILCHEY, *Dalhousie University*—The oculomotor readiness hypothesis is an efference-based theory of visuospatial orienting which makes two predictions; shifts in covert attention are accompanied by preparedness to move one’s eyes to the attended region, and preparedness to move one’s eyes to a region in space is accompanied by a shift in covert attention to the prepared location. In 1980 Klein tested and disconfirmed both predictions using an endogenous attention task. In the two experiments presented here, the same two predictions are tested using an exogenous attention task. It was found that participants experienced covert capture without accompanying oculomotor activation, or experienced oculomotor activation without accompanying covert capture. While under everyday conditions the overt



and covert orienting systems may be strongly linked, they can nonetheless operate with a high degree of independence from one-another.

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(3015)

Are Stripes Beneficial? Dazzle Camouflage Influences Perceived Speed and Hit Rates. BETTINA VON HELVERSEN, *University of Basel*, LAEL J. SCHOOLER, UWE CZIENSKOWSKI and EVALDAS JABLONSKIS, *Max Planck Institute for Human Development*—In the animal kingdom, camouflage helps prey avoid capture. Mostly camouflage is thought of as helping prey blend in with their background. In contrast, dazzle patterns, such as stripes and zigzags, have been hypothesized to help prey on the move avoid capture by impairing predators' perception of speed. We investigated how different patterns of stripes (longitudinal—i.e., parallel to movement direction—and vertical—i.e., perpendicular to movement direction) affect the probability with which humans can hit moving objects and if differences in hitting probability are caused by a misperception of speed. An experiment examining the link between perceived speed and hitting probability showed that longitudinally and vertically striped objects indeed were perceived as moving faster than unicolored objects, but, counter to the hypothesis, the striped objects were hit more often. In sum, our results provide evidence that striped patterns disrupt the perception of speed, which in turn influences how often objects are hit.

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(3016)

A Generalization of Weber's Law Predicted by the Diffusion Model. KSENIA VLASOV and PATRICK SIMEN, *Oberlin College*—A Poisson-spike version of the diffusion decision model gives a simple account of Weber's law (Link, 1992). It also explains the constancy of response time (RT) coefficient of variation (CV) typically observed in two-choice, perceptual decision making (Wagenmakers & Brown, 2007) and interval timing (Simen et al., 2011). This model also predicts a response-time corollary of Weber's law: that as the two comparison stimulus intensities increase proportionally, CVs remain constant while RTs decrease. At the same time, the model predicts violations of CV constancy when task conditions differ in key respects, including a decrease in CV with increasing task practice. The simplest form of the model further predicts an upper bound on the CV of observed RTs that is equal to the square root of 2/3 when responding is unbiased. We have begun testing the model's predictions with tactile and auditory stimuli, and data are so far consistent with the predictions.

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(3017)

Drift in Repetitive Timing. LINUS HOLM and GUY MADISON, *University of Umeå*, PAUL SCHRATER, *University of Minnesota*—The ability to represent and produce time intervals is fundamental to most perceptual-motor behavior. However, consistent rhythmic timing is difficult to achieve, and the production of successive intervals typically

exhibits slow fluctuations known as drift. Evidence suggests that interval production engages cognitive control, because interval production requires monitoring a perceptual-motor behavior while maintaining key timing information in memory. In this context, drift may represent memory dynamics of the cognitive control system. We characterized drift in continuation tapping, where the task is to maintain a regular interval without any external signal. Participants tapped with their index finger (8 subjects, 280 productions) or drumstick (7 subjects, 200 productions), and we estimated drift for ten inter onset intervals ranging from 500 to 1,500 ms. We found a highly systematic drift pattern involving an exponential decay from the standard toward a biased asymptote between 100 to 150 intervals that was consistent within (but not between) subjects and interval lengths. Moreover, the size of the bias increased with interval length. The results suggest that memory for timing has both its own dynamics and natural timescale.

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(3018)

The Role of 1000 ms When Crossing Timescales. ASHLEY S. BANGERT, NAZANIN M. HEYDARIAN, ALLYSON HUGHES and KIMBERLY EDWARDS, *The University of Texas at El Paso*—Debate exists about whether a single scalar timer (Gibbon, Church, & Meck, 1984) operates across both milliseconds and seconds. Different brain regions may subserve timing across these ranges (Lewis & Miall, 2003, 2006). Moreover, there is evidence that 1000 ms is reproduced with greater sensitivity than its sub- and supra-second neighbors (Bangert, Reuter-Lorenz & Seidler, 2011). The current study explores the role of 1000 ms when it is either the shortest or longest duration evaluated in a set. In experiment 1, 34 college students reproduced 5 target durations (300 ms, 475 ms, 650 ms, 875 ms, 1000 ms) of 1000 ms or shorter. In experiment 2, 27 college students reproduced target durations (1000 ms, 1350 ms, 1650 ms, 2000 ms, 2300 ms) of 1000 ms or longer. The coefficient of variation (CV) indexed timing sensitivity. In both experiments a main effect of duration was found, pointing to nonlinearities across both temporal ranges. In experiment 1, CVs tended to decrease with longer durations. In experiment 2, CVs were quadratic. Notably, in both cases, the duration furthest from 1000 ms had the highest CV. While the precise role of 1000 ms remains unclear, these results argue for a re-evaluation of scalar theories of timing.

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(3019)

Competitive Interaction Leads to Perceptual Distancing Between Actors. LAURA E. THOMAS, *North Dakota State University*, CHRISTOPHER C. DAVOLI and JAMES R. BROCKMOLE, *University of Notre Dame*—Social factors can shape observers' spatial perceptions of their environments, such as when the presence of a friend makes aspects of the surroundings appear less physically demanding. Can the competitive nature of a social encounter likewise influence how observers perceive spatial relationships between themselves and another actor in the environment? We examined this question by asking participants to play a ball toss game until

they reached a target score. An experimenter stood across the room from the participant and either 1) played the same game competitively, 2) played the same game cooperatively, or 3) observed the participant without playing. After the game, participants provided an estimate of the distance between themselves and the experimenter. Participants who competed with the experimenter consistently judged her to be more distant than participants who cooperated with the experimenter or played alone, suggesting that a socially distancing interaction created increased perceptual distance between actors.

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(3020)

Interactions Between Hand Posture and Eye Movement.

JIHYUN SUH and RICHARD A. ABRAMS, *Washington University in St. Louis*—Hand proximity affects the allocation of visual attention. Here, we examined eye movements nearby and far from the hands. Pro- and anti- saccade tasks were performed with different hand postures. Larger saccadic reaction time differences between pro- and anti-saccade tasks were observed when the hands were close to the stimuli. The results are consistent with previous findings suggesting that nearby hands inhibit attentional disengagement. The present study further reveals details of the interaction between hand posture and eye movements.

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(3021)

Context Effects and Learning in Perception of Maximum Reaching Height.

BRIAN M. DAY and JEFFREY B. WAGMAN, *Illinois State University*—Flexibly performing a given behavior requires that perception of whether (and how) that behavior can be performed reflect the action capabilities of the perceiver across changes in context. We investigated perception of maximum reaching height across changes in both point of observation and intended reaching task. Experiment 1 found that perception reflected reaching ability across changes in these contexts but most closely scaled to reaching ability when the point of observation was the same as that required for the reaching task. Experiments 2 and 3 found that perception more closely approximated reaching ability following practice performing the perceptual task regardless of whether the point of observation was the same as that required for the reaching task. The results show that changes in context influence how perception of maximum reaching height scales to reaching ability but do not influence whether such scaling occurs.

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(3022)

An Embodied Approach To Situation Awareness In Air Traffic Control.

DAN CHIAPPE, KIM VU and TOM STRYBEL, *California State University, Long Beach*, COREY MORGAN, *SA Technologies*—This study tested an embodied approach to situation awareness in air traffic control. It holds operators rely on interactions with their displays to access limited information, with only certain information held internally. Specifically, we tested 16 student air traffic

controllers to examine whether general and high priority information about the airspace (e.g., locations of aircraft conflicts) is held in working memory, while low priority and specific information (e.g., aircraft callsigns) is offloaded to displays and accessed only when needed. This was tested in a simulation environment where student controllers managed air traffic. A probe technique was used, where participants were periodically asked questions about the airspace (e.g., Is AAL123 co-altitude with SWA566?). We compared conditions where displays remained visible to ones where they were not visible during probe question presentation. This was done to determine what type of information was offloaded, and hence more likely to be affected by making information inaccessible from displays. We found that specific aircraft information is offloaded onto displays, but did not find that low priority information is offloaded, at least in the case of student controllers.

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(3023)

Dehydration Changes Inhibitory Regulation of Eye Movements and Visual Search.

ERIC LAURENT, KARL WELKLEN and NICOLAS NOIRET, *University of Franche-Comte*—The role basic bodily factors in visual perception has been studied through the influence of dehydration. In Experiment 1, dehydrated and non-dehydrated participants performed an antisaccade task in which they had to move their gaze in the opposite direction to a peripherally appearing picture. The picture could evoke dehydration (DP), hydration (HP), or be neutral with respect to hydration (NP). The number of correct antisaccades was higher in dehydrated than in non-dehydrated participants for both DP, and HP, but not for NP. In Experiment 2, dehydrated and non-dehydrated participants freely inspected pairs of pictures related to the three categories (i.e., DP, HP, NP). Dehydrated participants (as compared to hydrated participants) had a lower percentage of both fixations and fixation duration on DP, when the latter were presented either with HP or with NP. Dehydration selectively changes both inhibitory regulation, and maintenance, of gaze, in relation to the nature of stimulation.

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(3024)

Scaling-Up Perception-Action Links: Evidence From Synchronization With Individual and Joint Action.

VERONICA C. RAMENZONI, *Donders Institute for Cognition*, NATALIE SEBANZ and GÜNTHER KNOBLICH, *Central European University*—How do we map joint actions we participate in onto joint actions we observe others performing, such as when a couple dancing tango observes another couple dancing tango? We investigated this question using a task where participants were instructed to perform individual or joint movements in synchrony with individual or joint movements observed on a computer screen. The observed movements started slowly and then continuously increased in tempo (from 1.75 Hz to 3 Hz). The results showed that, with regard to spatial parameters, joint performance was more accurate when observing joint performance than when observing individual performance. Individual performance



was more accurate when observing individual action than when observing joint action. There were no systematic differences with regard to timing parameters. These results suggest that temporal coordination may be less susceptible to differences between individual and joint action than mechanisms of spatial matching.

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• EXPLICIT MEMORY II •

(3025)

Predators v. Demons v. Clowns: When Fear of the Supernatural Improves Recall in a Survival Scenario. STEPHANIE A. KAZANAS and JEANETTE ALTARRIBA, *University at Albany, SUNY*—We compared the standard effects of survival processing on recall (Nairne, Thompson, & Pandeirada, 2007) to a condition with a supernatural creature (i.e., demons), similar to the procedure described by Soderstrom and McCabe (2011). Pilot data had indicated participants rate “zombies” as far more neutral in valence than “demons,” a finding that may be the effect of recent films and television shows. We were interested in how a survival scenario, with a more negatively valenced supernatural creature, would affect later recall. Further, to investigate the effect of bizarreness on recall, we created an additional condition, replacing “food and water” with “rust and dice” and “predators” with “clowns.” Participants in each of these conditions recalled significantly more words than those in the pleasantness condition, with participants in the demons condition recalling the greatest number of words. Results are discussed within the context of survival processing, and whether our effects are problematic within a theory that is based in ancestral priorities.

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(3026)

Is the Advantage of Self-Reference in Survival Processing due to Deeper Processing or Evolutionary Drives? LAUREN E. BATES, *Colorado State University*, LISA MAXFIELD, *California State University, Long Beach* (Sponsored by Jessica Witt)—Recent memory research has identified a phenomenon known as the survival processing advantage (Nairne, Thompson, & Pandeirada, 2007). Several studies have consistently revealed that encoding information for its relevance to a survival scenario produces superior recall than all other encoding procedures used to date (Nairne, Pandeirada, & Thompson, 2008). Prior work from our lab, using the survival processing paradigm, demonstrated that self-survival enhances memory, relative to survival of another person (Bates & Maxfield, 2011). The current study investigates whether this is due to the deeper processing associated with self-reference (Rogers, Kuiper, & Kirker, 1977), or evolutionary drives. Again using the survival paradigm, participants encoded items with regard to either their own survival, or that of a family member, or a favorite

celebrity. Results are discussed in terms of which mechanisms underlying the adaptive functioning of memory best explain the survival processing advantage.

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(3027)

Survival Memory: Exploring the Underlying Mechanisms Across English and Spanish. CRYSTAL J. ROBINSON and JEANETTE ALTARRIBA, *University at Albany, SUNY* (Sponsored by Ludmila Isurin)—The current project examines the effects of survival processing relative to item-specific and relational processing on recall and recognition memory for both English monolinguals and Spanish-English bilinguals. It has been suggested that both item-specific and relational processing play an important role in the survival advantage (Burns, Hart, Griffith, & Burns, 2012; Burns, Hwang, & Burns, 2011). However, to date, the generalizability of this advantage has yet to be examined cross-linguistically. In two studies, participants were asked to make survival relevance ratings, pleasantness ratings, and to categorize a set of words from either common taxonomic or ad hoc categories. Spanish-English bilinguals performed this task in either English or in Spanish. All participants were then given a recall and recognition test. Findings are discussed with regards to how different levels of bilingual processing are helpful in determining the proximate mechanisms underlying the survival advantage.

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(3028)

Richness of Encoding and the Survival Processing Effect in Memory. SAMANTHA N. PETRELLA and DAWN M. MCBRIDE, *Illinois State University*—The current study provided a further test of the richness of encoding explanation (Kroneisen & Erdfelder, 2011) of the survival processing effect in memory. This idea was tested using an embodied cognition approach to memory (Glenberg, 1997). In the present study, subjects rated the relevance of items in both a survival and a moving scenario. In addition, half of the subjects were instructed to imagine interacting bodily with the items and half were not; they then completed a free recall test for the items. A survival processing advantage was found only when subjects were not asked to imagine interacting with the items. Mean recall did not differ in the survival conditions based on the type of instruction, supporting the richness of encoding explanation of the survival effect.

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(3029)

Choosing to Forget: A Self-Initiated Approach to Directed Forgetting. DANIEL P. CORTS, KATHERINE DEPA, LINDSEY KUTCHER and MACKENZIE MORIARTY, *Augustana College*—Proactive interference (PI) accrues with repeated exposure to information making subsequent information less like to be stored. However, researchers find that directing participants to forget (Directed Forgetting), prevents PI, resulting in better memory. We extended directed forgetting by adapting the two procedures—list method and item-method—to a self initiated model. For list method,

participants learned two lists and were then asked to remember one and forget the other. For the item method, participants were given a simple orientation task before a presentation began, and they applied the rule to make a remember/forget decision upon seeing each item. For example, deep processing might involve the rule: Remember words that are manmade items forget the others whereas the shallow would remember the words that are capitalized. Results indicate that individuals can remember and forget according to their own decisions, although this effect is weakened when the decision requires deeper processing.

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(3030)

Neural correlates of suppressing learned reputations. ATSUNOBU SUZUKI and YUICHI ITO, *Nagoya University*, SACHIKO KIYAMA, *National Center for Geriatrics and Gerontology*, HIROKI TANABE, HIDEKI OHIRA and JUN KAWAGUCHI, MITSUNOBU KUNIMI and TOSHIHARU NAKAI, *Nagoya University*—Information about others' reputations is often distorted in real life. It is thus an important ability to suppress learned reputations when they turn out to be inaccurate. Our previous work has shown that once they are learned, bad reputations are more difficult to suppress than good ones (Suzuki, Honma, & Suga, [in press]). Indelible distrust: Memory bias toward cheaters revealed as high persistence against extinction. *J. Exp. Psychol. Learn. Mem. Cogn.*) The present study investigated neural correlates of suppressing learned reputations in order to elucidate possible mechanisms underlying this mental process. Participants first learned whether stimulus persons were trustworthy or untrustworthy. They were then asked to intuitively judge the trustworthiness of each stimulus person while disregarding the learned trustworthiness. Brain activations during these tasks were measured with functional magnetic resonance imaging. Neural responses associated with the suppression of bad and good reputations will be reported.

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(3031)

Context Effects in Episodic Memory for Natural Scenes. PERNILLE HEMMER and KIMELE PERSAUD, *Rutgers, The State University of New Jersey*, MARK STEYVERS, *University of California, Irvine*, JOSEPH DEANGELIS, *Rutgers, The State University of New Jersey*, RACHEL VENAGLIA, *Lafayette College*—It is well known that the context of a scene can have a strong effect on the identification of objects in the scene (e.g., Biederman, 1982). However, it is unclear what role the context of natural scenes, such as kitchen and office scenes, plays on long-term episodic memory for objects. We present results from a series of experiments comparing episodic memory performance for objects in a number of conditions that manipulate scene context: full scene context including background and other objects, partial scene context with other (consistent) objects but no background, and random context with inconsistent objects and no background. We evaluate the degree to which the object and background

context contributes to memory performance and how much study time is needed to achieve equivalent performance between the three scene conditions.

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(3032)

Bystander Distinctiveness, Unconscious Transference, and a Sequential Lineup Advantage. CURT A. CARLSON, *Texas A&M University-Commerce*—This study assessed the influence of facial distinctiveness on the use of recollection and familiarity in face recognition experiments involving typical old/new recognition tests as well as lineups. Experiments 1 and 2 utilized the repetition-lag paradigm and Jacoby's (1991) Process-Dissociation Procedure to reveal that recollection was not used more for distinctive faces, but recognizing non-distinctive faces was driven by familiarity. Experiment 3 revealed an interaction between bystander distinctiveness and a sequential lineup advantage. Compared to simultaneous lineups, sequential lineups protected non-distinctive bystanders from familiarity-driven false alarms. Remember-Know assessment confirmed that false alarms of (non-distinctive) innocent bystanders were driven by familiarity, which is a novel way of conceptualizing unconscious transference.

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(3033)

Memory Positivity in the Face of Mortality. LEELAND L. ROGERS, BRIAN E. EMMERT JR., ANNA B. DRUMMEY and IRENE P. KAN, *Villanova University*—Memory positivity (i.e., better memory for positive than negative and neutral information) is commonly observed in older adults. A prominent account for this pattern is the Socioemotional Selectivity Theory (SST, Carstensen, 1993), which posits that memory positivity reflects our increasing motivation to maintain emotional well-being as we age, which results from the awareness of a shrinking time horizon. If memory positivity is mediated by awareness of a diminishing time horizon, then increasing mortality salience in healthy young adults should also result in memory positivity. We asked subjects to write about their thoughts and feelings associated with their own death (compared to having a dental procedure, cf. terror management theory) prior to a picture memory task. Whereas control subjects showed a negativity effect (negative > positive, a common finding in young adults), mortality subjects performed equally well in both conditions. Furthermore, mortality subjects outperformed controls in the positive condition.

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(3034)

The Effects of Forward and Reverse Mental Time Travel On Context Accessibility. BRANDEN ABUSHANAB and LILI SAHAKYAN, *University of North Carolina at Greensboro*—This report examined how direction of recall affects memory for more recent information in the list-before-last paradigm. Participants studied three lists (L1, L2, L3), and after L2 encoding, control group solved math, whereas experimental groups recalled L1. The direction of L1 recall was manipulated



through provision of cues: some participants retrieved L1 in the same order as encoded (forward group), some retrieved in reverse-order (backward group), and others retrieved in random-order (random group). Following L3 encoding, all participants completed L2 free recall. Despite equivalent L1 recall, L2 recall varied: Forward recall of L1 produced L2 forgetting compared to the math group, whereas backward recall did not produce forgetting. The random group fell between the forward and backward groups. We also examined serial position curves, first response probabilities, intrusions, and individual differences in recalling L1 critical region. Implications for contextual drift and consequences of mental time travel in forward and reverse directions are discussed.
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(3035)

Sleep Benefits Memory for Negative and Neutral Words Regardless of Encoding Strength. PATRICIA A. DEWINSTANLEY, RUTHIE WITTENBERG and HANNAH GILFIX, *Oberlin College*—People often recall more after an interval containing sleep than after the same amount of time without sleep. Consistent with previous research demonstrating a sleep advantage, our participants performed better on a cued-recall test after a 12-hr retention interval containing a night of sleep than after a 12-hr retention interval that did not contain sleep. Overall memory and the size of the sleep advantage was the same for negative words (e.g., knife, lice, trash) as compared to neutral words (e.g., send, active, above). We manipulated the strength of encoding by requiring participants to generate (e.g., murder – kn-f-) or read (e.g., murder – knife) the second words during study. Although we found a large generation advantage, we did not find a difference between emotional and neutral words in the size of the generate advantage, nor in the size of the sleep advantage. Our results failed to replicate studies demonstrating that sleep plays a particularly strong role in memory for emotional stimuli. We discuss the implications for the role that sleep plays in memory consolidation.
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(3036)

Exploring the Force Balance in Retrieval-Induced Forgetting: The Effect of Item Ratio Between Retrieval and No-Retrieval. NOZOMU HIRAOKA, *Gakushuin University* (Sponsored by Hisato Imai)—Retrieving a subset of learned items can cause impairing later recall of other items, a phenomenon called retrieval-induced forgetting (RIF). RIF has been mainly explained as inhibition process that works to resolve retrieval competition. However, it is little known where and how such inhibition derives from. Here, we hypothesized that, for promotional action to practiced materials on retrieval-practicing, there can be an equal and opposite reaction to unpracticed materials as inhibition simultaneously. This account expected RIF would weaken or disappear when the number of practiced items is less than that of unpracticed because the total amount of facilitative action to practiced items is equally distributed to each unpracticed ones as inhibitory reaction. The present experiment demonstrated that RIF occurred when the ratio of practiced and unpracticed

items was equal, but not when the ratio was unequal. This finding supports our prediction, and the mechanics of facilitation/inhibition on RIF will be discussed.

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(3037)

Spacing Retrieval Practice Promotes Long-Term Inhibition In Memory. ALMUDENA ORTEGA, *University of Granada*, CARLOS J. GÓMEZ-ARIZA, M. TERESA BAJO, ANTONIO IBÁÑEZ, *University of Jaén*—Retrieval Induced Forgetting (RIF) shows that selective retrieval of memories can impair later retention of related contents that compete for access during memory retrieval (Anderson, Bjork, & Bjork, 1994). The present study aimed to better understand the nature of this inhibitory mechanism by investigating the role of the retrieval practice schedule in the durability of RIF. On the basis of previous behavioral and neuroimaging data we predicted that spaced retrieval practice, relative to massed retrieval practice, would lead to longer-lasting forgetting effects. In our work we further explored this finding in a single experiment. We manipulated the practice schedule and the delay between the last retrieval-practice trial and the final test and we used an item recognition task as the final test. While reliable RIF was found on the immediate test after both massed and spaced practice schedules, this effect lasted 24-h only after spaced retrieval. Electrophysiological correlates seem to indicate that a spaced schedule of retrieval allows competing traces to recover from inhibition thus making these memories the target of inhibitory control over subsequent retrieval trials and promoting a more durable effect of inhibition.
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(3038)

Generation Protects Information From Retrieval-induced Forgetting. SASKIA GIEBL, TOSHIYA MIYATSU, ALAN D. CASTEL and ELIZABETH LIGON BJORK, *University of California, Los Angeles*—Retrieving information from memory not only makes the retrieved information more accessible (i.e., the testing effect), but also makes related information less accessible, a phenomenon called retrieval-induced forgetting (Anderson, Bjork, & Bjork, 1994). In typical RIF experiments, participants are presented with category-exemplar pairs and instructed to memorize them for a later memory test. The current study compared this typical condition to a condition in which participants generated their own exemplars prompted by names of categories. Participants in the current study recalled more generated items than presented items, and they also showed normal level of RIF among presented items, that is impaired recall of unpracticed items in a practiced category compared to items from an unpracticed category. However, no RIF was seen among the generated items. The generation effect, the memorial benefit of generation over simply reading, has been demonstrated numerous times with a wide variety of materials (see Bertsch, Pesta, Wiscott & McDaniel, 2007 for a review). Our finding suggests that this highly robust effect may come partly from generation's protective effect from retrieval-induced forgetting and other subsequent interferences.
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(3039)

Wait, Wait, Don't Tell Me! Tip-of-the-Tongue and Retrieval-induced Forgetting. REBECCA H. KOPPEL and JENNIFER WILEY, *University of Illinois at Chicago*, BENJAMIN C. STORM, *University of California, Santa Cruz*—Tip-of-the-tongue (TOT) states are retrieval failures accompanied by feelings of imminent recall. According to current theories, TOTs are experienced when a target memory trace is insufficiently activated by a given retrieval cue or temporarily blocked by the activation of competing memory traces. The current study investigated whether retrieval-induced forgetting (RIF), a phenomenon believed to reflect the ability to inhibit competing memory traces, can predict a person's propensity to experience TOTs. Across three experiments, participants rated TOTs for general knowledge questions and then took a recognition test to verify that they indeed knew the answers. A quadratic relationship was observed such that participants who exhibited either high or low levels of RIF experienced fewer TOTs than did participants who exhibited moderate levels of RIF. These results suggest that the memory processes underlying RIF may play an important role in determining whether, and when, someone experiences TOTs. Email: Benjamin Storm, bcstorm@ucsc.edu

(3041)

More Familiarity-Based Responses in MCI Make the Absence of Emotional Enhancement in Recognition. JUAN LI and PENGYUN WANG, *Chinese Academy of Sciences*, LIXIA YANG, *Ryerson University*—Objective: This study separated Recollection and Familiarity to investigate whether patients with amnesic mild cognitive impairment (aMCI) rely more on familiarity compared to healthy older adults during recognition testing, which resulted in the absence of emotional memory enhancement in their recognition memory. Method: Positive, neutral and negative faces were used as stimuli. Thirty-one aMCI patients and thirty healthy older adults participated in a recognition test followed by Remember/Know judgments. Results: For overall recognition performance, emotional memory enhancement was found only in healthy controls. However, for "Remember" responses, equivalent emotional memory enhancements were observed in both groups; for "Know" responses, their contribution to recognition performance was observed only in aMCI group, and furthermore they were not affected by the emotional valence of stimuli. Conclusions: The results indicated that the absence of emotional memory advantage in recognition test for aMCI was due to they relied more on familiarity-based "Know" responses for correct recognition. Email: Juan Li, lijuan@psych.ac.cn

• RECOGNITION MEMORY II •

(3040)

Source Memory Recognition is Dependent Upon Time of Learning. W. MATTHEW COLLINS, ANIL SAWH and RAYNA ORSINI, *Nova Southeastern University*, ANDREW COHEN, *University of Massachusetts Amherst*—A number of studies have examined the relationship between the ability to describe an event and memory for that event (Morris & Baker-Ward, 2007). Few studies, however, have directly manipulated the relationship between when something is learned and how that learning affects memory for the event. In this experiment, participants completed an initial learning phase, an exposure phase, a second learning phase, and, finally, a memory test. During initial learning, participants learned the names of imaginary animals. During the exposure phase, participants were asked to copy animal drawings. Some of these animals were new, while some had been learned during the initial learning phase. The second learning phase involved learning more animals, some of which had appeared during the exposure phase. Finally, on the memory test, participants were tested on their recognition memory for animals during the exposure phase. Compared to unlearned animals, participants more likely to recognize animals that were learned before they were encountered and, surprisingly, less likely to recognize animals that were learned after they were encountered. The latter result suggests source confusion for more recent items due to time of learning. Email: Matthew Collins, wc292@nova.edu

(3042)

Emotion and Motivation Effects on Episodic Memory in the Context of Monetary Incentives. HOLLY J. BOWEN and JULIA SPANIOL, *Ryerson University*—Emotion and motivation are types of affect whose influences on memory have not been clearly dissociated. The current study examined emotion and motivation effects on incidental memory formation in 91 younger adults. Encoding took place during a modified Monetary Incentive Delay task. Anticipatory affect was induced with reward and loss cues, and consummatory affect was induced with reward and loss feedback. Reward and loss outcomes were either contingent on speeded responses to a visual target (motivation condition) or were pseudorandom (emotion condition). Recognition memory for words presented during reward or loss anticipation did not differ across motivation and emotion conditions. Memory for words presented following reward feedback was also insensitive to the motivation/emotion manipulation. However, words presented after loss feedback were more often remembered in the motivation condition than in the emotion condition. This suggests that emotion and motivation effects on memory dissociate following aversive, but not appetitive outcomes. Email: Julia Spaniol, jspaniol@psych.ryerson.ca

(3043)

Reward Motivation and Memory. ALLISON STEEN, MEAGAN LUTTRELL and SHARON MUTTER, *Western Kentucky University*—There is a long history of research on reward motivation and learning, but relatively little is known about how motivational variables affect memory. To explore this issue, we presented high or low value reward cues prior to each word pair in a study list and examined how this manipulation affected subsequent item recognition (i.e.,



cued recognition and context recognition) and associative recognition (i.e., pair recognition and associative recognition). Preserved semantic context led to better item recognition performance, but reward value had no effect on either cued or context recognition. Associative recognition was poorer than pair recognition and reward value had a large effect on both of these tests. These findings suggest that reward motivation plays a more important role in the cognitive control processes responsible for item – item binding than in those responsible for context – item binding.

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(3044)

Context Reinstatement in Face Recognition: Metacognitive and Memory Effects. MACIEJ HANCZAKOWSKI, *Cardiff University*, KATARZYNA ZAWADZKA, *University of Southampton*, LAURA COOTE, *Cardiff University* (Sponsored by Dylan Jones)—Presenting familiar contexts in recognition tests leads to a misattribution of context familiarity, increasing both hits and false alarms, but not affecting recognition accuracy. Reinstating the exact study context for a particular target may sometimes aid recollection of an item-context association, selectively increasing hits and thus affecting recognition accuracy. In the present study we investigated these two context effects by examining confidence judgments and ‘don’t know’ responding in 2AFC recognition tests for faces. In three experiments presenting familiar (vs. novel) contexts at test led to higher confidence judgments in forced-report recognition and lower rates of ‘don’t know’ responses in free-report recognition, while having no effect on forced-report recognition accuracy. Presenting reinstated (vs. familiar) contexts further boosted confidence and reduced ‘don’t know’ responding, while affecting forced-report recognition accuracy only under specific testing conditions. Together, our results demonstrate that metacognitive measures can be more sensitive to context effects than memory measures.

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(3045)

The Role of Fluency in the Compound Word Effect in Associative Recognition. FAHAD N. AHMAD and WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—Ahmad and Hockley (2013) found in yes-no associative recognition, hits and false alarm rates were greater for compound word pairs (CW; store keeper) compared to non-compound word pairs (NCW; needle birth) with no difference in discrimination. We examined if fluency contributed to this effect. In Experiment 1, repeated NCW pairs were also presented at study. Repeated NCW pairs showed a discrimination advantage with a higher hit rate and lower false alarm rate compared to CW pairs. In Experiment 2, the CW effect was still present when perceptual fluency was eliminated by presenting items one at a time. In Experiment 3, degree of conceptual fluency was examined by comparing Transparent (e.g., hand bag) and Opaque (e.g., rag time) CW pairs. Discrimination and the CW effect were similar for both CW pair types. Familiarity based on unitization of CW pairs, rather than fluency of processing, is responsible for the concordant CW effect.

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(3046)

The Influence of Object-Context Conceptual Association During Encoding on Recognition Memory Processes and Corresponding ERP Correlates. YANN ETIENNE and FABRICE GUILLAUME, *Aix-Marseille University; CNRS* (Sponsored by Johannes Ziegler)—The present study investigated the effect of an encoding manipulation on the recognition processes (familiarity and recollection) and their electrophysiological correlates (the FN400 and LPC components, respectively) using a recognition task. During the study phase, participants had to categorize objects in scene as natural or man-made. The conceptual association between the objects and their surrounding context could be either congruent or incongruent (e.g., a broom in a kitchen vs. a tiger in a street). During recognition phase, old objects were presented without their encoding context, and we analyzed the encoding effect on the recognition processes as measured by the Dual-Process Signal-Detection model (DPSD) and ERPs. We found that object-context conceptual congruity had an effect on both the familiarity estimate and on the FN400, as well as on the LPC. These results are of particular relevance to the current debate about the functional nature of familiarity and its electrophysiological correlate.

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(3047)

Reliability of Criterion Shifting in Recognition Memory is Task Dependent. BRYAN A. FRANKS and JASON L. HICKS, *Louisiana State University*—We explored two research questions: whether criterion shifts in two different recognition tasks are related and whether the amount a person is willing to shift their decision criterion within a test reflects a stable cognitive trait. We manipulated either the probability (high or low) or memory strength of target test items. Change in false alarms was the measure of criterion shifting. Varying the probability of target items consistently produced criterion shifts, but manipulating target memory strength was less successful. Shifting via the probability manipulation on one day predicted shifting on a second day; less so for the strength-based manipulation. Additionally, one’s willingness to shift a decision criterion on one type of test did not predict willingness to do so on the other. Our results indicate that the extent to which a person will shift their decision criterion in recognition memory testing is largely dependent on the type of test.

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(3048)

Examining Output Interference in Memory for Factual Information. WILLIAM R. AUE, MELISSA A. PRINCE and AMY H. CRISS, *Syracuse University*—The positive benefits of testing on memory are well established and have been shown to generalize to a variety of testing scenarios both in the lab and in applied settings. However, negative aspects of testing have been highlighted by observations of output interference (OI). OI is the observation that memory accuracy decreases over the course of episodic memory testing. What is unclear, however, is whether the OI effect is also observed for tests of other types of information. In the current study we examined

whether tests of factual information also demonstrate OI effects. To accomplish this we systematically manipulated the order of questions on exams and measured performance across the exam. If OI generalizes to memory for factual information, performance will be worse for a question administered at the end of a test compared to the same question administered at the beginning of the test. Results will be discussed in the context of theories about memory.

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(3049)

An Exemplar-Based Sequential Sampling Model of Choice and Response Time in Memory and Reasoning. GUY E. HAWKINS and BRETT K. HAYES, *University of New South Wales*, EVAN HEIT, *University of California, Merced*—Recent research suggests memory and reasoning may be closely related. We examined the time course of recognition and inductive reasoning in a common experimental paradigm. A common stimulus list was used for study (recognition) or training (induction). A common test list containing items that varied in similarity to studied items was then presented for identification (recognition) or generalization (induction). Two experiments found task differences in patterns of positive responding to some stimulus classes but similar trends in response latency. We developed an exemplar-based sequential sampling model of recognition and induction that assumes total similarity to study stimuli drives judgments on both tasks. The model provides a good account of choice and response time data, suggesting memory and reasoning can arise from a single cognitive process where recognition has a steeper generalization gradient to novel stimuli relative to induction.

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(3050)

Two Dimensions in Recognition Memory: A State-Trace Analysis. CHRISTOPH STAHL and ROSCOE F.J.W. ARAUJO, *University of Cologne*—Theories of recognition memory postulate two separate processes or dimensions (e.g., recollection and familiarity) that inform old/new recognition decisions. For instance, Fuzzy Trace Theory (FTT) distinguishes similarity judgments based on gist from identity judgments based on verbatim memory. However, empirical findings tend to support one-dimensional accounts (e.g., Dunn, 2008; Pratte & Rouder, 2012). Here, we used a reversed-association/state-trace approach to test whether one-dimensional models can account for the outcome space generated by manipulations derived from FTT. We tested whether a monotonic relation exists between hits and false alarms to related lures across conditions. If monotonicity is violated, the data cannot be explained by a single underlying dimension. Using various stimuli (category and DRM word lists; pictures of objects and scenes), we demonstrate consistent violations of monotonicity. These findings provide considerable support for a two-dimensional nature of recognition memory. Implications for models of recognition memory are discussed.

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(3051)

Response Dynamics as a Measure of Bias and Strength in Recognition Memory. GREGORY J. KOOP and AMY H. CRISS, *Syracuse University*—The mechanisms that models of memory use to produce behavioral phenomena are designed to be psychologically plausible, but too often reliance on accuracy data alone makes it difficult to measure these processes. Over several studies, we show that continuous mouse tracking, or response dynamics, can augment our analytic repertoire in a way that speaks to the recognition process as it unfolds. We manipulated encoding strength alone in single-item and 2AFC recognition tasks, and then jointly manipulated encoding strength and the frequency of targets at test in a single-item task. We found that response dynamics showed substantial bias effects early in the recognition process, which was enhanced in strong encoding conditions. Finally, we apply our findings to the current debate surrounding the strength-based mirror effect, and show that the data are more in accordance with a differentiation account than a criterion-shift account.

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• COLLABORATIVE MEMORY •

(3052)

Effects of Collaborative Encoding and Delayed Testing on False Recognition. REBECCA B. BAYS, *Skidmore College*—We investigated collaborative encoding and delayed testing effects on false recognition using a modified Deese-Roediger-McDermott (DRM; Deese, 1959; Roediger & McDermott, 1995) paradigm. For collaborating pairs, participants received DRM lists presented in subsets (e.g., table, couch, desk, lamp followed by pillow, stool, bench, rocker). Pair members took turns generating scene descriptions cued by the subset items and generating images based on descriptions. For the solo condition, participants generated scene descriptions on their own. All participants completed a memory test immediately and following a 48-hour delay. Analyses revealed higher false recognition (e.g., indication of the lure chair during encoding) for collaborating pairs, and increased false recognition following a delay. Further analyses explore the content of scene descriptions as well as pair members' source attributions (self vs. partner) for related lures. Results support the Activation/Monitoring models of memory including the Source Monitoring Framework.

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(3053)

Collaborative Retrieval Enhances Organizational and Item-specific Processing. KATHRYN T. WISSMAN and KATHERINE A. RAWSON, *Kent State University*—Individuals recall less information when retrieval practice occurs in a group versus alone, a phenomenon referred to as collaborative inhibition. However, post-collaborative recall is greater for individuals who previously engaged in group retrieval practice. The current research explored a potential explanation for why collaborative retrieval increases



subsequent individual retrieval. Specifically, we evaluated the extent to which facilitative effects of collaborative retrieval result from enhanced organizational and/or item-specific processing. Learners studied categorical word lists and then engaged in two recall trials, either in a group or alone. All learners completed an individual final free recall test. Final recall was significantly greater for learners who engaged in group retrieval practice versus individual retrieval practice. Importantly, learners who engaged in collaborative retrieval also showed enhanced organizational and item-specific processing. Results suggest that group retrieval practice increases organizational and item-specific processing and contributes to post-collaborative recall advantages.

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(3054)

The Joint Influence of Collaboration and Part-Set Cuing. MATTHEW R. KELLEY and CARLIANN PENTZ, *Lake Forest College*, MATTHEW REYSEN, *University of Mississippi*, SARAH HARDY and THOMAS ESTRUTH, *Lake Forest College*—The Retrieval Strategy Disruption Hypothesis (e.g., Basden & Basden, 1995) has been offered to explain both collaborative inhibition and part-set cuing inhibition. Although studies have shown that one can mimic the effects of collaboration with a part-set cuing paradigm (e.g., Andersson, Hitch, & Meudell, 2006), these phenomena have rarely been studied in the same experimental setting. To this end, the present study was designed to explore the joint influence of collaboration and part-set cuing. Across three experiments, we found evidence that these phenomena operate independently of one another and they appear to disrupt (or even facilitate) different processes.

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(3055)

Social Transmission of Memory: An Agent-Based Modeling Investigation. CHRISTIAN C. LUHMANN and SUPARNA RAJARAM, *Stony Brook University*—Past research has uncovered evidence of social influences on a wide variety of behaviors. Everything from our choice of clothing to smoking appears to be shaped by the people we know. However, little is known about the mechanisms that underlie these influences. Here, we report a series of agent-based simulations investigating social transmission of information as a fundamental mechanism underlying these potent influences on our behavior. Specifically, we investigate how information is represented by individuals interacting within small groups and in larger social networks. Our findings suggest that many previously observed social influences on behavior likely rely on a substrate of information transmission and representation.

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(3056)

A Computer-Based Collaborative Recall Protocol for fMRI. HELENA M. BLUMEN and XIAOBO LI, *Albert Einstein College of Medicine*, YAAKOV STERN, *Columbia University*—Collaborating with others during recall reduces individual contributions during group recall, but also increases later individual recall. This fMRI study examined the neural systems

that operate during collaboration with a novel computer-based collaborative recall protocol. This protocol utilized perceived rather actual group recall to permit recall and collaboration in the scanner, and clustered image acquisition to reduce motion artifacts associated with speech production. Participants studied a list of words and then recalled these words alone and/or in collaboration with a computer program. This study is the first to examine the neural systems that operate during collaboration. Initial results suggest that brain regions previously linked to social processing of information are activated to a greater extent during perceived group recall than during individual recall. This fMRI protocol also has the potential to benefit fMRI studies of individual memory that tend to focus on recognition rather than recall to avoid motion artifacts.

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(3057)

Collaboration Eliminates the Positivity Effect in Older Adults' Recall. SARAH J. BARBER and MARA MATHER, *University of Southern California*—In general, younger adults preferentially remember negative information whereas older adults preferentially remember positive information. This is known as the positivity effect. In this study we tested the hypothesis that collaboration attenuates the positivity effect. According to the selection, optimization, and compensation with emotion regulation (SOC-ER) framework, older adults compensate for age-related cognitive declines by using their preserved social networks to accomplish emotion regulation goals. Because of this, we predicted that older adults would preferentially remember negative information in collaborative settings in order to regulate their negative emotions associated with those memories. Results were consistent with this. Although we observed a positivity effect when people recalled information alone, this effect was numerically reversed in collaborative groups. Furthermore, collaborating groups of older adults were more likely than groups of younger adults to discuss their personal emotional reactions, particularly about the negative information.

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• METAMEMORY/METACOGNITION II •

(3058)

The Influence of Feedback on Predictions of Future Memory Performance. DANIELLE M. SITZMAN and MATTHEW G. RHODES, *Colorado State University*—Although feedback is beneficial for memory, people do not appear to appreciate the memorial benefits of feedback (Kornell & Rhodes, 2013). We sought to replicate and further explore this finding. Participants in the current experiments studied Lithuanian-English word pairs and took an initial test with feedback on accuracy provided for some items and withheld on others. Following this, participants predicted the likelihood of later recalling a studied item. Consistent with Kornell and Rhodes' findings, participants' predictions accurately differentiated between items they would or would not remember on a

later test when feedback was withheld but predictions were considerably less accurate when feedback was provided. In follow-up experiments, we attempted to remedy this metacognitive deficit by activating theories of feedback, providing practice with feedback, and scaffolding feedback on the initial test. Collectively, our findings indicate that some methods may increase the accuracy of memory monitoring following feedback.

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(3059)

Efficacy of Metacognitive Decisions about Practice Tests: Spacing and Feedback. MATTHEW J. PAGANO and THOMAS C. TOPPINO, *Villanova University*—When learners can choose the spacing between an item's initial study presentation and a subsequent practice test, their choices depend on perceived item difficulty. Hard items are chosen to be tested sooner. A delayed test is chosen more for items that are perceived to be easier. The present research asked whether these metacognitive decisions are efficacious. Learners studied word pairs twice for a later cued recall test. The second presentation was always a practice test, with feedback conditions varied between groups. After an item's initial study opportunity, learners made a JOL and decided whether to take the practice test sooner, later, or not at all (no further exposure to that item). Usually choices were honored, but they were dishonored on a small proportion of trials. To the extent that learners' choices reflect accurate metacognitive knowledge, recall should be facilitated when choices are honored and impaired when they are dishonored.

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(3060)

Theory-Based Allocation of Study Time. BENJAMIN D. ENGLAND and MICHAEL J. SERRA, *Texas Tech University* (Sponsored by Phil Marshall)—Efficient allocation of study time is important for student learning and test performance. The discrepancy-reduction model proposes that students focus on studying information with the largest discrepancy between current and goal knowledge (i.e., the most-difficult items), whereas the region of proximal-learning model proposes that students focus on studying information that will most benefit from the available study time (e.g., moderate-difficulty items when time is limited). The present research examined students' theory-based (i.e., hypothetical) allocation of study time. Across multiple experiments, participants responded to vignettes in which we manipulated multiple factors of the study situation (e.g., learning goal, amount of study time, prior knowledge) and participants indicated how they would allocate study time to different sets of information under those conditions. Although learners' theory-based study-time allocation reflected changes in such factors, the results favored discrepancy-reduction over region of proximal-learning for such judgments, even as study time became more constrained.

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(3061)

Enough is Enough: Metacognitive Decisions to Continue or Halt Study. KOU MURAYAMA, ADAM B. BLAKE and ALAN D. CASTEL, *University of California, Los Angeles*—We are often exposed to more information than we can actually remember. The current study examined whether people can effectively monitor memory capacity and interference, and control the amount of information that they should study. We developed a novel task in which participants could decide how much information to study, in order to maximize their recall. In Experiment 1, participants could study up to 30 words, but were permitted to stop the study session at any point, and proceed to the recall session (the "stop" condition). A control group studied all 30 words, without the option to stop. More than half of participants in the stop condition chose to terminate the study session prior to the presentation of all of the words. However, recall performance did not differ between the stop and control conditions, indicating that participants in the stop condition achieved the same recall performance with fewer study events. In Experiment 2, a similar set of findings were obtained when participants were given monetary incentives for higher recall performance. The results suggest that people can effectively monitor and control how much information they choose to study, in order to maximize recall performance.

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(3062)

Using Fluency as a Metacognitive Cue: Subjective Experience or Explicit Belief? DEBBIE A. MAGREEHAN and MICHAEL J. SERRA, *Texas Tech University*—Judgments of learning (JOLs) are metacognitive assessments of how likely one will be to recall recently studied materials on an upcoming memory test. To improve the accuracy of JOLs, we need to understand how people make these judgments. The cue-utilization approach assumes that people make JOLs based on learned relationships between cues in the environment and memory. Although this account can explain people's effective cue-utilization, it struggles to explain why people often use non-predictive cues to make JOLs. Thus, we focused on how people use the non-predictive cue of perceptual fluency to inform JOLs. Across experiments, we manipulated perceptual fluency either within or between participants (as well as the presence or absence of other cues) to assess its use as a cue. The results indicate that people use an explicit belief about fluency to inform their JOLs rather than the subjective experience of fluency as assumed by the cue-utilization approach.

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(3063)

Metacognition of Emotion Recognition in Children. KAREN J. KELLY and JANET METCALFE, *Columbia University*—Metacognition of emotion recognition has been studied in adults using static and dynamic stimuli and the findings suggest that adults do have metacognition in this area – they are able to distinguish between emotional stimuli they will be able to identify from those that they will not. No research on metacognition of emotion recognition has been done with children. Most metacognitive research with children



has focused on learning, studying, and comprehension and while most findings indicate that both 3rd and 5th graders possess metacognitive abilities in these areas, some findings suggest there might be a developmental difference between the two groups. The current research explores whether or not 3rd and 5th graders are able to make metacognitive assessments about their emotion recognition ability. In seeking to answer this question, a unique set of stimuli was created using cartoon images from popular children's movies. While both grades possess metacognitive ability on this task, 3rd grade performance is worse than 5th graders who do not differ from college students. These results will be discussed within the context of the development of social fluency.

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(3064)

Effects of Prior Knowledge on Memory and Metamemory for Names and Faces. JEFFREY P. TOTH, LEANNE M. LASECKI, CAITLIN A. NORTHCUTT and KAREN A. DANIELS, *University of North Carolina at Wilmington*—How does prior knowledge influence memory and metamemory for names and faces? To examine this question, we had young adults study the names or faces of actors who were famous in the 1960s or 2000s, giving an immediate JOL to each. Half of the names (faces) in each decade were accompanied by the corresponding face (name), while the other half were presented in isolation. Recognition memory for the names or faces was then assessed with a Recollect/Familiar/No-Memory judgment. Replicating prior research (Toth, Daniels, & Solinger, 2011), we found higher JOLs, higher recollection, and higher JOL accuracy for the 2000s compared to 1960s names and faces, indicating a positive effect of prior knowledge on memory and metamemory for both names and faces. Adding names to the faces, or faces to the names, of the 2000s actors had minimal effects on memory and metamemory. In contrast, adding names to the faces, or faces to the names, of the lesser-known (1960s) actors increased JOLs and JOL accuracy but paradoxically reduced memory. Results are discussed in terms of the role of recollection in mediating JOL accuracy.

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(3065)

Metamemory for Emotional Pictures. KATHLEEN L. HOURIHAN and ELLIOTT BURSEY, *Memorial University of Newfoundland*—Positive emotional information is typically remembered better than neutral information. When predicting future memory performance via judgments of learning (JOLs), individuals are sensitive to intrinsic item qualities. The current study examined how the emotionality of pictures guides JOLs, recognition, and recognition confidence. Subjects studied a mixed list of positive and neutral pictures, and made immediate JOLs. Confidence judgments were made in an old/new recognition test that followed. In Experiment 1, subjects gave higher JOLs for positive pictures than for neutral pictures, but recognition performance showed the opposite result: Neutral pictures were more discriminable than positive pictures. Experiment 2 replicated the procedure with a new set of positive and neutral pictures. Results are discussed in terms

of the relative contributions of emotionality and perceptual distinctiveness to metamnemonic judgments and recognition memory performance.

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(3066)

Non-probative Photos Affect People's Immediate Judgments About Their Recent Actions. BRITTANY A. CARDWELL, *Victoria University of Wellington*, ERYN J. NEWMAN, *University of California, Irvine*, JEFFREY L. FOSTER, *Georgia Institute of Technology*, LINDA A. HENKEL, *Fairfield University*, MARYANNE GARRY, *Victoria University of Wellington*—How do non-probative photos affect people's immediate judgments about their recent actions? To answer this question, people played a computer game where they pressed keys to give food to and take food from several unfamiliar animals. Then people saw the animal names again; for each animal, some people judged the truth of the claim that they gave food to the animal, others that they took food from the animal. During this test, half the animal names appeared with a photo of the animal. Photos led people to say they gave food to animals, even when they did not. In another experiment, we found that this bias persisted for more complex actions. Other experiments support the idea that one way photos might exert these effects is by helping people rapidly bring to mind thoughts and images related to actions—mental products people tend to mistake as evidence of genuine experience.

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(3067)

Report Bias in the Course of Memory Testing: Rigid or Malleable? KATARZYNA ZAWADZKA and PHILIP A. HIGHAM, *University of Southampton*—Response bias on old/new recognition memory tests has been extensively examined with the use of type-1 signal detection theory (SDT). This research has shown that when memory strength is manipulated, response criterion placement is relatively stable during the test and it remains static even after a change in test conditions. However, less is known about criterion placement in recognition tasks involving type-2 SDT. To this end we examined the effects of memory strength on reporting (versus withholding) answers on recognition tests. Participants were given two multiple-choice recognition tests on which the strength of the tested targets was either consistent or inconsistent. Although the pattern of results concerning criterion placement was similar to the one found in type-1 tasks, we posit that it was caused by different mechanisms. We present a model suggesting that a concordant distribution and criterion shift after test 1 is responsible for our results.

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(3068)

Failing to Retrieve Practice Items reduces Overconfidence in Metacognition. TYLER M. MILLER, *South Dakota State University*, LISA GERACI, *Texas A&M University*—People often predict that they will remember more information on a future memory test than they actually do. The current experiments examined whether providing participants with

practice items would improve their metacognitive accuracy. We used a novel paradigm in which participants studied a list of paired-associates for a later memory test, made a performance prediction, attempted to retrieve one or more practice items, and made a second performance prediction. Experiment 1 showed that participants who failed to retrieve a practice item improved their metacognitive accuracy – they became less overconfident in their subsequent prediction. Experiment 2 showed that participants who practiced retrieving a difficult item improved their metacognitive accuracy whereas those who practiced retrieving an easy item did not. In Experiment 3, participants practiced retrieving four easy, medium, or difficult items or none. The results revealed a significant interaction such that the medium difficulty retrieval practice was most beneficial for monitoring accuracy.
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(3069)

The Making of a Jeopardy Champion: The Value of Metacognitive Judgments at the Category Level. RUTHANN C. THOMAS, *Hendrix College*, BRIDGID FINN, *Educational Testing Service*, LARRY JACOBY, *Washington University in St. Louis*—Most metacognition research has focused on aggregate judgments of overall performance or item level judgments about performance on particular questions. However, metacognitive judgments at the category level may determine what topics students choose to study for an exam or what topics contestants choose on quiz shows, such as Jeopardy. We investigated whether category-learning judgments (CLJs) were sensitive to differences in the difficulty of general knowledge categories. After either studying or being tested on facts from several categories (e.g., Shakespeare, Astronomy), participants estimated the likelihood that they could correctly answer new questions from those categories on a later test (i.e., they made CLJs). Results showed that CLJs were sensitive to differences in category difficulty. Further, participants with prior test experience on a subset of questions predicted poorer performance on new questions from the same categories compared to participants with prior study experience. The lower CLJs in the prior test group diminished overconfidence to improve the absolute accuracy of CLJs for each category. Results highlight the value and relevance of CLJs both in educational settings and in theories of metacognition.
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(3070)

Under Pressure: Are We Metacognitively Aware of the Effects of Pressure on Our Performance? ANDREW S. ROBERTS, MATTHEW DAVIS, ANA M. FRANCO-WATKINS and AIMEE A. CALLENDER, *Auburn University*, JOSEPH G. JOHNSON, *Miami University*—Pressure affects people in a variety of everyday situations; however, it is unclear if people are metacognitively aware of its effects. The current study investigated whether time pressure adversely affects performance on a novel decision making task and subsequent metacognitive judgments. Participants were trained-to-criterion on a decision making task and then tested twice: under a severe time pressure (less than 1s to respond) and with no pressure. Participants made metacognitive

judgments concerning their performance before and after each test for both pressure conditions. Additionally, working memory was assessed to determine if individuals differentially vary in awareness of their performance. Results indicated that time pressure adversely affected all participants' performance and performance did not differ based on working memory. However, metacognitive judgments were affected by working memory ability, pressure condition, and the order in which the pressure conditions occurred. Implications for the impact of a stressor on metacognition are discussed.
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(3071)

A Metacognitive Model of Teaching. KEITH THIEDE, JONATHAN BRENDEFUR, MICHELE CARNEY, RICHARD OSGUTHORPE, JENNIFER SNOW, AMANDA BREMNER, STEVEN OSWALT and SUSAN WOODARD, *Boise State University*—We used a procedure commonly used in metacognitive research to assess the accuracy of teachers' predictions of student learning. On a reliable test of mathematics knowledge, monitoring accuracy was greater for teachers who put their students in more problem solving situations, asked deeper more conceptually based questions, and addressed student misconceptions through classroom conversations and questioning than for teachers who did not. Consistent with prediction derived from a metacognitive model of teaching, differences in prediction accuracy were associated with differences in student achievement. That is, performance on a standardized test of mathematics achievement was greater for students whose teachers more accurately predicted student learning than for students whose teachers less accurately predicted student learning.
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(3072)

Generation Instructions to Improve Monitoring Accuracy and Self-Regulation: Evidence From the Classroom. ANIQUE B. DE BRUIN and MARIETTE VAN LOON, *Maastricht University*, TAMARA VAN GOG, *Erasmus University Rotterdam*, JEROEN J. VAN MERRIENBOER, *Maastricht University*—Learners are typically poor at monitoring and regulating their understanding of text-based materials. Research has shown that this can be improved when learners generate valid cues at a delay after study (e.g., keywords or summaries; Thiede et al., 2003). We extended this research to adolescents and elementary school children, to test the generation hypothesis and develop instructions to improve metacognitive skills in young learners. First, we found that generating sentences improved self-regulation compared to delaying JOLs only when 4th and 6th graders studied idioms. JOL reaction times suggest that learners used different cues after sentence generation than after delayed JOLs. Moreover, 9th graders more accurately monitored learning after generating sentences than after delayed JOLs. By contrast, a reflection prompt had a negative effect on the number of commission errors (i.e., completely incorrect answers). Finally, we show that generating diagrams at a delay after text study led to more accurate monitoring than no or immediate diagram generation in 9th grade students. We will



discuss explanations for the effect of generation instructions and when and why these might be preferable over often-used reflection prompts.

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(3073)

Differentiating Between Metacognition and Meta-metacognition: Exploring Penalty Size and Type of Confidence in the Strategic Regulation of Accuracy. MICHELLE M. ARNOLD and LISA M. CHISHOLM, *Flinders University* (Sponsored by Steve Janssen)—In two experiments general-knowledge tests were modified so that participants had to strategically regulate their accuracy (i.e., report/withhold) and complete separate confidence ratings for their answers versus their decisions. One goal was to examine the impact of penalty size on both strategic regulation and the confidence ratings; in Experiment 1 the standard correction-for-guessing penalty was used, whereas in Experiment 2 the size of the penalty varied within-subjects (i.e., large vs. small penalty for reporting incorrect responses). A second goal was to explore if self-reported confidence ratings differed depending on whether they were directed at answer accuracy (metacognition) versus at decisions about that answer (meta-metacognition). Overall, results showed that there was a significant difference between the two confidence measures, and the pattern of this difference depended on whether responses had been reported or withheld. Further, the size of the penalty impacted both metacognitive monitoring (i.e., type-2 discrimination and bias) and meta-metacognition. Email: Michelle Arnold, michelle.arnold@flinders.edu.au

(3074)

Requiring Metamemory Judgments Changes Behavior. B. HUNTER BALL and GENE A. BREWER, *Arizona State University*—Although considerable research has investigated the metamemory processes that underlie judgments of learning (JOLs) and the types of cues that feed into these judgments, relatively little work has examined how making immediate JOLs affects subsequent memory performance. In the current study, participants passively learned words or actively rated their JOLs at encoding and were given either a recall (Experiment 1), cued-recall (Experiment 2), or recognition (Experiment 3) test at retrieval. Recall performance was enhanced for items that received JOLs when the encoding was from pure lists (i.e., all items received JOLs), but not from mixed lists (i.e., half the items received JOLs and half were passively learned). Alternatively, cued-recall and recognition performance was enhanced for items that received JOLs when encoding was from mixed lists, but not from pure lists. These findings suggest that making JOLs fundamentally alters the encoding and retrieval processes depending on learning conditions and the nature of the subsequent memory test.

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• MEMORY AND AGING •

(3075)

Aging and Event Segmentation: An fMRI Investigation of Individual Differences in Event Perception and Memory. CHRISTOPHER A. KURBY, *Grand Valley State University*, JEFFREY M. ZACKS, *Washington University*, JESSE Q. SARGENT, *Francis Marion University*, HEATHER R. BAILEY, *Washington University*—People spontaneously segment activities into discrete events, and such segmentation is associated with an increase in activity in a collection of brain regions including posterior cortex and lateral frontal cortex. Some individuals segment more normatively than others, and those people also remember more about the activity afterwards. The current study investigated whether individual differences in segmentation and event memory are related to individual differences in brain response to event boundaries, and age-differences in such relations. Consistent with previous research, older adults performed worse on behavioral measures of segmentation and memory than younger adults. Also consistent with previous research, regions in posterior cortex and lateral prefrontal cortex increased in activity around event boundaries. These brain responses did not differ with age, and the behavioral measures were unrelated to the evoked brain responses. Analyses assessing inter-subject agreement in brain response across time revealed an association with segmentation ability. These results suggest that much of the neural response correlated with event boundaries is robust to individual differences and age-related change. Email: Christopher Kurby, kurbyc@gvsu.edu

(3076)

Use of Life-Script Information in Episodic Future Thought Across Adulthood. LISA EMERY and HEATHER BURKETT, *Appalachian State University*—Previous research suggests that older adults have more difficulty imagining single episodic future events than do young adults, a phenomenon that has been attributed to age-related episodic memory deficits. The current study investigated whether differential use of cultural life-script information also contributes to age differences in future event construction. Young (ages 20-30), middle-aged (ages 40-50), and older adults (ages 60-70) were asked to describe two types of future events: events that could occur within the next 5 years and events that might occur in their old age. Young and middle-aged adults were more likely than older adults to use life-script information in constructing future narratives. This effect was found for both types of future events, suggesting that it is not merely a reflection of the greater number of life-script events in earlier adulthood. The life-script effect appears to be separate, however, from episodic specificity, which declined linearly with age. Email: Lisa Emery, emerylj@appstate.edu

(3077)

Spacing and Retrieval Practice Differentially Influence Accuracy and Retrieval Response Latency in both Young and Older Adults. GEOFFREY B. MADDOX and DAVID A. BALOTA, *Washington University in St. Louis*—The present study examines the benefit of continued retrieval practice (i.e.,

1 vs. 3 vs. 5 retrieval attempts) for paired associates on a final cued recall test as a function of the spacing interval separating study and retrieval events, retention interval, and age. Analyses from two experiments emphasize performance on the final test for items that were successfully retrieved during the acquisition phase (i.e., retention) and reveal similar functions across age groups relating continued retrieval practice and lag to final test performance. Importantly, results revealed increasing final test performance with increased testing in the short lag condition but an increasingly smaller benefit in the long lag condition. Moreover, results revealed a dissociation between accuracy and response latency suggesting that lag is more related to accuracy, whereas retrieval practice is more related to response latency.

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(3078)

Episodic Specificity and Aging: Dissociable Effects of an Induction on Remembering, Imagining, and Describing.

KEVIN P. MADORE, BRENDAN GAESSER and DANIEL L. SCHACTER, *Harvard University*—We examined the impact of an episodic specificity induction on memory, imagination, and picture description in young and older adults. In Experiment 1, participants completed two sessions in which they received the specificity induction or a control induction prior to the memory, imagination, and description tasks. Older adults provided fewer internal details (i.e., episodic, on topic) and more external details (i.e., semantic, off topic) than young adults across the three tasks irrespective of induction. However, the specificity induction selectively increased internal details for memory and imagination in both age groups compared to the control induction. Internal details for picture description were unaffected by the induction manipulation, as were external details across the three tasks. Experiment 2 replicated these results in another two-session study where young adults received the specificity induction or a different control induction lacking an episodic retrieval component. Our findings point to a dissociation between episodic processes involved in memory and imagination and non-episodic processes involved in picture description, and thus support the constructive episodic simulation hypothesis (Schacter & Addis, 2007).

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(3079)

Word Frequency Does Not Influence Age-Related Associative Deficits, But Gender Does.

STEPHEN P. BADHAM and ELIZABETH A. MAYLOR, *University of Warwick*—Older adults show particular difficulty in forming associations between words compared to remembering the individual words (age-related associative deficit hypothesis). The frequency of words in language influences their memorability. Higher frequency words may be less memorable individually but easier to associate because they occur in more contexts and therefore have broader (more associable) memory representations. To examine whether this could alleviate age-related associative deficits, young and older adults studied pairs of high and low frequency words followed by recognition tests for both the individual words

and their associations. Age-related associative deficits were found, but only for males, and they were unaffected by word frequency such that individual-word memory was better for low frequency words and associative memory better for high frequency words in both age groups.

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(3080)

It's About Time: The Role of Time Perspective in Memory Positivity.

SHAINA GARRISON, ANNA B. DRUMMEY, LEE LAND L. ROGERS and IRENE P. KAN, *Villanova University*—A well-replicated finding in the aging literature is a positivity effect in memory (i.e., better memory for positive than negative and neutral information). This pattern is often explained in terms of the Socioemotional Selectivity Theory (SST, Carstensen, 1993), which posits that the positivity effect reflects our increasing motivation to maintain emotional well-being as we age. This motivational change results from a shift in time horizon and time perspective. Indeed, as time horizon shifts from expansive to limited, we become more present-oriented and more focused on emotionally positive information. We tested this critical assumption and hypothesized that time perspective should impact the positivity effect. We examined the effect of time perspective on picture memory in a group of healthy adults (age 45 to 85). Consistent with the SST, we found a positivity effect in present-oriented subjects but not in future-oriented subjects (as measured by the Future Time Perspective Scale).

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(3081)

Age Differences in Recognizing Affective Stimuli: A Meta-Analysis.

SCOTT H. FRAUNDORF, *University of Illinois at Urbana-Champaign*, KATHLEEN L. HOURIHAN, *Memorial University*, AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—It has been proposed that older adults preferentially recognize stimuli that have positive emotional valence. However, it has been argued that this apparent benefit may reflect nothing more than older adults' bias to affirm positive items as recognized regardless of mnemonic status. As part of a large meta-analysis of the effects of aging on recognition, we evaluated 33 experiments that reported young and older adults' hits and false alarms to stimuli that varied in affective valence. Taken together, the literature reveals that the age-related deficit in memory sensitivity is indeed smaller for affective stimuli, but that it was smallest for negative rather than positive stimuli (mean age deficit in d' : 0.39 for neutral stimuli, 0.56 for negative, 0.50 for positive). However, older adults did exhibit a more liberal criterion for reporting positive than other stimuli as having been studied (mean age difference in c : -0.01 for neutral, <0.01 for negative, -0.06 for positive). These results suggest that age groups differ in sensitivity in recognition memory for affective stimuli, but that apparent advantages in memory for positively valenced stimuli also reflects differences between the groups in criterion policy.

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(3082)

The Activation of Stereotype Threat in Aging Reduced Metamemory Self-Efficacy and Episodic Memory Performance. BADIAA BOUAZZAOU, *University of Tours*, ALICE FOLLENFANT and FRANÇOIS RIC, *University of Bordeaux*, SEVERINE FAY, *University of Tours*, JEAN CLAUDE CROIZET, *University of Poitiers*, MICHEL ISINGRINI and LAURENCE TACONNAT, *University of Tours*—Older people are vulnerable when they face memory testing and then may underperform in memory tasks. To explore the impact of stereotype threat in older episodic and metamemory performance, two groups of older participants were compared: a threaded group and a non- threaded group (control). First, both groups completed the Metamemory In Adulthood questionnaire (MIA) to evaluate their own memory functioning. Then, the “threaded group” was subliminally primed with a negative age stereotype. Finally, both groups were administered Logical Memory task and Memory Self-Efficacy questionnaire. To enhance stereotype threat, the memory component of the test was emphasized in the threaded group. Results indicate that the threaded group performed lower than the control group in memory task and reported to be less memory efficient. Moreover, their performance was explained by perceived capacity and change in memory functioning (MIA subscales) whereas in the control group the performance was explained by the use of internal strategy and perceived sense of control over memory (MIA subscales). This result confirm that the stereotype threat can affect older memory performance and self-belief in one’s own memory functioning.

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(3083)

How Do Age-related Cultural Schemas Affect Perspective Taking? CHRISTIE CHUNG, MONICA BOWER and DEVON THURMSTON, *Mills College*, SARAH BLACHER, *Whitman College*—Easterners often hold a more positive view of aging than Westerners (Levy & Langer, 1994; Chung & Lin, 2012). In the present study, we examined the effect of age-related cultural schemas on young adults’ memory. We extended a perspective taking paradigm designed by Sullivan, Mikels, and Carstensen (2010) by adding a cultural component to the methodology. Each young participant (18-30 years old) listened to two stories, one of a 25-year-old character and one of a 75-year-old character. Half of the participants were told that these stories happened in the US, the other half in Hong Kong. As hypothesized, young adults showed a negativity bias in recall of all stories. Participants, however, used more positive words to recall the story of the Hong Kong 75-year-old than the US 75-year-old character. These results suggest that age-related cultural schemas might influence the perspective one takes to encode and recall an event.

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(3084)

Conceptual Processing Facilitates Binding of Source Memory Components in Older Adults. ANDREA SMYTH, MOSHE NAVEH-BENJAMIN and LAURA HASTINGS,

University of Missouri—Recent work by Boywitt, Kuhlmann, & Meiser (2012) and Naveh-Benjamin and Martin (2013) extended the Associative Deficit Hypothesis of age differences in episodic memory from difficulty binding item-item or item-source relationships to also include age-related deficits when memory requires binding perceptual source memory components together. The present study investigated whether this binding deficit for source memory components in older adults is mitigated when one of the source memory features engages deep-level processing at study. Older and younger participants viewed unrelated word pairs and were asked to choose the word appearing in a given color (shallow-level perceptual processing) and the more pleasant word in the pair (deep-level conceptual processing). Results indicated that source memory recall was higher with deeper processing, and that levels of binding of source components were similar between older and younger adults. This suggests that deep-level processing can attenuate the associative deficit for source memory in older adults.

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(3085)

Memory Tests Increase Older Adults’ Subjective Age. MATTHEW L. HUGHES, LISA GERACI and ROSS L. DE FORREST, *Texas A&M University*—How old one feels, one’s subjective age, has been shown to predict important psychological and health outcomes. The current studies examined whether being in a memory testing context would affect older adults’ subjective age. Across four studies, we found that taking or expecting to take a memory test significantly increased older adults’ subjective age relative to baseline. This subjective aging effect was selective to older adults, as younger adults’ subjective age was not affected by participating in a memory experiment. The effect was also specific to memory, as taking a vocabulary test did not affect older adults’ subjective age. Finally, relative to baseline older adults reported feeling older following memory test instructions (without actual memory test experience). Taken together, the data suggest that being in a memory testing context subjectively aged older adults.

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(3086)

Effects of Feature-Based Retrospective Cues on Working Memory in Adult Aging. AMANDA L. GILCHRIST, AUDREY DUARTE, , PAUL VERHAEGHEN and RADHIKA SOLANKI, *Georgia Institute of Technology*—Emerging evidence suggests that the contents of working memory can be flexibly manipulated by top-down attention in young healthy adults. For example, prior research found that visual working memory performance benefits from presenting retrospective cues (‘retrocues’). This cue occurs after a visual array is presented, and indicates the item location that will be tested. We recently reported no retrocue benefit for working memory accuracy in older adults, whereas there was a benefit for young adults; however, this study used spatial retrocues. It is unclear whether similar results would occur if object features were cued instead. We presented young adults and

older adults with a change-detection task that used retrocues based on shape or color, which reduced effective working memory load. There was also a condition in which participants received an uninformative cue requiring them to maintain the entire array. Both age groups showed a performance benefit for trials with retrocues, as well as an increase in accuracy with declining memory load. Participants were also more accurate in responding to shape cues than color cues, suggesting that salience of features may differentially affect how items are represented in working memory.

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(3087)

Dynamic Control Adjustments in a Working Memory Task During Healthy Aging. ALEXANDRA B. MORRISON, SUZANNE C. PARKER and AMISHI P. JHA, *University of Miami*—Prior research shows that during completion of a working memory task younger adults perform better following high-demand trials than low-demand trials, and this suggests that younger adults can dynamically adjust cognitive control according to the trial's demand characteristics. We investigated moment-to-moment changes in performance in older ($n = 68$) and younger ($n = 56$) adults. Participants completed a delayed-recognition task that varied in mnemonic load (one or two items) and distractor type (confusable or not confusable with memoranda). When trials were divided by the demand characteristics of the previous trial, older and younger adults were more accurate following high load trials than low load trials. Yet, only younger adults were more accurate following confusable distractors trials than non-confusable distractors. Results suggest that dynamic adjustments according to load occur in all adults, but adjustments according to distractor type are more fragile and specific to younger adulthood.

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(3088)

Eye Movement Recordings Reveal Major Differences in the Way Young and Older Adults Memorize Sets of Words. LAURENCE TACONNAT, *University of Tours*, MICKAËL FRASCA and NICOLAS VIBERT, *University of Poitiers*—This experiment investigated the way young and older adults encode words in anticipation for a memory task. Age-related differences in the number and duration of fixations made on words were assessed for one organisable and one non-organisable set of 20 words. The words were dispersed over the eye-tracker screen and presented for 100 seconds to 20 young and 20 older participants. Young adults recalled more words than older adults, and words from the organisable set were better recalled. Older adults made fewer fixations on words than young adults. Aging did not significantly impact the fixation durations, but only the younger adults made longer fixations on non-organisable than on organisable words. Altogether, recall performance would depend on the number of times each word is fixated. Part of older adults' difficulties may simply arise from the fact that they do not actually fixate the words to learn as much as young adults.

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(3089)

Age Differences in Decisions From Memory. ANIKA K. JOSEF, RUI MATA, , THORSTEN PACHUR and RALPH HERTWIG, *Max Planck Institute for Human Development*—In many situations information is not conveniently presented to decision makers but rather needs to be retrieved from memory. Aging is associated with memory decline that may lead to decision making deficits in such situations. We present results of two studies investigating the role of memory demands in determining age differences in decision making. We compared young and older adults in two decision conditions varying in their memory demand, one in which information about decision alternatives was presented on the screen, and another in which participants had to recall information about the decision alternatives (after a prolonged learning phase in which participants were trained to criterion). The two studies suggest that age differences in decision performance are moderated by memory demands, with older adults showing poorer performance in decisions from memory. Computational modeling suggests that age deficits in both strategy selection and execution may underlie such performance differences.

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(3090)

Nonlinear Dynamics of Lifelong Learning: The Myth of Cognitive Decline. MICHAEL RAMSCAR, PETER HENDRIX, CYRUS SHAOUL and HARALD BAAYEN, *University of Tübingen*—As adults' age increases, their reaction times slow across a range of psychometric tests. This has been taken to show that cognitive information-processing capacities decline throughout adulthood. We suggest that these slower responses are not indicative of processing deficits, but instead reflect an escalating search problem as learning increases information in memory. A series of analyses and simulations show how age-related slowing emerges naturally in learning models, suggesting that the pattern of slowing observed in many (but, as we show, not all) tasks reflects statistical properties that typify much of human experience, and the increased information-processing load that a lifetime of learning from this experience inevitably brings. Once the cost of processing this information is controlled for, findings taken to indicate declines in cognitive capacity can be seen to support little more than the unsurprising idea that choosing between or recalling items becomes more difficult as their numbers increase.

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• PROSPECTIVE MEMORY •

(3091)

Exploring Individual Differences in Prospective Memory Output Monitoring. MARGARIDA PITAES, B. HUNTER BALL and GENE A. BREWER, *Arizona State University*—The current study examined individual differences in prospective memory output monitoring (OM) abilities in a group of young-adults differing in working memory, episodic memory,



and attention control abilities. OM refers to one's memory for previously completed prospective memory target actions, and this ability is a source of repetition and omission errors. To be successful in OM paradigms, one must maintain an attention allocation strategy and also engage in controlled retrieval of past target actions whenever a cue is encountered. The results revealed that successful OM was significantly correlated with both working memory capacity and episodic memory abilities. Moreover, regression analyses showed that episodic memory abilities were a significant predictor of successful OM when controlling for working memory capacity and attention control. The current study highlights the importance of examining external correlates of OM abilities and contributes to the growing body of research on individual differences in prospective memory.

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(3092)

Prospective Memory Error Type of Adults With and Without ADHD. DANIELLA KARIDI and STEVEN G. ZECKER, *Northwestern University*, PETER G. RENDELL, *Australian Catholic University*—From a clinical perspective understanding the pattern of Prospective Memory (PM) errors made by adults with ADHD may provide important information for possible interventions addressing PM difficulties. The current study investigated PM performance in adults with and without ADHD with the aim of assessing PM errors. Nineteen adults with ADHD and 24 controls completed the Virtual Week task, a computer simulation of PM tasks encountered in everyday life. Errors on Virtual Week can be classified into several types including early responding, late responding and missed responses. In addition, participants can err by committing repetition errors or distractor errors. The adults with ADHD only differ from non-ADHD participants on the number of missed responses. This result points to the importance of focusing on task completion and reducing the likelihood of failing to perform a PM task when designing interventions to address PM difficulties.

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(3093)

Beyond Sadness: The Beneficial Effect of Negative Mood on Event-Based Prospective Memory Performance. THADDEUS MEEKS, SHELBY ZURICK and CHRISTOPHER B. ROSNICK, *Southern Illinois University—Edwardsville*—Event-based prospective memory (EBPM) involves performing a planned action upon encountering an environmental cue. While much research has examined the relationship between clinical mood/anxiety disorders and prospective memory, the impact of non-clinical affective states has been examined to a lesser extent. Rummel et al. (2012) found that the induction of a negative affective state, primarily described as sad, led to better EBPM performance as compared to a positive or neutral state. We replicated the finding of increased EBPM in the negative mood condition and more specifically examined the mood state changes related to EBPM performance. Participants' self-reported levels of sadness increased after the negative mood induction; however, increases in EBPM were contingent upon changes in

other mood states. These results suggest that sadness may not be the only or the primary affective state related to increased EBPM performance. The findings are discussed in relation to processing and motivational theories.

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(3094)

How Context Influences Intentions Formed Before, but Not During Interruptions. GABRIEL I. COOK, *Claremont McKenna College*, PAUL S. MERRITT, *Clemson University*, ARLO CLARK-FOOS, *University of Michigan—Dearborn*, THADDEUS MEEKS, *Southern Illinois University—Edwardsville*—We investigated the effect that interruptions have on delayed-execute intentions. Prospective memory for event-based cues encountered during an interrupting task was worse than when those cues occurred before an interruption. Importantly, when cues appeared in an ongoing task, but before the interruption, delayed-execute prospective memory was worse when the prevailing environmental context was not reinstated after the interrupting task. Providing participants with information about the future context for making the delayed-execute response, however, ameliorated some of these deficits. We believe these data provide evidence for the importance of encoding specific intentions that can be associated them with a performance context. These results highlight the role of context when executing intentions that one cannot complete immediately.

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(3095)

The Effect of Contextual Cues on Prospective Memory Accuracy and Cost to the Ongoing Task. SHEILA MELDRUM and REBEKAH E. SMITH, *The University of Texas at San Antonio*—The current experiment builds upon previous research showing that the use of contextual information can have a significant impact on ongoing task performance in a prospective memory (PM) paradigm. Three groups of participants all completed an ongoing trivia task. The control condition performed only the ongoing task. Participants in the PM context and PM no context conditions were to touch four target words when they appeared in the ongoing task. In the PM context condition participants were given information about when the target events would occur within the performance interval (i.e., within the ongoing task block in which the PM task was to be performed). The results indicate that being able to anticipate the occurrence of the PM target events can influence the pattern cost to the ongoing task within the performance interval.

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(3096)

Using Near Infrared Spectroscopy (fNIRS) to Study Prospective and Episodic Memory. MICHAEL T. PASCALE, JEFFREY P. TOTH and KAREN A. DANIELS, *University of North Carolina at Wilmington*—Functional Near Infrared Spectroscopy (fNIRS) is a noninvasive, optical-imaging technique for measuring changes in blood flow associated with cognitive activity. The goal of the current research was to determine if this technology could detect activity changes

in prefrontal cortex (PFC) associated with (a) goal-related shifts of attention related to prior intentions (i.e., prospective memory) and (b) successful (recalled) versus unsuccessful (not recalled) memory encoding. Across multiple blocks, participants viewed lists of words with instructions to name the color of each word (which varied word-to-word) and, for some participants, to silently remember target words from specific, pre-cued categories (e.g., animals). Results showed increased oxygenated hemoglobin (HbO₂) in rostral PFC associated with the global intention to remember target words, but little difference in PFC activity between target and nontarget control words. As well, recalled target words were associated with a decrease in HbO₂ at encoding compared to not-recalled target words. Overall, the results suggest that fNIRS can be used to assess relatively subtle attention- and memory-related functions mediated by the rostral prefrontal cortex.

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(3098)

Spontaneous Retrieval Without Reminder on Prospective Memory: A Diary Study. HISATO IMAI and YUKIKO ISHII, *Gakushuin University*—In previous memory studies, spontaneous retrieval has been dealt with mainly on prospective memory topics, which have entirely focused on the contexts with external reminders due to their necessity and limitation of the experimental paradigm. Therefore, any features of spontaneous retrieval without external reminders have been unclear. To address this issue, we conducted a preliminary memory diary study with prospective events. Fourteen undergraduates carried recording instruments for 22 days, and recorded (1) details of spontaneously reminding on prospective events, (2) what they were doing then, and (3) what triggered the reminding. We found, in the case of no external reminders, spontaneous retrieval occurred once for three times on average, and tended to be popping into mind involuntarily with some sort of mental activities, such as thinking another thing. Implications for the emergence of spontaneous memory retrieval will be discussed in terms of subjectivity based on implicit and/or explicit memory processing.

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(3099)

The Role of Selective Attention and Working Memory Capacity on Prospective Memory Performance. JESSIE D. MARTIN and PAUL VERHAEGHEN, *Georgia Institute of Technology*—The ability to focus and allocate and maintain attentional resources is critical to successful execution of many cognitive tasks; however, the degree to which performance on prospective memory tasks is mediated by working memory capacity and/or selective attention remains unclear. In this study, the relationship between SA and WMC on monitoring strategy and prospective memory performance was assessed via an individual differences perspective. Participants performed an event-based prospective memory task consisting of a control, focal, and non-focal condition, as well as measures of WMC and SA. Overall, performance on the PM task was uncharacteristically low; however there was a relationship between both WMC and SA on ongoing

task performance. Interestingly, when the data was broken down into a monolingual and bilingual group, bilinguals demonstrated a distinct relationship between the roles of SA and WMC on ongoing task performance that was not present in the monolingual group. Implications for future studies on memory, executive control, and bilingualism are addressed.

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• VISUAL SEARCH •

(3100)

Visual Search Facilitation by Divider Frames Depends on the Saliency of the Frames. KAZUHIKO YOKOSAWA, *The University of Tokyo*, RYOICHI NAKASHIMA, *Tohoku University*, HIROKI KAWAI, *The University of Tokyo*—A typical visual search paradigm in experimental psychology requires observers to find a target among undivided spatial arrays of items. However, our visual environment is populated with items often arranged within smaller spatial areas outlined dividers. Nakashima and Yokosawa (2013) revealed that frame enclosures of multiple items appear to induce a grouping effect that facilitates search performance (e.g., guiding serial allocation of attention). This study expands this finding: It examined the effect of the saliency of the divider frames. A spatial configuration search task (i.e., search for “T” among “L”s) was conducted, manipulating the color (black or yellow) and number (1, 4, or 16) of frames subdividing search displays. Results showed that black divider frames facilitated visual search, whereas yellow did not. We suggest that visual search facilitation by divider frames can occur only when the saliency of the frames is low.

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(3101)

What Determines Search Efficiency Differences in Blank Trials? GERNOT HORSTMANN and ARVID HERWIG, *Bielefeld University*, STEFANIE BECKER, *The University of Queensland*—A remarkable result in visual search studies is that efficiency differences between easy and hard searches manifest themselves not only in target trials but also in blank (target absent) trials. Because the focus of models of visual search is on target trials, theoretical or empirical treatments of blank trials have been presented only sporadically. Here we examine eye movements to explore three hypotheses concerning the causes of differential search efficiencies in blank trials: (a) distractor skipping regulated by a variable threshold, (b) rescanning, and (c) attentional dwell times. Participants performed a very inefficient search for two types of emotional target faces among neutral distractor faces. Target-distractor similarity (TDS) was varied between blocks to create easy and hard search conditions. The distractors were the same in all blocks. Visual search times differed between easy and hard search. Eye movements were analyzed for skipping of distractors, rescanning of distractors, and first



pass fixation times. Results showed that differences in first pass fixation time and rescanning accounted for most of the search time differences between hard and easy search.

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(3102)

Searching for Poorly Defined Camouflaged Targets.

ALYSSA HESS, ANDREW WISMER, COREY BOHIL and MARK NEIDER, *University of Central Florida*—Visual search in the real world often involves locating objects that blend in with the environment. In severe instances, observers might be forced to seek small background discontinuities, as opposed to discrete objects, to indicate a target's presence. In two experiments (with and without target preview, respectively), we characterized search behavior under such conditions by having participants search for target discontinuities of varying sizes in natural scenes. Importantly, the targets were created directly from a portion of each corresponding search image. Both behavioral and oculomotor measures indicated that although participants initially performed slightly worse without a target preview (e.g., lower accuracy; longer reaction times; less efficient scan paths), these differences were nearly eliminated with practice. Our data suggest that successful search is not predicated on the availability of discrete objects or perfect target representations. When necessary, observers can form and utilize categorical templates to guide search towards poorly defined targets.

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(3103)

Cueing vs. Familiarity: An Eye Movement Study of Colour-Form Binding Through Stored Knowledge.

GILES M. ANDERSON, *Oxford Brookes University*, GLYN W. HUMPHREYS, *University of Oxford*—Previously, it has been demonstrated that search for a target in its familiar colour is quicker and more efficient than search for an unfamiliar target. In experiment 1, we compared responses and initial eye gaze deployment during search for a yellow or purple coloured corn target amongst aubergine distractors, half of which were yellow, half purple. Search was faster and more efficient when the search-irrelevant colour of the target was familiar, due to early eye movements being directed to items with the colour habitually associated with the target. Experiment 2 introduced cues, which predicted the target colour at 80% validity. Cues directed first fixations to items with the cued colour. The benefit for familiar targets was reduced when targets matched the cue, however there was no effect on the efficiency of search for an uncued target carrying its familiar colour. Experiment 3 generalised the findings to other coloured items. The data are consistent with attention being automatically attracted in a bottom-up manner to targets in their familiar colour, a bias that can be modulated by top-down processes.

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(3104)

Effects of Action on Visual Search.

BLAIRE J. WEIDLER and RICHARD A. ABRAMS, *Washington University in St. Louis*—Recent research has revealed that when participants make a simple action towards an object (such as a button press) – but not when they merely view the object – they later allocate attention preferentially toward properties of that object in an unrelated visual search task. We further explored this effect by examining if the effect occurs when there is no need to process any property of the acted on object and when the object's presence is not affected by the action. In addition, we considered the possibility that effects attributed to the action may instead be due to goal updating (if participants' default state is not to act, then acting requires an updating of that state). Our findings indicate that the effect still occurs when participants don't need to process the object, it occurs when the object does not offset on response, and the effect is not due to goal updating.

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(3105)

Can Ensemble Statistics in the Periphery be Used to Guide Search?

REBECCA R. GOLDSTEIN and MELISSA R. BECK, *Louisiana State University*—The present study examined whether people can incidentally learn to use summary statistic information in the periphery to guide search. Although feature information is less available in the periphery due to crowding, ensemble statistics are accessible in crowding (Bulakowski, Post, & Whitney, 2011). Therefore, ensemble statistics may be useful in understanding guidance during search. On each trial, participants searched within four clusters of items for a target item appearing in the center of one of the clusters. On 80% of trials the target was surrounded by six lines to form a cluster with a constant ensemble statistic. When a target cluster with a constant shape and ensemble statistic was repeated, reaction times were faster compared to non-repeated trials. Eye movement data revealed that the difference was due to faster target identification in the repeated target clusters rather than the statistical information guiding search.

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(3106)

Cultural Differences In Visual Search With Items Defined By Higher-Order Features.

YOSHIYUKI UEDA, *Kyoto University*, RAI CHEN, *Kyoro University*, EMILY S. CRAMER and RONALD A. RENSINK, *University of British Columbia*, JUN SAIKI, *Kyoto University*—Studies on cultural differences in attention are often contaminated by conscious strategies, reasoning styles and motivation. We eliminated these confounding factors by using speeded visual search with culturally neutral items, and focusing on search asymmetry, instead of search efficiency. For long and short line items, North American participants had a reliable search asymmetry: search for long lines among short lines was faster than vice versa whereas Japanese participants had no such asymmetry. This pattern was not affected by speed accuracy trade-off. Moreover, using O and mirror-reversed Q items, Japanese also showed weaker search asymmetry than North Americans. However, with vertical and tilted lines, both North

Americans and Japanese showed search asymmetry with comparable magnitudes. These results suggest that attentional processing of basic features (e.g., orientation) is invariant across cultures whereas that of higher-order features (e.g., length or combination of basic features) is different across cultures.

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(3107)

Learning About Rare Targets. NICHOLAS HON and SYAHEED JABAR, *National University of Singapore* (Sponsored by Melvin Yap)—It is well-known that probability of occurrence affects target detection, with the standard finding being that rare targets are detected less well than more frequently occurring counterparts. However, whether a particular target is rare or not is something that an observer must learn as he/ she gains experience with the task and, more specifically, the target in question. The robustness of the target probability/ prevalence effect indicates that observers are quite capable of such learning. Here, we assessed the amount of target sampling necessary for target probability information to be fully acquired and entered into behavior-governing mental representations. In this study, we tested learning of different target probabilities (5, 10, 20 and 40%) within the context of the simple detection paradigm. We found that the target probabilities, although very different from each other, nevertheless required a similar amount of target sampling to learn.

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(3108)

Finding a Needle (and a Thread, and a Thimble, and...) in a Haystack: Multiple-Target Visual Search for Ultra-Rare Items. ADAM T. BIGGS and STEPHEN R. MITROFF, *Duke University*—Many search tasks, including those conducted by professionals in radiology and airport security screening, can contain multiple targets in a single search display. Previous work has repeatedly demonstrated that finding one target can impair accuracy for additional targets present in the same display; however, it remains unclear why this effect, termed “satisfaction of search,” occurs. It is vital to understand the underlying causes to best alleviate multiple-target search errors, yet it is difficult to assess potential influences due to practical limitations. Whether testing in a laboratory-based or real-world setting, it is hard to amass sufficient data to truly tease apart different theories. By using “big data” obtained from the smartphone application Airport Scanner, we were able to compare performance from thousands of players and millions of trials on a multiple-target search task. This large data set, which contains 79 unique target types (60 with prevalence rates below 1%), allowed us to examine how multiple-target search was affected by a variety of factors including item prevalence, perceptual set biases, and visual salience. We will describe how these factors interact to affect multiple-target search accuracy.

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• DISCOURSE PROCESSES •

(3109)

Mind Wandering and Narrative Inferences. JAMES FARLEY and PETER DIXON, *University of Alberta*—We examined how mind wandering while reading affected the ability to draw situation-model inferences. Subjects read short mystery stories sentence by sentence, attempted to solve the mystery, and rated their tendency to mind wander after each story. Subjects were better able to solve the mysteries when on task, particularly if critical information was cued by the narrator. Mind wandering was reduced and solutions increased by the introduction of a 2 or 4 s delay between sentences. The results were interpreted in terms of the resources required to activate and integrate textual information.

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(3110)

When Do Readers Expect Characters to Check on Completed Goals? JEFFREY E. FOY, *Colgate University*, RICHARD J. GERRIG, *Stony Brook University*—When reading narratives, readers monitor characters’ goals to understand their actions. We propose a distinction between the objective status of goals (i.e., whether they have been overtly completed) and characters’ subjective mental states with respect to those goals. We conducted a series of experiments in which participants read stories that established goals. In different versions of the stories, the goal was either overtly completed or not. Subsequently, a character either worried about the consequences of goal completion or not. We found that reading times for a sentence describing characters checking that the goal was completed were affected by information about the characters’ thoughts about the goal, but not the objective status of the goal. However, we found that participants’ direct judgments of whether characters should check were affected by information both by characters’ subjective states and the objective status of the goal.

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(3111)

The Role of Familiarity and Context Strength in Metaphor Processing. SPENCER J. CAMPBELL and GARY E. RANEY, *University of Illinois at Chicago*—Metaphors are often used to express complex ideas in vivid terms. Although familiar metaphors such as “the mind is a sponge” seem to be processed easily in isolation, less familiar metaphors such as “a forest is a harp” can be difficult to process without a context that provides cues to the intended meaning. The current research uses eye tracking to examine how familiar and unfamiliar metaphors are processed when presented in contexts that vary in how strongly they support the intended meaning of the metaphor. Results indicate strong familiarity effects (faster processing as familiarity increases) and context effects (faster processing as context strength increases), and little evidence of an interaction between context strength and familiarity. These findings are consistently found in fixation durations, fixation counts, and regression patterns. Furthermore, differences in



fixation times are larger for measures that include multiple passes through the metaphor (e.g., total time) than for first pass times.

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(3112)

Metaphors Serve a Basic Social Function. ANDREA E. BOWES and ALBERT N. KATZ, *University of Western Ontario*—We demonstrate metaphor plays a fundamental social function in communication. In each of three studies, following the processing of metaphor or literal sentences, participants completed a so-called unrelated task, namely identifying the emotions expressed in pictures of eyes. In study 1, participants generated meaningful contexts to metaphors and literal sentences. In study 2, participants read metaphors and literal counterparts presented in discourse contexts involving two friends, and then were asked questions about each passage. In study 3, participants read metaphor or literal counterparts without an explicit context. In all three studies greater accuracy on the “eyes task” was associated with social factors in the metaphor but not the literal condition, related to: the affective content generated (Study1), when the friends in the text were perceived as closer to one another (study 2) and even when merely reading metaphor (study 3). The findings are interpreted in terms of embodied cognition.

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(3113)

Precedence and Audience Design. CLAUDE G. CECH, ELIZABETH L. MELVIN and KYLE E. ALBARADO, *University of Louisiana at Lafayette*—Are directors describing ambiguous tangram figures influenced by an initial attempt to sort the figures based on other directors’ descriptions? Such influence may involve employing similar linguistic precedence) or better (improved audience design) descriptions. We investigate these issues by exposing directors to descriptions of 12 figures obtained under varying entrainment and codability/memory load conditions: Descriptions came from a 1st or a 3rd block, and were generated under circumstances in which all of the figures were viewable while describing each, or figures were presented one at a time to be described. We examine not only whether current directors exhibit similar patterns and descriptions as the earlier directors, but also the extent to which matchers exhibit differing performance. Finally, to further explore claims that matcher accuracy improves with multiple perspectives, we varied whether some matchers sorted an initial block of figures using the descriptions initially viewed by their director, or different descriptions.

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(3114)

Entrainment in the Wild Across Friends and Strangers. KRIS LIU, JEAN E. FOX TREE, NATALIA BLACKWELL and MARILYN WALKER, *University of California, Santa Cruz*—In one of the first studies of entrainment outside of the laboratory, pairs of friends and strangers participated in a tangram/map task hybrid that involved walking, talking, navigation, and object identification. Directors in a laboratory instructed

followers in the field to identify public art in downtown Santa Cruz via cell phone. Entrainment was observed across two iterations of the task. Surprisingly, however, strangers entrained just as efficiently as friends, with similar turns to agreement and similar number of descriptors for the art (e.g., describing the color, shape, material). Strangers and friends were also equally unsuccessful at locating target objects. A variety of factors including personality traits, task comfort, and familiarity with the town, among others, were tested for how well they predicted communicative effectiveness. Variation based on these factors was mostly observed in stranger pairs. The influence of these factors was markedly absent in friend pairs. This suggests that friends may have developed techniques for accommodating to one another that mask the effect of factors that influence strangers.

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(3115)

Which Way to Integration? Examining Directional Association in Word-to-Text Integration Using ERPs. JOSEPH Z. STAFURA and CHARLES A. PERFETTI, *University of Pittsburgh*—In this study, event-related potentials (ERPs) were used to explore on-line lexico-semantic integration in conditions in which prospective and retrospective processing were made more or less likely, through the manipulation of the direction of lexical association between words in isolation and in two-sentence texts. In both word relatedness judgment (RJ) tasks and text comprehension (TC) tasks, reduced N400 component amplitudes were seen over central scalp electrodes in conditions in which word pairs were either forward or backward associated, relative to conditions in which word pairs were unrelated (RJ) or lacking one word of the pair (TC). Additionally, a reduced negativity was found for forward associated pairs over right parietal electrodes in RJ, and an increased positivity was found for the backward associated texts over left parietal electrodes in TC. The evidence from central electrodes suggests that retrospective integration processes are functional in modulating the N400 in incremental text processing. Additionally, the results suggest a role for expectancy in modulating ERPs at right parietal sites, and, potentially, an engagement of memory processes in text processing over left parietal sites.

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(3116)

“That’s ur Opinion”: Alignment and Agreement in Computer-Mediated Communication. DAVID KOVAZ, *University of Memphis*, MONICA A. RIORDAN, *Chatham University*, WESLEY A. BOYD and ROGER J. KREUZ, *University of Memphis*—Previous research has documented that various forms of structural alignment occur between interlocutors in computer-mediated communication (CMC; Riordan, Markman, & Stewart, 2013). We extend these findings by directly assessing whether alignment occurs under conditions of agreement versus disagreement. Participants interacted via Instant Messenger with a confederate who either agreed with their position on cell phone use while driving, or disagreed. We assessed alignment in terms of length, duration, and affect. As in earlier research, we found

that alignment increased as the interaction progressed, but only in the agreement condition. In the disagreement condition, alignment actually decreased. However, duration alignment increased as the conversations progressed, regardless of condition. There were mixed results regarding the interlocutors' use of positive and negative emotion words (as measured by LIWC; Pennebaker et al., 2007). These results suggest that some forms of structural alignment may be influenced by interlocutors' agreement in CMC, whereas others are not.

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(3117)

Tracking Location in Narratives: Do Specific Location-Based Goals Matter? EDWARD N. GRIFFITHS and WILLIAM H. LEVINE, *University of Arkansas* (Sponsored by Joel S Freund)—In narrative comprehension research literature, the effect of location shifts on the accessibility of information about location has led to mixed results. The experiments we conducted examined the hypothesis that the presence of specific character goals may explain some of the inconsistency in the literature. Participants read vignettes in which a character was introduced in an initial location (e.g., a library) and was described as having either a specific (e.g., to deposit a paycheck) or vague goal (e.g., to go) to accomplish in a second location (e.g., a bank). The character then either moved or did not move to the new location. A recognition probe word (the initial location) was presented shortly after the shift (or lack thereof). The results suggest that that initial location was less accessible after a location shift regardless of the type of goal that was associated with the second location.

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(3118)

Understanding the Boundaries of Auditory Imagery Experiences During Reading. JAMES A. CLINTON, *Northern Illinois University*, CHRISTOPHER A. KURBY, *Grand Valley State University*, JOSEPH P. MAGLIANO, *Northern Illinois University*, DAVID N. RAPP, *Northwestern University*—Readers can imagine auditory features of dialog during silent reading, a phenomenon referred to as auditory imagery experiences (AIEs). We set out to determine if prior exposure to characters' voices is necessary to generate AIEs. Participants either listened to or read scripts from an old radio comedy. They then read the scripts and were asked to respond to probe words that were either in the voice of the character speaking a line of dialog or in the other character's voice. AIEs occurred if participants responded faster to probes when they matched the character speaking the line than when they do not. In Experiment 1, participants responded faster when the probe voice matched rather than mismatched the target character currently speaking, but only if participants had previously listened to the voices. Experiment 2 further demonstrated that this pattern occurs for specific rather than generic voices. Taken together, the results indicate that prior auditory exposure is required for the activation of AIEs during reading.

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(3119)

You Are Your Words: Linguistic Correlates of Cognitive Task Performance. LAURA K. VARNER, *Arizona State University*, SCOTT A. CROSSLEY, *Georgia State University*, ERICA L. SNOW and DANIELLE S. MCNAMARA, *Arizona State University*—Recent research has examined individual differences in cognitive skills that relate to variation in students' writing proficiency (Kellogg, 2001). However, it is unknown precisely how these individual differences manifest themselves in terms of the linguistic properties of students' writing. We investigated relations between students' performance on cognitive tasks (e.g., working memory span task) and linguistic properties of their essays. Participants (n = 110) completed a battery of cognitive and literacy assessments, including a timed, prompt-based essay, and a set of cognitive tasks previously identified as predictors of literacy skills (Varner et al., in preparation). Analyses identified specific linguistic properties within the essays (e.g., cohesive cues) that were predictive of students' cognitive task performance (e.g., working memory scores). Additionally, results indicated that the predictive strength of the linguistic variables varied as a function of reading skill.

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(3120)

Attested Knowledge and Belief: On the Relationship Between Evidentiality and Modality. SUMEYRA TOSUN and JYOTSNA VAID, *Texas A&M University* (Sponsored by Lisa Geraci)—Evidentiality refers to the source of an asserted claim; epistemic modality refers to the reliability and probability of a claim. Whether evidentiality is an independent property of language or a variant of epistemic modality has been a subject of debate. The present study examined adult speakers' interpretations of sentences describing an event with either evidential (reportedly, apparently, presumably, supposedly) or modal markers (must have, should have, might have, could have). For each sentence participants were to judge the source of knowledge and the degree of reliability of the asserted information. Preliminary findings suggest a strong influence of source type in judgments of reliability but less of an influence of degree of reliability in judgments about source type. These findings are discussed in terms of their bearing on different theoretical proposals for the relationship between evidentiality and modality and, in particular, the inclusion hypothesis as proposed by Chafe and by Matlock.

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(3121)

Social Similarity Effects on the Re-Conceptualization of Referents Following Conversation. CHRIS SCHMADER and WILLIAM S. HORTON, *Northwestern University*—Previous research has shown that speakers often change how they conceptualize referents based on interactions with others. Here, we investigated how often speakers adopted new referential conceptualizations after conversations with interlocutors who were more or less similar to themselves. Participants first independently labeled abstract figures in a pre-test, then completed a communication task with a partner involving the same figures, and finally drew and labeled the



figures in a post-test. Beforehand, they learned their partner was another Northwestern student (ingroup condition) or a community college student (outgroup condition) and rated their similarity to their partner based on a mock social media profile. Comparison of pre- and post-test labels revealed that ingroup participants adopted new conceptualizations of images less often when they felt more similar to their partner, but this was not the case for outgroup participants. Speakers may rely more on initial conceptualizations when negotiating reference with highly similar others.

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(3122)

You Like Comedy, I Like Drama: The Effect of Discussing Differences on Subsequent Perspective-Taking. CASEY J. NOBLE and WILLIAM S. HORTON, *Northwestern University*—Recent work by Todd et al. (2011) has shown that participants who have been led to focus on differences perform better on pencil-and-paper perspective-taking tasks than participants who focus on similarities. At issue is whether this effect generalizes to perspective-taking during conversation. We present findings from two studies that use a novel getting-to-know-you task to highlight similarities or differences directly between pairs of participants. Using this procedure, we partially replicate one of Todd et al.'s findings in Experiment 1. In Experiment 2 we apply this procedure to conversational perspective-taking, using a task adapted from Wardlow-Lane and Ferreira (2008). Surprisingly, participants in the difference condition were initially less sensitive to perspective for contrasts that were mutually visible between partners. When the contrast was privileged to the speaker, performance did not differ between conditions. Implications for various types of perspective-taking and a similarity or difference mindset will be discussed.

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(3123)

Justice is Blind: Examining Miranda Processing Using an Eye Movement Paradigm. KYLE C. SCHERR, STEPHEN J. AGAUAS and JANE ASHBY, *Central Michigan University*—Although research examining Miranda rights comprehension exists, the majority of this research has relied on trained raters' interpretation of individuals' responses – thus creating the potential for rater bias. We monitored eye movements in order to examine Miranda processing in a more objective way that complements existing measures. Undergraduate participants were presented with three versions of Miranda of varying difficulty and a baseline reading assessment (TOWRE). Online processing was measured as total reading time and total number of fixations on each of the five sections of Miranda. Participants spent less time reading and made fewer fixations on the juvenile version compared to the more difficult standardized and adult versions, and the differences between versions primarily appeared in the fifth section. These results demonstrate the effectiveness of monitoring eye movements to detect and localize the online processing difficulties that individuals experience when silently reading different versions of Miranda warnings.

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(3124)

Moving Beyond the Keys: Talk Aloud Protocols to Measure What's on Your Mind. CONNIE SHEARS, ADRIANA ARIZA, ERIKA SAM, JAY KIM, SHAUN FLAX and FRANCESCO ONORATI, *Chapman University*—If this is happiness: “A good laugh always lifted Kaitlyn's mood. She likes to go to the comedy club.” Then, what is this? “Tom studied the mangled mess of his bike. He should never have tried that highest jump.” Past literature (Sauter, 2010) demonstrates that the rich variety of emotions is missed in reducing emotional language to categories of positive or negative. We measure the formation of causal inferences to explore comprehension of emotional language. More specifically, we are looking at emotional language, which conveys a character's emotion such as regret or sympathy—valences that are not easily categorized (Shears et al., 2013). Based on post hoc grouping, individual differences had a significant impact on whether readers formed inferences. Traditional measures of yes/no key press responses fail to capture those differences. Considering the importance of these unique perspectives, we employ a procedure that deviates from traditional methodologies and branch into talk aloud procedures.

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(3125)

Situation Model Updating in Young and Older Adults. HEATHER R. BAILEY, *Kansas State University*, JEFFREY M. ZACKS, *Washington University in St. Louis*—Readers construct mental models of situations described by text. Activity in narrative is dynamic, so readers must frequently update their situation models when dimensions of the situation change. Updating can be INCREMENTAL, such that a change leads to updating just the dimension that changed, or GLOBAL, such that the entire model is updated. Here, we asked whether older and younger adults make differential use of incremental and global updating. Participants read narratives containing changes in characters and spatial location, and responded to recognition probes throughout the texts. Responses were slower and less accurate when probes followed a change, suggesting that situation models were updated at changes. When either dimension changed, responses to probes for both dimensions were slowed; this provides evidence for global updating. Older adults updated more globally than did young adults. Globally updating situation models may help older adults to reduce working memory load as they read.

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(3126)

Influence of Causal Connective “Because” on Evaluations of Scientific Explanations. KATJA WIEMER and LILLIAN K.E. ASIALA, *Northern Illinois University*—Metacognitive failures have been documented across a variety of cognitive processes (Wegner 1994, Wegner 1997, Iliev & Medin 2009, Monin & Miller 2001). The purpose of this study was to examine failures induced by the use of the causal connective “because” (Blank & Chanowitz, 1978) in the evaluation of scientific explanations. A causal marker may make an inadequate explanation seem more explanatory than it is, while its presence or absence should have no effect on the evaluation

of a satisfactory explanation. Students evaluated answers to a causal (“why”) question after reading brief descriptions of scientific phenomena. Answers were equivalent in semantic accuracy, semantic overlap with the text (assessed with Latent Semantic Analysis), as well as in writing quality (per norming), but varied by explanation (correct vs. correct-sounding pseudo-explanation) and use of “because” (used vs. not). As predicted, the use of “because” improved evaluations for pseudo-, but not for correct explanations.

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• LANGUAGE PRODUCTION/WRITING •

(3127)

Lexical Verb Knowledge in the Development of Complex Spatial Language. KRISTEN JOHANNES, COLIN WILSON, and BARBARA LANDAU, *Johns Hopkins University*—Static spatial relations are encoded in English by both prepositional (X is in/on Y) and lexical verb constructions (X is hanging from Y). We report that in spatial language production (Experiment 1) adults, but not 4-year-olds, use lexical verbs when describing spatial locations for 11 different feature-based spatial relation subtypes of containment and support. We asked whether these differences reflect the limited spatial lexicon of children or differences in children’s and adults’ choices of informative spatial expressions. In Experiment 2, adults and children showed similar truth value judgments for “is in/on” and lexical verb expressions when they were paired with each spatial relation, suggesting that children have access to the same lexicon of verbs as adults. In Experiment 3, adults and children chose whether “is in/on” VS. a lexical verb expression best described each spatial relation. Consistent with production, adults but not children selected lexical verb descriptions. These data suggest that, while 4-year-olds have a robust lexicon of spatial verbs, they are not yet sensitive to these verbs as informative alternatives to “is in/on” constructions.

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(3128)

Timing of Lexical Activation in Determiner-Adjective-Noun Phrase Production. AMY DIBATTISTA and NEAL J. PEARLMUTTER, *Northeastern University*—A series of picture-word interference experiments investigated the time course of lexical activation of adjectives and nouns in production of noun phrases. In the main experiment, participants described drawings of colored or patterned shapes or clothing articles (e.g., “the red dress”). A prime adjective or noun that was semantically related, phonologically related, or unrelated to the corresponding word in the target description appeared across the drawing at one of three negative or three positive SOAs. Noun primes created semantic interference at the -200 and +200 ms SOAs and phonological facilitation at the -50 ms SOA. Semantic interference from adjective primes occurred from the -200 ms SOA through the +200 ms SOA, and phonological facilitation occurred at the +250 ms SOA.

These patterns suggest simultaneous initial activation of noun and adjective lemmas, activation of noun lexemes before adjective lexemes, and late reactivation of noun lemmas.

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(3129)

Semantic Interference in Word Production: Insights From Remote Associates Problem Solving. KIMBERLY PREUSSE, *Georgia Institute of Technology*, ALEXANDRA FRAZER and PADRAIG O’SEAGHHDA, *Lehigh University*—Semantic interference during blocked cyclic picture naming has the potential to provide insights into underlying knowledge substrates. It may also provide insights into thematic or goal-driven reconfigurations of meaning such as may occur during the pursuit of insight itself. We hypothesized that interference would arise due to adjustments in conceptual-lexical links during cyclic picture naming of remote associates test (RAT) triples. We found semantic interference, comparable to that for categorically related triples, when RAT solutions were provided. We observed cumulative interference beyond dual tasking costs when participants named pictures while also actively seeking solutions to real and false (no solution) RAT sets. Dynamic changes occurred at and beyond the point of solution of the real RATs. Becoming aware of a previously unknown connection among items, or merely seeking such a connection, can engender semantic interference. The latter finding goes beyond previous reports of interference among thematically linked items.

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(3130)

Duck, Duck...Mallard: Advance Word Planning Facilitates Production of Dispreferred Alternatives. DANIEL KLEINMAN and VICTOR S. FERREIRA, *University of California, San Diego* (Sponsored by Ram Frost)—People often plan speech several words in advance. Relative to planning and producing an isolated word, advanced planning increases the lag between deciding what meaning to express and selecting a word for production. When a meaning can be equally well expressed by multiple words, delaying lexical selection in this way may cause the activation level of a dispreferred alternative (e.g., ‘sofa’) to increase more than that of the preferred alternative (‘couch’), thereby increasing the likelihood that speakers will select ‘sofa’. To test this, speakers named pictures with two acceptable names, one of which was strongly preferred in a norming study. These pictures were either named in isolation or presented simultaneously with (and named after) another picture, giving speakers more time to select a name. As predicted, speakers produced dispreferred names significantly more for pictures in the simultaneous condition. Given that concurrent speech planning processes likely bottleneck lexical selection during naturalistic production, which words we choose are influenced by our tendency to plan them in advance.

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(3131)

Meaning-Related Constraints on Phonological Activation During Speech Production. JORDANA HELLER and MATTHEW GOLDRICK, *Northwestern University*—

How is the retrieval and encoding of phonological word-form information during speech affected by higher level (grammatical and meaning-related) encoding? We examine how the activation of phonological neighbors (words differing from the target by a single phoneme; Vitevitch, 2002) is modulated by contextual constraints. We previously found that grammatical constraints (e.g., nouns must closely follow definite determiners) constrain the activation of neighbors in production; when target nouns appear in syntactic contexts, naming latencies increase as number of noun neighbors increases, controlling for total neighborhood size. Here, we examine how meaning-related constraints influence phonological activation. We compare how neighbors influence picture naming latencies when targets appear in two-sentence scenarios where pragmatic constraints are strong (few of a target's neighbors are contextually plausible) vs. weak (nonpredictive context; many pragmatically plausible neighbors). The relative contribution of meaning-related processes to phonological activation and lexical processing beyond constraints available from syntactic cues will be discussed.

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(3132)

Facilitation and Interference in Naming: A Consequence of the Same Learning Process? JULIE HUGHES and TATIANA SCHNUR, *Rice University*—

Our naming success depends on what we have named previously, a phenomenon thought to reflect learning processes. Repeatedly naming the same picture facilitates language production, whereas naming categorically related pictures hinders subsequent performance (i.e., semantic interference). Semantic interference is found when naming categorically related items once (continuous naming) or multiple times (blocked-cyclic naming). A computational model suggests that the same learning mechanism responsible for facilitation in repetition creates semantic interference in categorical naming (Oppenheim, Dell, & Schwartz, 2010). Accordingly, we tested the predictions that variability in semantic interference is correlated across categorical naming tasks and is caused by learning. The results revealed no relationship in semantic interference effects across paradigms, and learning (repetition priming) did not predict semantic interference effects in either task. We conclude that semantic interference in blocked-cyclic and continuous naming differs. Further, the findings question whether learning fully captures the cause of interference in naming.

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(3133)

Exploring the Factors that Contribute to Cumulative Structural Priming Effects. TIMOTHY J. KUTTA and *MICHAEL P. KASCHAK, *Florida State University*—

We report experiments addressing two questions about cumulative structural priming effects. First, how many tokens of a “prime” construction - in our case, double object (DO) and

prepositional object (PO) constructions - must be produced in order for there to be a persistent priming effect across many “target” productions? Experiment 1 shows that as few as 2 prime constructions are capable of producing a priming effect that persists over the next 10 sentences, although the priming effect gets larger when 10 or more prime constructions are produced. Our second question concerns the source of the individual variation in rates of DO and PO production that occurs in cumulative priming experiments independently of the priming that is induced through the experimental manipulations. Experiment 2 demonstrates that individual differences in performance on implicit learning tasks accounts for at least some of the individual differences in the rates of DO and PO production that are seen in a sentence completion task. The implications of these results for theories of structural priming and theories of language production are discussed.

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(3134)

Taboo Trumps Semantics During Picture-Word Interference. KATHERINE K. WHITE, RICHARD J. COLLINS and SARAH M. KOEHLER, *Rhodes College*,

LISE ABRAMS, *University of Florida*—Although it is well-established that emotion influences cognition, our understanding of emotion's effect on speech production is limited. Previous research has shown that taboo words slow picture naming relative to neutral words. This experiment investigated interference from taboo words in comparison to semantically related words, which also slow picture naming. Participants named target pictures superimposed with semantic, taboo, or unrelated distractor words that were presented 150 ms before, simultaneously, or 150 ms after picture onset. To investigate carryover effects from taboo trials, two filler pictures accompanied by unrelated distractors were presented after every target. Relative to unrelated distractors, both semantic and taboo distractors slowed picture naming at all three SOAs, with greater slowing for taboo trials and for distractors presented before and simultaneously with target pictures. Slowing from taboo distractors persisted when naming subsequent filler pictures. These findings emphasize the theoretical importance of emotion and attention in speech production.

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(3135)

Phonological Planning of Compound Words in Mandarin Chinese. JENN-YEU CHEN and TRAINMIN CHEN, *National Taiwan Normal University*—

Employing the implicit priming task, Jacobs and Dell (2012) reported a study showing no preparation effect when English participants prepared to produce the second syllable of a compound or monomorphemic word upon being prompted by the first syllable (e.g., see ‘hot’, say ‘dog’), indicating that English speakers have to start from the beginning of a word even when the task is to say its second part. Using the same kind of task with Mandarin compounds and monomorphemic words, we observed a preparation effect. The distinct pattern between English and Mandarin implicates that the planning

scope of phonological encoding is different between these two languages, which is the phonological word for English, but is the syllable for Mandarin.

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(3136)

Frequency Effects of Compound Word Naming in Aphasia. KELLY M. GARVEY, ERICA L. MIDDLETON, and HILARY TRANT, *Moss Rehabilitation Research Institute* (Sponsored by Myrna Schwartz)—According to some models of lexical access, naming a compound word (e.g., eggplant) requires retrieval and combination of its constituent forms (“egg” and “plant”). Other models contend a compound’s form is represented independently of its constituent morphemes. To speak to this issue, because word form retrieval is the predominant (if not exclusive) locus of frequency effects in production, we examined the impact of constituent frequency and compound frequency on compound naming accuracy in fourteen participants with chronic aphasia from stroke. Mixed linear regression analysis revealed compound frequency and frequency of the second constituent (e.g., plant in eggplant) were reliable and independent predictors of naming accuracy, even while controlling for an additional 6 important psycholinguistic variables. We suggest that in the production of compounds, both a compositional route and direct retrieval of the full compound word form may be involved, similar to dual-route models of inflectional morphology in verbs and nouns.

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(3137)

Temporal Dynamics of Written Word Production: Evidence From Blocked Cyclic Naming. BONNIE BREINING and BRENDA RAPP, *Johns Hopkins University*—Do the temporal dynamics involved in converting meanings to sounds also apply to converting meanings to letters? While spoken and written language systems may appear to be comparable in many ways, written language is a relatively late cultural innovation and written words are produced over a considerably longer time course than spoken words. Previous research has shown that, in spoken production, people are slower to say the name of a picture when it follows items from the same semantic category as compared to items from different semantic categories. We examined if this phenomenon of cumulative semantic interference extends to written production. Using a written blocked cyclic naming task, we found that participants were also slower to write the names of pictures when they appeared in related vs. unrelated blocks. These findings reveal fundamental similarities in the dynamics of spoken and written word production.

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• LETTER AND WORD PROCESSING II •

(3138)

Homograph Priming Effects Are Independent of Environmental Context. KIMBERLY WEAR, *High Point University*, DAVID S. GORFEIN, *University of Texas at Dallas*—Theories of homograph processing argue that meaning selection is very brief (e.g. Gernsbacher & St. John, 2001; Simpson & Kang, 1994). Gorfein and colleagues have shown long-term effects of such processing ranging from 10 minutes (Gorfein, Brown, & DeBasi, 2007), to 24 hours (Gorfein & Walters, 1989), to a full week (Gorfein, 2012). Critics have raised the question of whether these long-term effects are due to episodic memory. It is well known that episodic memory is dependent on contextual retrieval (e.g., Parker, Dagnall, & Coyle, 2007). The present study used the same materials as Gorfein, 2012, to test these explanations. 74 participants viewed images related to the secondary meaning of homographs followed by the auditory presentation of the homograph ½ second later. Environmental context was manipulated across two sets. Word associations showed priming of secondary meaning with no effect of environmental context. The results support the activation-selection model (Gorfein, 2001).

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(3139)

Factors That Influence the Carry-Over Effects of Lexical-Ambiguity Priming. DAVID S. GORFEIN, *University of Texas at Dallas*, WILLIAM SCHWEINLE, *University of South Dakota*—In recent years we have shown that there is persistent effect of processes that guide the selection of a particular meaning of a homograph. Long-term effects of meaning selection in ambiguity processing have been shown ranging from a matter of minutes (Gorfein, Brown, & DeBasi, 2007), 24 hours (Gorfein & Walters, 1989), to a full-week (Gorfein, 2012). The effect of meaning selection has also been shown to be influenced by multiple priming events (Gorfein, Brown, & Schweinle, 2011). The present paper investigates some of the factors that influence performance including the role of accuracy feedback, and the possibility of testing effects. Results are interpreted within the framework of the Activation-selection model.

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(3140)

Bring On The Noise! Subjective Experience and Online Control of Noise are Influenced by Context in Young and Older Adults. CHAD S. ROGERS and ARTHUR WINGFIELD, *Brandeis University*—Prior work has shown that older adults are more reliant upon context than young adults when listening to words in noise, both in terms of identification and subjective experience (Rogers et al., 2012). Two experiments assessed how this relationship impacts older adults’ sensitivity to variations in noisy environments. In Experiment 1, young and older adults listened to words at three signal-to-noise ratios (SNRs). SNRs were adjusted relative to each participant’s baseline hearing level. Target words were semantic associates to the primes (e.g., ROW-



BOAT), or phonological neighbors to the semantic associates (e.g., ROW-GOAT). Participants' identifications and subjective confidence in their responses varied as a function of age, semantic context, and SNR. In Experiment 2, older and young adults listened to noisy passages that varied in terms of cloze predictability. Critically, participants were given the option to adjust the SNR online to facilitate comprehension. Noise adjustments and later comprehension are discussed in terms of context and audibility serving as qualitatively different bases for listening.

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(3141)

Induced Stroop-Like Interference in Memory: Evidence for Semantic Competition. BRADLEY R. STURZ, MARSHALL L. GREEN, LAWRENCE LOCKER and TY W. BOYER, *Georgia Southern University*—Discussions of the source of Stroop interference continue to pervade the literature. Semantic competition posits that interference results from competing semantic activation of word and color dimensions of the stimulus prior to response selection. Response competition posits that interference results from competing responses for articulating the word dimension versus the color dimension at the time of response selection. To induce semantic competition in memory while eliminating response competition, we embedded a Stroop-like task into a delayed match-to-sample task. We probed each dimension independently by presenting either color targets (i.e., two colors) or word targets (i.e., two words). Participants viewed a real color word or a nonsense control word in black or colored fonts congruent or incongruent with the real color word. After a 5s delay, participants viewed color targets or word targets (i.e., a match and a foil), and were instructed to select the correct match (sample color if color targets; sample word if word targets). We manipulated whether the foil conflicted with the sample along its other dimension (e.g., word sample “red” in blue font with the word “red” as the match and the word “blue” as the foil) and show Stroop-like interference such that performance deteriorated for real but not nonsense words during the critical conflict trial. A follow-up experiment with 10 and 25s delays between sample and targets replicated the results while showing a decrement in performance at 25s. Results provide evidence for semantic competition in memory while eliminating response competition.

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(3142)

Frequency and Consistency Effects in Polysyllabic Word Naming and Lexical Decision. DEVIN M. KEARNS, XIN XU, ROBERT PUTNAM and REEM AL GHANEM, *Boston University* (Sponsored by Gloria Waters)—The aim of the present study was to develop a measure of consistency for polysyllabic words and examine whether the effects of frequency and consistency followed the same pattern as in monosyllabic words. Part 1: We calculated feedforward word body/rime consistency (FFRC) for the stressed syllables of all of the polysyllabic words in CELEX (Baayen, Piepenbrock, & van Rijn, 1995). We tested whether FFRC accounted for variance in the English Lexicon Project naming and lexical

decision RTs (Balota et al., 2007) and found that it did. Part 2: We blocked words on frequency for 3rd and 4th grade readers (Zeno, Ivens, Millard, & Duuvuri, 1995) and FFRC and tested 3rd and 4th grade readers on their naming and lexical decision response times for these words. We analyzed the data with person- and word-specific ANOVAs and found an interaction between frequency and consistency. Post hoc tests indicated that consistency plays no role in RTs for high frequency words but is important for low frequency, consistent with prior studies (e.g., Chateau & Jared, 2003; Waters, Seidenberg Tanenhaus, & Barnes, 1984). The results indicate that our FFRC metric may be a useful measure of polysyllabic consistency.

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(3143)

Feeling the Invisible: The Emotional Grounding of Abstract Concepts. MARTA PONARI, DAVID VINSON, BAHADOR BAHRAMI and GABRIELLA VIGLIOCCO, *University College London*—A traditional view is that abstract concepts are rooted in linguistic knowledge, while concrete concepts are grounded in sensorimotor experience. Recent studies, however, suggest that abstract concepts can be grounded in emotional states. Here we assess whether emotional associations of abstract words could be available preconsciously. Using continuous flash suppression to render stimuli invisible, we measured how long it takes them to become visible (Time to Emerge, T2E). T2E was measured for negative, positive or neutral facial expressions (Experiment 1) and words (Experiment 2). T2E was longer for Negative faces/words than neutral and positive faces/words. Having established the equivalence between preconscious emotional effects for faces and words, in Experiment 3/4 we contrasted well-matched negative and neutral abstract and concrete words. Negative abstract words took longer to emerge than well-matched neutral and/or concrete words, confirming a pivotal role of emotional associations in preconscious processing of abstract, but not concrete, words.

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(3144)

How Do PDP Models Learn Quasiregularity? WOOJAE KIM, MARK A. PITT and JAY I. MYUNG, *The Ohio State University*—Parallel Distributed Processing (PDP) models have had a profound impact on the study of cognition. One domain in which they have been particularly influential is quasiregular learning, in which mastery requires both learning regularities that capture the majority of the structure in the input plus learning exceptions that violate the regularities. How PDP models learn quasiregularity is still not well understood. Small- and large-scale analyses of a feedforward, three-layer network were carried out to address two fundamental issues about network functioning: how the model can learn both regularities and exceptions without sacrificing generalizability; and the nature of the hidden representation that makes this learning possible. Results show that capacity-limited learning pressures the network to form componential representations, which ensures good generalizability. Small and highly local perturbations of this representational system allow exceptions

to be learned while minimally disrupting generalizability. Theoretical and methodological implications of the findings are discussed.

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(3145)

Delayed Parafoveal-on-Foveal Effects From Previewing Word n+1 in Eye Movements During Reading. SARAH RISSE and REINHOLD KLI EGL, *University of Potsdam*—Processing a word in parafoveal vision leads to benefit in word-viewing times when the word is finally fixated. However, effects on eye-movement control at the moment when the word is previewed parafoveally are not consistent. In fact, recent findings showed that such parafoveal-on-foveal effects were delayed into the next fixation (Risse & Kliegl, 2012, *J. Exp. Psych. Hum. Perc. Perf.*, 38, 1026-1042). In order to investigate the time course of parafoveal processing during reading we conducted two gaze-contingent display-change experiments manipulating the preview difficulty and the preview validity of an upcoming word n+1 relative to the word at its subsequent fixation. Effects of preview difficulty on the target word confirmed delayed parafoveal-on-foveal effects of previewing word n+1 during fixating the pretarget word n. Moreover, the results suggested that such effects were almost of the same size than the preview benefit of word n+1. Quantile regressions over the two preview effects provided further insight into the temporal integration of foveal and parafoveal information across the perceptual span and indicated when such information controlled the eye-movement decisions during reading.

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(3146)

Effects of Parafoveal Flanking Letters on Foveal Word Recognition. SEBASTIAAN MATHÔT, FRANÇOISE VITU and JONATHAN GRAINGER, *Aix-Marseille University*—We used the “flanking letters lexical decision” paradigm of Dare and Shillcock (2013) in order to test a model of multi-word reading. In the model, multiple words (on fixation, and to the left and right of fixation) are processed in parallel by a bank of location-specific letter detectors. These letter detectors feed information forward to a “bag of bigrams” that represents location-invariant sublexical orthographic information for all words processed in parallel. Bigrams are only formed within words (i.e., between spaces) but activate all compatible word representations. The model accounts for a finding reported by Dare and Shillcock (2013): Word recognition is facilitated when flanking letter pairs are present in the target (e.g. RO ROCK CK) compared with different letter flankers (ST ROCK EN), but independently of the position of the flanking bigrams (e.g., CK ROCK RO). In the present study we replicate this key finding and show that, as predicted by the model, although bigram position does not matter, within-bigram letter position does. Word recognition is harder when the position of letters within bigram flankers is reversed (e.g., OR ROCK KC / KC ROCK OR), but these conditions still facilitate with respect to a different letter flanker condition.

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(3147)

Parafoveal Pre-Processing of Word-Initial Trigrams During Sentence Reading by Adults and Children. ASCENSION PAGAN, HAZEL I. BLYTHE and SIMON P. LIVERSEDGE, *University of Southampton*—Previous research has shown that letter position information for the first letter of a parafoveal word is coded less flexibly than internal or final letters (Johnson, et. al, 2007). This experiment explored the pre-processing of letter identity and position information of a parafoveal word's initial trigram by adults and children using the boundary paradigm during sentence reading. Seven previews were generated: Identity (captain); transposed letter and substituted letter nonwords in position 1&2 (acptain-imptain); 1&3 (pactain-gartain) and 2&3 (cpatain-cgotain). First, single fixation and gaze durations showed a robust transposed letter effect for positions 1&2 and 2&3 in adults supporting contextual positional coding (Whitney, 2001). In children, there was no transposed letter effect. When the first letter was manipulated (positions 1&2 and 1&3), children showed longer fixation times in the above-mentioned measures suggesting that children strictly encode word initial letter position information.

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(3148)

Strength of Semantic Association Influences N400 Amplitude but Not Lexical Decision Times. CYMA VAN PETTEN, *Binghamton University, SUNY*, BARBARA J. LUKA, *Bard College*—Semantic context affects a variety of dependent measures, including reaction times for judging whether a letter string is a word (lexical decision), and the amplitude of the N400 component of the event-related brain potential (ERP). For N400 amplitude, the strength of semantic constraint in sentences yields reliable gradations in amplitude, but strength of association has not been well explored for word pairs. For lexical decision time, a surprising number of experiments have failed to find a strength-of-association effect. In three experiments with different subjects and different stimuli, we examined lexical decision times and N400 amplitudes concurrently. The second words of pairs were semantically unrelated to the first words, or associated according to production norms. N400 amplitudes were graded depending on strength of association (unrelated > weakly associated > strongly associated). In contrast, lexical decision times showed only a binary division; semantically associated words elicited faster RTs than unrelated, but the impact of association strength was null. We discuss the dissociation between these measures.

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(3149)

An Event-Related Potential Investigation of Individual Differences in Visual Word Recognition. NEGIN KHALIFIAN, *Binghamton University, SUNY*, KARA D. FEDERMEIER, *University of Illinois at Urbana-Champaign*, SARAH LASZLO, *Binghamton University, SUNY*—Neuropsychology and behavior strongly suggest that readers vary in the degree to which they rely on sub-skills of visual word recognition, such as phonological decoding and



direct lexical-semantic access. The Event-Related Potential technique is well-suited to characterizing such variation, due to its functional specificity: the ERP can be sub-divided into components corresponding specifically to perception, phonology, and semantics. However, despite this favorable characteristic, ERPs have not been used to systematically investigate individual differences in reading strategy. Here, we quantified the degree to which individuals relied on phonological decoding and lexical-semantics during reading by examining phonological regularity and lexicality effects in the ERP record. Results confirm that meaningful differences in visual word recognition can be observed in individuals' ERPs, suggesting that analyzing ERP reading data at the individual level—as opposed to the group level, as is typical—is an untapped, rich, source of information.

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(3150)

Incremental Orthographic Learning Indexed by ERPs.

LI-YUN CHANG, JOSEPH Z. STAFURA and CHARLES A. PERFETTI, *University of Pittsburgh*—This study examined how dynamic versus static encoding of stroke orders affect adult second language learners' ability to learn orthographic representations of Chinese characters. A high-temporal-resolution Event-Related Potential approach was adopted to investigate dissociations between procedural memory (P300) and episodic memory (P600) during orthography learning. Nineteen English speakers viewed thirty dynamic and thirty static animations of Chinese characters three times each. The results showed that, although there was no difference between dynamic and static conditions at time 1, the dynamic characters elicited greater P300 amplitudes than the static characters at time 2 and time 3. In the time window of the P600, this condition difference disappeared, whereas a frequency effect emerged; at time 2 and time 3 characters elicited P600s with increased peak latencies. This study shows that, while multiple encoding methods support Chinese orthographic learning, procedural memory is facilitated more under dynamic encoding conditions.

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(3151)

R34D1NG W0RD5 WITH NUMB3R5: Electrophysiological Evidence for Semantic Activation. NICOLE R. MARTIN and MEI-CHING LIEN, *Oregon State University*, PHILIP A. ALLEN, *University of Akron*—The present study examined whether semantic activation occurs for LEET stimuli, where digits were used as parts of words (e.g., “R34D1NG” instead of “READING”). Previous studies (e.g., Perea et al., 2008) using behavioral measures have suggested that LEET stimuli result in semantic activation because of priming effects. We attempted to provide converging operations for this result by using a more direct, electrophysiological measure: the N400 effect elicited by words (a measure of whether participants detected a mismatch between the word and the current semantic context). This N400 effect can occur only if a word has been identified and processed up to the semantic level. Participants performed a categorization task in the present experiment—determining whether a word or LEET stimulus

was related or unrelated to a given category name. We found that LEET stimuli produced an N400 effect similar to that for regular words, suggesting that LEET words result in access to meaning in a similar manner to words presented in consistent uppercase letters.

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(3152)

The Effect of Cross-Language Bigram Frequency on the N1 in Late Bilinguals.

GIORDANA GROSSI, EMILY HEIMBENDER and ELIZABETH SACCHI, *State University of New York-New Paltz*—The posterior N1 (130-200 ms) is an event-related potential modulated by orthographic and lexical factors in single word reading experiments. This study tested whether this deflection is modulated by cross-language bigram frequency in late bilinguals, as proposed by Grossi et al. (2010). Three groups of participants (advanced learners of Spanish, intermediate learners, and controls) performed two lexical decision tasks with English and Spanish stimuli. For each language, half of the stimuli had high cross-language bigram frequency and half had low cross-language bigram frequency. Words formed by high, compared to low, bigrams in the other language elicited more negative N1 amplitudes. Furthermore, this effect was fully significant only in advanced learners of Spanish. These findings suggest that cross-language bigram frequency modulates the N1 amplitude in bilinguals. However, they do not support Grossi et al.'s hypothesis, which predicted an effect in the opposite direction and a larger effect in less proficient bilinguals.

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(3153)

Signs in the Mind's Eye: Embodied Action and Mental Imagery Enrich Sign Representation.

LAURA M. MORETT, *University of Pittsburgh*—Because it is articulated with the hands, sign language is more dependent upon the motor system and is more iconic than spoken language. Thus, sign language is an ideal medium for testing the tenets of embodied theories of cognition (Barsalou, 1999; 2008), which posit that the body facilitates language processing. The current work examines the roles of embodied action and mental imagery in American Sign Language acquisition by hearing adult learners through manipulation of the method by which signs are learned, as well as their semantic and phonological relatedness. The results of Study 1 demonstrated that signs are learned more effectively via enactment than via referent visualization, arbitrary hand motion, or comprehension, but that sign iconicity did not affect recall. The results of Study 2 demonstrate that signs learned via enactment are organized in the mind semantically, rather than phonologically, by showing that novice learners are more likely to confuse phonologically related signs than semantically related signs. Taken together, these results indicate that engagement of embodied action and mental imagery via enactment enhances sign language acquisition by strengthening associations between sign forms and referents.

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(3154)

The Missing-Colour Effect: The Attentional Beam Captures Reading-Relevant and Reading-Irrelevant Information.

JEAN SAINT-AUBIN, *Universite de Moncton*, RAYMOND M. KLEIN and HELENE DEACON, *Dalhousie University*—The specificity of the attentional beam involved in reading was tested by investigating its relative sensitivity to reading relevant (shape) versus reading irrelevant (colour) features. In Experiment 1, participants read either a black and white version of the Nelson-Denny reading test or a multi-colour version in which each letter was printed in a different colour. While reading for comprehension, participants either searched for the letter t or for a colour. Comprehension was similar in all conditions, and whether they were looking for a letter or a specific colour, participants missed more targets in function than in content words. This pattern was replicated in Experiment 2 in which function and content words were equated on all relevant features and in Experiment 3 using a rapid serial visual presentation procedure controlling for eye movements. Results are interpreted by assuming that the attentional beam involved in reading is sensitive to both reading-relevant and reading-irrelevant information.
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• JUDGMENT AND DECISION MAKING I •

(3155)

Disjunction Fallacies in Episodic Memory. K. NAKAMURA, C.J. BRAINERD and VALERIE F. REYNA, *Cornell University*—Reasoning illusions such as the disjunction and conjunction fallacies have been extensively studied in the judgment and decision-making literature. However, they have not been explored in more basic domains, such as episodic memory. In our prior work, we detected the disjunction fallacy with a standard source-monitoring paradigm, using lists of unrelated words, and we were able to predict the kinds of manipulations that would produce the phenomenon. The current study is an extension of that work, this time adding semantic structure to the lists, in the form of taxonomic categories, in order to determine whether that would enhance the illusion. The memory form of the disjunction fallacy was indeed affected by the presence of taxonomic categories, suggesting that the illusion is tied to the ability to connect semantic relations across list items. That conclusion is consistent with fuzzy-trace theory's original analysis of disjunction fallacies in reasoning.
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(3156)

Unpacking the Recognition and Fluency Decision Heuristics: Contributions From Familiarity and Recollection. SHANE R. SCHWIKERT and TIMOTHY CURRAN, *University of Colorado-Boulder*—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

quick decisions. In an initial experiment, we used a city-size comparison task while recording event-related potentials (ERPs) to investigate the potential contributions of familiarity and recollection to the two heuristics. ERPs were markedly different for recognition heuristic-based decisions and fluency heuristic-based decisions, suggesting a role for familiarity in the recognition heuristic and recollection in the fluency heuristic. In a follow-up behavioral experiment, we coupled a remember-know procedure with a city-size comparison task. Although current literature suggests the fluency heuristic relies on retrieval fluency alone, our preliminary results suggest differential contributions of retrieval fluency and subjective memory (recollection) to fluency heuristic-based decisions.

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(3157)

Susceptibility to Hindsight Memory Distortion is Negatively Correlated With Susceptibility to the Misinformation Effect.

DUSTIN P. CALVILLO, *California State University, San Marcos*, DAYNA M. GOMES, *Simon Fraser University*—Two forms of memory distortion, hindsight bias and the misinformation effect, are typically measured with similar designs. Hindsight bias occurs when individuals make judgments, are provided with feedback, and recall their original judgments as being more similar to the feedback than they actually were. The misinformation effect occurs when individuals witness an event, are provided with misinformation, and recall the original event as containing elements of the misinformation. Seventy-five participants completed a hindsight bias task, a misinformation task, and some individual difference measures related to memory distortions. Working memory capacity was negatively correlated with both hindsight bias and the misinformation effect, but hindsight bias was negatively correlated with the misinformation effect. Although hindsight bias and the misinformation effect are measured with similar designs and both are predicted by working memory capacity, the negative correlation between these two phenomena suggests they result from different processes.

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(3158)

Individual Differences In Interpretation of Weather Forecast Uncertainty.

MARGARET A. GROUNDS and SUSAN JOSLYN, *University of Washington*—Previous research on predictive interval forecasts found that people understand complex expressions of uncertainty and make better decisions when they are available. However, people make two systematic errors: Deterministic Construal Error, misinterpreting the uncertainty forecast as deterministic and Subadditivity, judging the probability of the whole to be less than the sum of the parts. Errors may be due to limitations in working memory capacity. Uncertainty requires decision-makers to consider multiple possible outcomes increasing working memory load. Errors could also be due to lack of numeracy skills because forecasts are expressed numerically. In an attempt to explain these errors, we had participants complete a weather forecast decision task as well as a numeracy and a working memory



capacity assessment. Numeracy was a moderate predictor of both errors while working memory capacity was a moderate predictor of the Deterministic Construal Error. Limitations and implications of these results will be discussed.

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(3159)

The Role of Working Memory in Decision Strategies.

HANNA B. FECHNER, LAEL J. SCHOOLER and THORSTEN PACHUR, *Max Planck Institute for Human Development*—How and why does working memory load affect the use and selection of different decision strategies? Within a dual-task paradigm, participants decided which of two animals had the longer lifespan given several probabilistic cues. Working memory load was manipulated by way of a secondary task, in which participants had to count bird voices. Experiment 1 examined the impact of working memory load on strategy execution. Participants were instructed to use a noncompensatory strategy (take-the-best) or a compensatory strategy (tallying), manipulated between subjects. Results show time costs for take-the-best under high working memory load, while tallying remained relatively unaffected. Using the cognitive architecture ACT-R, we investigate to what extent these interference effects might arise from an interplay between the problem state representation and long-term memory processes. In Experiment 2, participants were not instructed to use a particular decision strategy to study the effects of working memory load on strategy selection.

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(3160)

Mapping the Time Course of Confidence Judgments in Facial Recognition.

PATRYCJA A. ZDZIARSKA, SHULI YU and TIMOTHY J. PLESKAC, *Michigan State University*—Time heals all wounds, does it mend confidence bias? We investigated the time course of confidence judgments in a facial recognition paradigm. Across two studies, participants learned a set of faces and then took a memory test where for each test face they made a recognition decision and then expressed how confident they were in that decision. Confidence judgment time was manipulated either indirectly through time pressure at the time of the recognition decision (study 1) or directly by fixing decision time and varying confidence judgment time from 500-4000ms (study 2). Results from study 1 do not show an effect of time pressure on confidence judgment time. Both studies reveal an initial bias to rate faces that were thought to have been seen previously with high confidence. Furthermore, results show a correction of this bias with longer confidence judgment time leading to better overall confidence resolution.

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(3161)

Waiting When Both Certainty and Magnitude are Increasing: Certainty Overshadows Magnitude Again.

TARA L. WEBB, *Southern Illinois University Carbondale*, MICHAEL E. YOUNG, *Kansas State University*—The tradeoff in preferences between probability, delay, and magnitude is fundamental to everyday decisions. The current study was

designed to determine the relative impacts of magnitude and probability when they were both increasing over a 10 s delay by using a modified version of the escalating interest task. A first-person shooter video game was adapted for the study of choice when both outcome magnitude and probability of reinforcement were increasing either in unison (Experiment 1) or at different rates (Experiment 2) over a 10 s delay to maximum weapon charge. Experiment 1 showed that participants waited longer to ensure a greater probability than to ensure a greater magnitude and even longer when they changed in unison. Experiment 2 revealed more sensitivity to changes in probability than to changes in magnitude.

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(3162)

Confidence in Simple Decisions.

STEPHEN M. FLEMING, *New York University*—Confidence in decision-making is presumably affected by intrinsic factors, such as task difficulty, and extrinsic factors, such as the setting of a decision threshold, fatigue, and so forth. It is unknown how these factors affect confidence in simple decisions. Here we examine the link between confidence and different elements of the decision process. We start with the well-validated drift-diffusion model (DDM) of choice and RT (Ratcliff, 1978), but remain agnostic about how confidence is related to model parameters. 32 subjects carried out a near-threshold visual discrimination task followed by a confidence judgment. Fits to choice and RT data were carried out using the Hierarchical DDM (HDDM) toolbox (http://ski.clps.brown.edu/hddm_docs/index.html). A model with both drift rate (v) and threshold (a) varying between confidence levels provided the best fit to the data. Drift rate (v) was found to be lower when confidence was lower, indicating that (subjectively) more difficult judgments are held with lower confidence. More surprisingly, the threshold (a) was also increased when confidence was lower. This result indicates that confidence is driven by factors extrinsic to the strength of evidence supporting a choice.

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(3163)

Modeling Response Bias.

CHELSEA VOSKUILEN and ROGER RATCLIFF, *The Ohio State University*, PHILIP SMITH, *The University of Melbourne*—We used a diffusion model to examine the effects of a bias manipulation on response time data collected from a two-choice asterisk task. In this task, subjects are asked to determine whether the number of asterisks in a grid was larger or smaller than an experimenter-provided cutoff value. On some blocks of trials, there were either three times more large trials or three times more small trials. Consistent with previous research (Leite & Ratcliff, 2011; Ratcliff, Van Zandt & McKoon, 1999), this bias manipulation was best accounted for by changes in the starting-point of the diffusion process. Unlike recent work by Hanks, Mazurek, Kiani, Hopp, and Shadlen (2011), we found no evidence for changes in the drift criterion as a function of the bias manipulation. Models with collapsing bounds were also tested and compared with models with fixed bounds.

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(3164)

Anchoring on Warning Severity When Making Judgments about Weather Threats. JOY E. LOSEE, KAREN Z. NAUFEL and LAWRENCE LOCKER, *Georgia Southern University* (Sponsored by Kent Bodily)—Anchoring on Warning Severity When Making Judgments about Weather Threats Weather forecasts change, which means that judgments about weather severity involve uncertainty. When making judgments under uncertainty, people anchor on initial values (e.g., Tversky & Kahneman, 1985) or salient qualities like severity (Joslyn et al., 2011). We tested anchoring's role in the judgment of the perceived threat of a hurricane that changed in severity across two warnings (e.g., strengthened from a Category 1 to a Category 5 hurricane or weakened from a Category 5 to a Category 1 hurricane) or remained stable (e.g., remained at a Category 1 or 5 status). Results showed that participants judged the hurricane to be a high threat for all conditions with a Category 5 warning, even if the warning sequence downgraded the hurricane from a Category 5 to a Category 1. This finding suggests that the anchoring heuristic is employed when making judgments about a single weather threat forecasted across a series of warnings.

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(3165)

Improving Compliance With Weather Warnings. JARED E. LECLERC, SUSAN L. JOSLYN, *University of Washington*—Despite improvements in forecasting extreme weather events, the number of injuries and deaths related to noncompliance with weather warnings remains unacceptably high. One way to increase compliance might be to combat the “cry wolf” effect by raising the threshold at which warnings are issued to reduce false alarms. Another way might be to include a probabilistic uncertainty estimate. In an experiment, participants made weather-related decisions using forecasts and automated decision advice. We systematically manipulated the false alarm rate of the decision advice. Although we found a false alarm effect overall, participants given advice with a low false alarm rate did no better than participants given economically optimal advice. However, participants who were also given a probabilistic uncertainty estimate performed significantly better and were more compliant than those given economically optimal advice alone. Results are discussed in terms of how best to promote compliance with weather warnings.

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(3166)

What Are the Limits of Human Predictions via Bayesian Inference? PETE CASSEY, *The University of Newcastle*, GUY HAWKINS and CHRIS DONKIN, *University of New South Wales*, SCOTT D. BROWN, *The University of Newcastle*—People make predictions about everyday events frequently, and easily. Previous work has demonstrated that these predictions are consistent - in many ways - with statistically optimal Bayesian inference. We explore conditions under which human predictions deviate from Bayesian inference. For example, normatively irrelevant changes in the wording of the prediction question can induce large changes in participants' predictions. Such findings might imply that

human predictions are not consistent with Bayesian inference. Alternatively, many of our results can be made consistent with humans making predictions via Bayesian inference, if one allows substantial freedom in the participants' goals - their behavior is almost always Bayes-optimal, given sufficient leeway in considering exactly what the participant might be trying to optimize. We explore the implications of these findings for theoretical accounts of prediction.

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(3167)

Moral Judgments Under Uncertainty. SHROOQ ALZHRANI, *City University London*, PETKO KUSEV, *Kingston University London*, PAUL VAN SCHAİK, *Teesside University*—Research on ‘moral dilemmas’ has shown that respondents judge personal moral actions (“to push” in the footbridge dilemma) as less appropriate than equivalent impersonal moral actions (“to switch” in the trolley dilemma). Furthermore, theorists argued (e.g., Greene et al., 2001) that judgments of appropriateness in personal moral dilemmas are (i) more emotionally salient than impersonal moral dilemmas, and (ii) more cognitively demanding, as respondents spend relatively more time judging the appropriateness of personal moral actions. In contrast, in one experiment, we found that (i) the level of uncertainty regarding moral actions predicted judgments of appropriateness and (ii) participants spent relatively more time judging the appropriateness of actions in moral dilemmas with a high level of uncertainty. These results question existing theoretical accounts based on “cognitive emotional parameters” in processing of morally sensitive information, and offer a simple cognitive explanation, based on learning and elimination of uncertainty.

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(3168)

Moral Decisions: Religious Beliefs Override “Logic” when Cognitive Capacity is Reduced. SARAH E. CAVRAK and HEATHER M. KLEIDER, *Georgia State University*—Two studies investigated the impact of religion on moral decisions. We hypothesized that religious rules function as moral decision heuristics, conserving cognitive effort, and if examined alongside cognitive ability, then would underpin use of ‘hot/emotion-based’ versus ‘cold/logic-based’ system processes during moral decision making. In Study 1, participants made forced-choice decisions about moral (trolley-type) and nonmoral (neutral) dilemmas. Cognitive ability (WMC) and religiosity were measured. Results indicate that lowWMC/religious participants made more rule-based decisions (consistent with religious dogma) to moral dilemmas than either highWMC/religious or lowWMC/nonreligious persons. In Study 2, participants were cognitively loaded when rendering moral decisions. Preliminary data suggest that load selectively impacts the highWMC/religious participants leading to more religious-rule-based decisions that those rendered in Study 1. Overall results suggest that religiosity impacts moral decisions only when cognitive resources are insufficient to balance the demands of both moral and religious rules.

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(3169)

Predicting Judgments of Randomness. BJORN HUBERT-WALLANDER and GEOFFREY M. BOYNTON, *University of Washington* (Sponsored by John Palmer)—Why do some sequences of outcomes seem “random” and others more like a pattern? Conventional wisdom suggests several factors, but evidence for these is often subjective and anecdotal. In Experiment 1, we built a model that can estimate with high accuracy and reliability the perceived randomness of simple binary sequences (e.g., a string of coin flips) using only three simple statistical descriptions of the stimulus. In Experiments 2 and 3, we found that the fitted model generalizes very well to predict the perceived randomness of both longer and differently represented sequences. Finally, we demonstrate an interesting application: given a binary sequence with a subset of pre-specified elements, we can fill in the remaining elements to produce a sequence that will appear either maximally random or maximally patterned to a typical human observer. Email: Bjorn Hubert-Wallander, bjornhw@uw.edu

(3170)

The Role of Format, Salience, Validity, and Discriminability in Judgment. LISA FIORENZO and ANDREW L. COHEN, *University of Massachusetts*—Research on the effectiveness of using different graphical presentation formats to display information has found that certain formats facilitate performance on judgment tasks, while other formats hinder the ease with which information is processed. MacGregor and Slovic (1986) investigated the comparative efficacy of a variety of display formats for a cue combination task and, using a lens model framework, found that judgment performance was improved or attenuated by the degree to which the display format provided a match between the validity of cues and the psychological salience of a display's features. Utilizing behavioral and eye tracking measures, a series of experiments replicates and extends these basic findings. Results suggest that salience alone is an incomplete explanation of this phenomenon; rather, it is the visual discriminability of the display format's features which elicits improved performance for certain graphical display types. Email: Andrew Cohen, acohen@psych.umass.edu

• ANIMAL LEARNING AND COGNITION •

(3171)

Two-Choice Matching-to-Sample Accuracy in Pigeons is Not Reduced by Extraneous Reinforcement. DOUGLAS S. GRANT, *University of Alberta*—Blough (1998) proposed an instance-based memory model of discrimination performance. The model assumes that the occasion for memory storage is reinforcement, not trial termination. Whenever reinforcement occurs, a memory record is stored that codes whatever stimulus and response information is available at that time. Consistent with this model, Blough found that delivering extraneous reinforcers (i.e., reinforcers that were not contingent upon correct responding), rapidly and markedly reduced discrimination accuracy. We assessed

the applicability of Blough's theory to performance in a two-choice identity matching-to-sample task involving blue and yellow samples and comparison stimuli. Several experiments failed to reveal any evidence that accuracy was reduced by extraneous reinforcement. In the most robust test of his theory, correct choices were reinforced with $p=.05$ and 50% of trials terminated in extraneous reinforcement (no choice test). Our results suggest, at the least, that Blough's theory is not applicable to all types of discrimination tasks. Email: Douglas Grant, douglas.grant@ualberta.ca

(3172)

The Near Miss Effect in Pigeons. JESSICA P. STAGNER, MARY F. STICKLEN and THOMAS R. ZENTALL, *University of Kentucky*—On a three-reel slot machine, what is referred to as a “near miss” (or more accurately a near hit) occurs when the winning symbols on the first two reels line up on the payoff line but the winning symbol on the third reel does not. This may be perceived by humans as closer to a win than a clear loss and may encourage more gambling behavior. Maclin, Dixon, Daugherty and Small (2007) found that when given a choice between two slot machines with wins and losses on the two machines equated, people preferred the machine that resulted in more near hits. We tested pigeons on a similar task by giving them a choice between two alternatives, one that sometimes provided near hit trials while the other did not. With the probability of reinforcement equated, pigeons showed a clear preference for the alternative that did not include near hit trials. We attribute the difference between humans and pigeons to the illusion of control by humans (humans overgeneralize from contexts in which their behavior affects the outcome, e.g., shooting a basketball) whereas the effect of near hits on pigeons appears to be the devaluation of the conditioned reinforcer. Email: Thomas Zentall, zentall@uky.edu

(3173)

Number of Exemplars Control Abstract Rule use in a Reversal Learning Task With Pigeons. ADAM M. GOODMAN, *Auburn University*, JOHN F. MAGNOTTI and ANTHONY A. WRIGHT, *University of Texas Medical School at Houston*, JEFFREY S. KATZ, *Auburn University*—Three experiments employed novel assessments of abstract-concept utilization in four pigeons using a simultaneous two-item same/different task. Pecks to the lower of two pictures for same trials or a rectangle beside the lower picture for different trials were rewarded. Upon reaching criterion, these correct responses were reversed until pigeons reached criterion. Such reversals were repeated using a 1024-item set-size, which promotes relational strategies. Once reversal acquisitions appeared stable, relational rule-use was tested by intermixing novel-item trials at the start of a reversal in Experiment 1. Experiment 2 tested the effect of spacing stimulus configurations on strategies. Experiment 3 examined reversals and carry-over effects using a 2-item training set-size to promote item-specific strategies. Testing revealed equivalent acquisition performance for novel-item and training trials in experiments 1 and 2, but not experiment 3. These findings

provide converging evidence using a reversal manipulation, in which item-specific and relational strategies correspond to relative set-sizes.

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(3174)

Decay Happens: The Neurobiology of Active Forgetting in Long-Term Memory. OLIVER HARDT, *The University of Edinburgh*, PAOLA V. MIGUES, JACINDA WONG, SEUNGHYUN KO and JEONGHO LYU, *McGill University*, YU TIAN WANG, *University of British Columbia*, KARIM NADER, *McGill University* (Sponsored by Almut Hupbach)—Forgetting has been extensively studied, but its underlying neurobiology is poorly understood. Research into long-term memory maintenance may shed light on biological forgetting processes. Long-term memory persistence depends on sustaining GluA2-containing AMPA receptors (GluA2/AMPA) at post-synaptic sites, and memory strength correlates positively with their level of expression. Therefore we tested whether removal of post-synaptic GluA2/AMPA receptors underpins forgetting of consolidated long-term memory. We found that blocking activity-dependent removal of GluA2/AMPA receptors in the hippocampus prevented time-dependent forgetting of object location memory in rats. This treatment did not prevent interference because blocking the removal of GluA2/AMPA receptors potentiated new learning, rather than impairing it. Blocking NMDA receptors also attenuated forgetting, while enhancing their function accelerated it. We thus identify the biological substrate of a forgetting process in the hippocampus that requires NMDA receptor activation and removes GluA2/AMPA receptors to eliminate consolidated memories over time. Our data establish that interference does not mediate all forgetting in long-term memory, but that, perhaps predominantly, decay happens.

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(3175)

Rats' Use of Spatial and Non-spatial Cues to Anticipate a Broken Rung on the Inclined Ladder. DANIEL LOPATIN, JORDYNNE ROPAT, MEIGHAN MINEAU and JEROME COHEN, *University of Windsor*—We examined rats' use of spatial and non-spatial cues that signal potential 'danger' on their path back to their 'home' base. Rats had to traverse a slightly inclined ladder to their individual holding cages for their end-of-day food rations. One of the rungs on the ladder would collapse when the rat stepped on it with its 'full' weight. On some trials, the broken rung was cued by a rubber-coated rung either as the broken rung or on the rung just before it while on other trials the broken rung occurred without any such non-spatial cue. We assessed rats' use of these two kinds of information to anticipate the broken rung by measuring where they began to reduce their speed as they approached it and if they stepped lightly on it or over it when either source of information occurred together or separately.

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(3176)

Rats' Object-Recognition Working Memory of Simultaneously and Separately Processed Non-Spatial and Spatial Information. BERNABO MATTEO, CORRINE KESHEN and JEROME COHEN, *University of Windsor*—Rats learned to find which one of four objects had been missing from a previously exposed array when either objects' locations were fixed (Fixed Location group) or were varied (Varied Locations group) over trials. Increasing the interval between the 'study' array of three objects and the 'test' array of four objects (the retention interval) was expected to reduce rats' accuracy for finding the missing object more in the varied than fixed locations group when both non-spatial and spatial cues were relevant. The opposite difference was expected when only one of these sources of information was relevant in a trial's test array. These predictions are based on the hypothesis supported in previous research from our laboratory suggesting that rats in the fixed locations group simultaneously process objects' spatial and non-spatial information while those in the varied locations group separately process them.

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(3177)

Pinyon Jays Share...Sometimes? The Role of Dominance and Reciprocity in Food Sharing. JUAN F. DUQUE and JEFFREY R. STEVENS, *University of Nebraska-Lincoln*—Prosocial behaviors are those that improve the welfare of others. In the case of sharing food, a recipient gains a benefit at the expense of another individual, the donor. While expected in parent-offspring and pair-bonded individuals, it is unclear why, and under what circumstances this takes place in other cases. Here we examine factors that may influence an individual's propensity to voluntarily share food. In pinyon jays, we have documented many donor-initiated sharing events using two adjacent cages where one bird has access to food and another does not. Though some birds share, other individuals never share, suggesting that individuals differ in their propensity to share food. Furthermore, specific pairings of birds lead to more sharing, indicating a synergistic or dyad-specific effect. Ongoing research is examining the interplay between dominance position and propensity to share, and also whether sharing events tend to be reciprocated. The spontaneous, voluntary sharing observed suggests a level of prosociality previously unknown in this corvid, and provides a model for testing proximate mechanisms underlying this behavior.

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(3178)

Visual Nesting of Stimuli Affects Rhesus Monkeys' (*Macaca mulatta*) Quantity Judgments in a Bisection Task. AUDREY E. PARRISH and MICHAEL J. BERAN, *Georgia State University*—Nonhuman animals are proficient at quantity judgments, although those are constrained by the ratio between sets as predicted by the Approximate Number System (ANS). Animals also show some of the same perceptual biases in quantifying sets that humans show based on the organization of stimuli. Here, we demonstrated a perceptual bias that emerges from the illusion of nested sets.



Rhesus monkeys (*Macaca mulatta*) classified arrays of circles presented on a computer screen as numerically larger than or smaller than an established central value. Like humans, macaques showed a pattern of biased perception in which they underestimated quantities when circles were nested within each other, a pattern predicted by ANS estimation. Although some macaques overcame this perceptual bias with experience over time, or were relatively immune to the bias from the outset of testing, the majority of the monkeys underestimated the quantity of nested arrays throughout the experiment.

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(3179)

Metacognitive-Like Information Seeking in Lion-Tailed Macaques (*Macaca silenus*): A Generalized Search Strategy After All? HEIDI L. MARSH, *Bucknell University*, SUZANNE E. MACDONALD, *York University*—Old World primates seek information about the location of a hidden food item, unless they are privy to the hiding process, which has been interpreted as evidence of metacognition. In the present research, lion-tailed macaques were tested on an object choice task. Conditions varied with respect to whether the hidden food was shown to subjects before a choice was required, and whether its location could be inferred by logical exclusion. Additionally, the hidden food could be located visually before a choice was made, by peering under the objects through a Plexiglas tray. Across conditions, monkeys consistently looked for the food when it had not been seen, even if its location could be inferred. This suggests that apparently 'metacognitive' information seeking in monkeys may instead reflect a generalized search strategy, in which subjects reach for food when it is seen, or look for food until it is spotted.

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• STATISTICS AND METHODOLOGY •

(3180)

Multidimensional Scaling for Comparing Problem Solving Knowledge to an Ideal. LAUREN E. MARGULIEUX and RICHARD CATRAMBONE, *Georgia Institute of Technology*—Instructions to learners were manipulated to assess their effect on problem solving performance on computer programming tasks. Instructions that emphasized subgoals, compared to conventional instructions, were predicted to help novices mentally organize their knowledge better (i.e., closer to an ideal organization) and solve problems more successfully. To measure knowledge organization, participants were asked to sort cards into groups based on similarity. Participants' categorizations were compared to an ideal using nonmetric multidimensional scaling. Multidimensional scaling maps items (e.g., cards) in p dimensions in such a way that more distance between items corresponds to less similarity between items. Coordinates for each condition's average categorization

and the ideal were made. Next, orthogonal Procrustean rotation was used to rotate each map to the same orientation. The square root of mean differences for each dimension and the maps showed how each condition's categorization differed from the ideal.

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(3181)

Modeling Latent Factors in Decision Making Tasks. JOACHIM VANDEKERCKHOVE, *University of California, Irvine*—Empirically validated cognitive models can be used as measurement tools. The individual differences that are observed in cognitive parameters can then be linked to external covariates (such as intelligence), but can also be deconstructed into constituent components using latent variable techniques. Cognitive latent variable models form a broad category of formal models that can be used to aggregate information regarding cognitive parameters across participants and tasks. Latent structures are borrowed from a vast literature in the field of psychometrics, and robust cognitive process models can be drawn from the cognitive science literature. This approach is ideally suited for uncovering correlations between latent task abilities as they are expressed in experimental paradigms, and the latent abilities can in turn be connected to external measurements. One example application deals with the structure of cognitive abilities underlying a simple perceptual task, another with executive functioning.

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(3182)

Tetrachoric Correlation Methods for Multidimensional Signal Detection Theory. LESLIE M. BLAHA, *U.S. Air Force Research Laboratory*, TAMARYN MENNEER, *University of Southampton*, MICHAEL J. WENGER, *University of Oklahoma*—We evaluated multiple applications of tetrachoric correlation estimates as candidate techniques for modeling data in studies employing general recognition theory (GRT). GRT is a multidimensional signal detection theory providing a rigorous framework for distinguishing perceptual and decisional effects when perceptual dimensions interact (Ashby & Townsend, 1986). Within GRT, model construct violations can be represented as non-zero correlations in multiple aspects of the GRT space, which are not directly estimated by traditional GRT analyses. New marginal and conditional tetrachoric correlation analyses were developed and applied to simulated GRT data to determine their ability both to detect correlations present in the confusion matrix data and to distinguish different violations of perceptual and decisional independence. Marginal analyses detected opposite correlations from perceptual and decisional separability violations, corroborated by conditional analyses, which also detected perceptual independence violations. These new analyses illustrate patterns of correlations within confusion matrices that can augment traditional signal detection analyses.

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(3183)

Meta-Analysis of ROC Curves From Experimental Data.

JUAN BOTELLA and MANUEL SUERO, *Universidad Autónoma de Madrid*, JESÚS PRIVADO, *Universidad Complutense de Madrid*—Some procedures often employed for meta-analysis of ROC curves with experimental results (especially with recognition memory data) are not correct. Specifically, calculating the simple arithmetic mean of the average hits and false alarm rates ignores most features of the data. Furthermore, the simple mean of the estimates of the parameters is neither a procedure that takes in account all the features involved. The estimates obtained with procedures that take in account all those features should show higher accuracy. The results of a simulation study that cover several scenarios are presented. In all them they are assumed two assumptions: (a) homocedastic normal distributions; and (b) the distributions of the sample sizes and of the set of studies con follow uniform or triangular distributions. The results show the benefits of the procedure proposed. Although the bias does is small the efficiency does improve, as it does the coverage of the confidence intervals.

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(3184)

Representation of Variance and its Impact on Mean Size Estimation in Visual Short-Term Memory.

YELDA SEMIZER and AYSECAN BODUROGLU, *Bogazici University*—Most research on statistical summary representations have focused on representation of average tendencies of visual features. In a series of experiments we examined how variance in displays are represented in visual short-term memory and how variance impacts mean size judgments. In two experiments, participants judged whether two consecutively presented displays consisting of circles of various sizes and yet with identical means also have the same variance. When the second display had higher as opposed to lower variance, accuracy was significantly lower suggesting that people were overestimating the variance of the initial display. A separate set of experiments in which participants estimated mean size of either circles or lines demonstrated that there was greater error and a systematic bias to overestimate mean size in high variance as opposed to low variance and homogenous displays. These findings demonstrate a tendency to represent visual displays as more variable than they are.

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(3185)

Effect Sizes Should Be Easy: A Windows Program to Calculate Effect Sizes and Their Confidence Intervals.

ERIN M. BUCHANAN, KATHRENE D. VALENTINE, LISA COTA, CORY DERRINGER and CARRIE MELIA, *Missouri State University*—Although the APA (2001, 2010) has strongly encouraged the use of effect size reporting in journal publications, current report rates are only moderate for clinical sources (40%) and somewhat better for non-clinical sources (70%; Fritz, Scherndl, & Kühberger, 2013). This presentation will outline a new free effect size program that was developed to calculate various effect sizes, Cohen's d , ω , η^2 , r/R^2 , ϕ , f , and odds-ratios, and their corresponding confidence intervals. We

have included options for users to calculate from information traditionally provided in journal articles (for power or meta-analyses) or output from statistical analyses programs like SPSS. Users can navigate by selecting an effect size or the statistical test performed (such as independent t), which provides flexibility depending on the goals and knowledge level of the user. Recent publications on the “replication crisis” have shown that effect sizes and their confidence intervals can give us powerful insight into the potential file drawer of a study, as well as the ability to examine if an effect is consistent with a particular size. Development and applications of the program will be discussed.

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(3186)

Robust Misinterpretation of Confidence Intervals.

RINK HOEKSTRA and RICHARD D. MOREY, *University of Groningen*, JEFF N. ROUDER, *University of Missouri*, ERIC-JAN WAGENMAKERS, *University of Groningen*—Null hypothesis significance testing (NHST) is undoubtedly the most common inferential technique used to justify claims in the social sciences. Even defenders of NHST seem to agree that its outcomes are often misinterpreted. Confidence intervals (CIs) have frequently been presented as a more useful alternative to NHST, and are even strongly encouraged in the APA Manual. Nevertheless, little is known about how researchers interpret CIs. In this study, 120 researchers and 442 students – all in Psychology -- were asked to indicate whether statements reflecting possible interpretations of CIs were correct. Although all statements were incorrect, researchers and students endorsed on average more than three statements, indicating a gross misunderstanding of CIs. Moreover, self-declared experience with statistics did not seem related to researchers' performance, and researchers hardly outperformed students who had had no education on statistical inference whatsoever. Our findings suggest that many researchers do not know the correct interpretation of a confidence interval. These misunderstandings are particularly unfortunate because NHST and CIs are the main tools by which psychologists draw conclusions from data.

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(3187)

A Hierarchical Bayesian Approach to Distinguishing Serial and Parallel Processing.

JOSEPH W. HOUP, *Wright State University*, MARIO FIFIC, *Grand Valley State University*—Research in cognitive psychology often focuses on how people deal with multiple sources of information. One important aspect of this research is whether people use the information in parallel (at the same time) or serially (one at a time). Various approaches to distinguishing parallel and serial processing have been proposed, but many do not appropriately control workload (how processing changes as more sources are added). The mean interaction contrast (MIC) is one measure that does not confound the serial-parallel question with workload. The MIC has been applied in limited settings because the measure required a large number of trials and lacked a mechanism for group level inferences. We address these shortcomings by using hierarchical Bayesian analyses. The combination of the



MIC with hierarchical Bayesian modeling gives a powerful method for distinguishing serial and parallel processing at both individual and group levels, even with a limited number of participants and trials.

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(3188)

MorePower 6.0 for ANOVA With Bayesian (BIC) Hypothesis Testing. JAMIE I.D. CAMPBELL and VALERIE A. THOMPSON, *University of Saskatchewan*—MorePower 6.0 computes sample size, effect size and power statistics for a specified ANOVA effect. It also calculates confidence intervals for the effect based on formulas from Masson and Loftus (2003; see also Jarmasz and Hollands, 2009), as well as Bayesian posterior probabilities for the null and alternative hypotheses using the Bayesian Information Criterion (Masson, 2011; Wagenmakers, 2007). The program affords a straightforward comparison of these alternative approaches to interpretation of ANOVA. MorePower 6.0 is freely available at <https://wiki.usask.ca/pages/viewpage.action?pageId=420413544>.

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(3189)

Change in Intra-Individual Variability in Older Adults and Individual Differences: A Longitudinal Study. DELPHINE FAGOT, NATHALIE MELLA and ANIK DE RIBAUPIERRE, *University of Geneva*—It is commonly accepted that most cognitive abilities decline with advancing age in adults, at least as concerns the average performance. In contrast, change in intraindividual variability (IIV) is less investigated, despite growing evidence that IIV predicts long-term decline in cognitive skills. This presentation will 1) examine within-individual changes in both mean level and IIV, in a longitudinal study for which three occasions of measurement have taken place every two years, 2) compare individual profiles of change or stability across tasks. Various tests measuring cognitive performance at different complexity levels were administered to older adults (N=215, 71.1 years at T1). A bootstrap method was used, in the response time tasks, in order to reliably define change in cognitive performance at the level of the individuals. Results show that, independent of the tasks, interindividual differences are very large, and decline is far from being the only pattern observed.

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(3190)

Evolution of Research Topics in Experimental Psychology: 50 Years of Psychonomic Session Titles. JASON R. FINLEY, *Washington University in St. Louis*, WILLIAM F. BREWER, *University of Illinois at Urbana-Champaign*—Session titles compiled from 50 years of annual meetings of the Psychonomic Society provide novel and uncensored insights into the evolution of research topics in experimental psychology from 1960 to 2009. We present a variety of visual representations of the data—including cladograms and word clouds—to vividly

illustrate patterns of emergence and extinction, convergence and divergence. In particular, we highlight the paradigm shift from behaviorism to cognitive psychology.

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(3191-3192)

Grant Funding Agencies. Information about various grant funding opportunities is available. Representatives will be present throughout the conference.

POSTER SESSION IV

Saturday Noon,

Sheraton Centre Toronto Hotel, Sheraton Hall

Viewing 10:00 a.m.-1:30 p.m., Author Present 12:00 noon-1:30 p.m.

• ACTION AND PERCEPTION III •

(4001)

How Do Observer's Responses Affect Visual Long-Term Memory? TAL MAKOVSKI, *The College of Management Academic Studies*, YUHONG V. JIANG and KHENA M. SWALLOW, *University of Minnesota*—How does responding to an object affect explicit memory for visual information? The close theoretical relationship between action and perception suggests that items that require a response should be better remembered than items that require no response. However, conclusive evidence for this claim is lacking, as semantic coherence, category size, and trial frequency often differ between stimuli that require a response and those that do not. Here we showed that memory is affected by response requirements, even when confounding factors were eliminated. Participants viewed a stream of images and encoded them into memory. During encoding, some images required a response whereas others did not. Although all images were task-relevant, images that were overtly responded to (e.g., with a button press) were better remembered than those that were not. However, the action itself was not critical to the memory advantage. Covertly counted images were better remembered than those that were not. Moreover, when participants pressed a button for most images, images that required withholding a button press were remembered better than the others. We conclude that the need to modify an ongoing activity results in improved memory.

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(4002)

Role of Working Memory in Transformation of Visual and Motor Representations For Use in Mental Simulation. CARL GABBARD and JIHYE LEE, *Texas A&M University*—This study examined the role of visual working memory when transforming visual representations to motor representations in the context of motor imagery. Young adult participants viewed randomized number sequences of 3-, 4-, and 5 digits, and then reproduced the sequence by finger tapping using motor imagery or actually executing the movements; movement duration was recorded. One group ($n = 42$) viewed the stimulus for 3 s and responded immediately at the tone, while the second group ($n = 43$) had a 3 s view followed by a 3 s blank screen delay before responding. As expected, delay group times were longer with each condition (imagined and executed) and digit load. Whereas correlations between conditions (temporal congruency) were significant in a positive direction for both groups, interestingly, the delay group's values were significantly stronger. That prompted speculation that delay influenced the congruency between motor representation and actual execution via internalization time.

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(4003)

Simulation as an Engine of Physical Scene Understanding. PETER BATTAGLIA, *Massachusetts Institute of Technology*, JESSICA HAMRICK, *University of California, Berkeley*, JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology*—In a glance, we can perceive whether a stack of dishes will topple, a branch will support a child's weight, a grocery bag is poorly packed, liable to tear or crush its contents, or a tool is firmly attached to a table or free to be lifted. Such rapid physical inferences are central to how people interact with the world and with each other, yet their computational underpinnings are not well understood. We propose a model based on an intuitive physics engine, a cognitive mechanism similar to computer engines that efficiently simulate rich physics in video games and graphics, but that uses probabilistic simulations to make robust inferences in complex natural scenes where crucial information is unobserved. Our model fits data from five psychophysical experiments, captures several illusions and biases, and explains core aspects of human mental models and common-sense reasoning that are instrumental to how humans understand their everyday world.

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(4004)

Driven by the Efficiency: Spatial Realignment in Sensorimotor Adaptation. LEI WANG and JOCHEN MÜSSELER, *RWTH Aachen University*—The present study reviewed the modular approach in adaptive motor control by taking cognitive efficiency into account. Three experiments were conducted to compare different visuomotor learning mechanisms (modular adaptation, use-dependent plasticity and spatial realignment) in response to visuomotor rotations. During exposure, the visual feedback of flicking movements in a single-target scenario was rotated either 30° clockwise (cw) or counterclockwise (ccw) at a left and right starting location. Exposure to the cw and ccw rotations was carried out in an alternating order. After adaptation to the rotations, generalization was evaluated by assessing aftereffects from a set of untrained starting locations to the target (Experiments 1 and 2) or from the trained starting locations to a set of new targets (Experiment 3). Predictions made based on the different visuomotor learning mechanisms were compared to the empirical data. In spite of evidential advantages of modular structure, the current work could show a particular case of visuomotor transformation, in which modularity lacks efficiency. Results indicate that the adaptive motor control system employed the spatial realignment to accomplish adaptation more efficiently.

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(4006)

Spatial Congruence (Simon) Effects on the Duration of Motor Processing?

JEFF MILLER, *University of Otago*—Vertical and horizontal spatial congruence (Simon) effects were examined with reaction times (RTs) and event-related potentials (ERPs) in a 4-choice task with left and right hand and foot responses. Irrelevantly, each stimulus appeared in one of four positions—above or below fixation and to its left or right—allowing separate measurement of horizontal and vertical congruence effects. RTs showed approximately equal effects of horizontal and vertical congruence, both for hand and foot responses, and these congruence effects were strongly under-additive. Stimulus- and response-locked motor-related ERPs were examined for effects of spatial congruence on the duration of motor processing. To avoid confounding with stimulus-related asymmetries, the effect of vertical congruence was assessed in ERPs with the lateralized readiness potential, which differentiates responses made with left and right sides of the body, and the effect of horizontal congruence was assessed with the limb selection potential, which differentiates hand and foot responses.

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(4007)

What Shape or Color Is the Door Handle? Correspondence Effects are Modulated by Object Location not Grasping Affordance. DANIEL GRAY, ELLIOTT JARDIN and MEI-CHING LIEN, *Oregon State University*, ROBERT W. PROCTOR, *Purdue University*—Previous studies have suggested that when the grasping response implied by a visual object is task-irrelevant, it nevertheless primes that response. Tipper, Paul, and Hayes (2006) argued that this action-affordance effect occurs only when the attended feature is associated with some potential action on the object. We examined this claim using event-related potentials (ERPs). Participants made a left or right keypress to the shape of the door handle in Experiment 1 or the color in Experiment 2. Handle orientation did or did not correspond with the response-key location. The handles were centered as in Tipper et al., or the base of the handle was centered (so the graspable part was clearly positioned left or right). We found correspondence effects in the base-centered condition but not the handle-centered condition. The effect was not evident in the P1 and N2 ERP components, thought to reflect vision and affordance-action binding. These findings suggest that location coding, not grasping affordance, produces the correspondence effect.

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(4008)

Expertise in Variance Discrimination of ‘Operation-Response Noise’ Influences Decision-Making Under Risk Increment Condition. SACHIYO UEDA, *Ochanomizu University*, REIKO YAKUSHIJIN, *Aoyama Gakuin University*, AKIRA ISHIGUCHI, *Ochanomizu University*—An information-processing system’s response like a computer outputs contains some noises. When these noises get larger, the system becomes uncontrollable and we are exposed to serious risks. In this study, we investigated whether expertise

in variance discrimination between inherent and abnormal noises influences the decision-making under avoidance of the risk. In the experiment, the observer operated the visual motion stimulus. The spatial noise was added to the visual feedback, and the observer’s threshold of the variance discrimination was measured. In this situation, the experts were defined through the training session by comparing an ideal observer. In the decision-making task, the noise variance gradually gets larger. When noise variance exceeds the risk level, the observer loses one’s score. Thus, they must make a decision to stop the operation. As a result, the experts stopped the operation more frequently than the novices when variance size was nearer to the risk criterion.

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(4009)

Temporal Coordination in Music Ensemble Performance:

Probing Forward Models. ANNA ZAMM and CAROLINE PALMER, *McGill University*, PETER Q. PFORDRESHER, *University at Buffalo, SUNY*—We investigated how musicians coordinate the timing of their action sequences during ensemble performance when self-generated auditory feedback is present or absent. Pairs of pianists performed three tasks: Solo performance, Unison (performing the same melody simultaneously), and Round (performing the same melody at a temporal offset from each other). During Unison and Round performances, pianists heard auditory feedback from both performers (Full) or only from their partner (Other). Although asynchronies indicated that pianists were sensitive to the presence of self-feedback (Full feedback), the absence of self-feedback (Other feedback condition) did not generate the expected breakdown of coordination. Instead, pianists adapted more to their partner when they heard only feedback from their partner (Other) and when they executed the same actions simultaneously (Unison performances). These findings question whether forward planning models, which typically assume that perceptual input is either treated as self-feedback (guiding planning) or as irrelevant, can account for ensemble music performance.

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(4010)

Who is Talking in Backward Crosstalk? How Action Goals

Influence Dual-Task Performance. MARKUS JANCZYK, *University of Würzburg* (Sponsored by Volker Franz)—Specific interference phenomena can influence dual-task costs, and commonly their direction and size are ascribed to overlaps in stimulus and response features of both tasks. One particularly interesting example is a variant of the backward crosstalk effect (BCE), where improved Task 1 performance is observed if the Task 2 response shares features with the response or stimulus of Task 1. Here I ask which aspects of responses are critical for BCEs. Inspired by effect-based models of action selection (e.g., the ideomotor theory) I suggest that not the bodily movement per se but rather its contingent, change in the environment (i.e. its action effect) is the crucial aspect. Across several experiments this assertion is supported: For example, BCEs occur when Response 1 shares features with the visual effect of Task 2 (instead of the mere observable motor movement), and

they occur when both responses yield similar visual effects. These results contribute to the understanding of dual-task performance and give some indications on how to facilitate dual-task performance.

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(4011)

Multimodal Integration During the Shaping of a Round Ceramic Cylinder. MOUNIA ZIAT, CHERYL KONIECZNY and BRIAN KAKAS, *Northern Michigan University*—Pottery is a multimodal task that involves visual, auditory, and tactile modalities. Indeed, a potter relies not only on her vision to shape the clay but also on the tactile contact with the clay and the sound produced by the potter's wheel during the process of creation. In this study, we compared the potters' performances to shape a round ceramic cylinder when deprived of a sensorial modality. Ceramic students were asked to shape the clay and were divided into groups: 1) participants of group 1 were blindfolded to remove the visual input, 2) participants of group 2 were wearing earplugs and headphones with a NRR of 62dB to prevent them from hearing the sound produced by the potter's wheel, and 3) participants of group 3 were wearing Nitrile gloves of 15 mil (0.381 mm) that reduce significantly the cutaneous contact with the clay. The results showed that the potters adapted very quickly to the task and succeeded to shape the cylinder despite the deprivation of one of their sensorial modality.

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• TESTING EFFECTS II •

(4012)

When Testing Does and Does Not Enhance Learning: The Case of Spelling. STEVEN C. PAN, BENJAMIN R. RUBIN and TIMOTHY C. RICKARD, *University of California, San Diego*—The two most commonly used methods for teaching spelling are testing with feedback and repeated writing. Those techniques were compared in three experiments that involved a training session and a retest one week later. A testing advantage was observed for the number of words recalled, but not for the proportion of words spelled correctly. In a fourth experiment, testing with feedback was compared to the more usual reading control, and a clear testing advantage was observed both for the number of words recalled and the proportion of words spelled correctly. These results raise the possibility that, in spelling as well as other domains, the reading control may not always be the most potent study reference against which to evaluate testing. The equivalent efficacy of testing and repeated writing for learning to spell raises the possibility that the two techniques engage the same learning mechanisms.

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(4013)

Incongruity Reveals the Brittleness of the (Pre)Testing Effect. JOSHUA F. DOXTATOR and GARY L. BRADSHAW, *Mississippi State University*—Testing facilitates long-term retention even when the test is given prior to the to-be-learned material. One experiment examined the congruency of pre-test, studied material, and post-test using a text describing the processes of mitosis. In the congruent condition, pre-test questions matched the phrasing in the text and in the post-test questions. In the incongruent condition, pre-test questions reversed the propositional focus of the text and the post-test. The congruent pre-test group performed better than the incongruent condition, revealing a striking limitation on transfer for the pre-test effect. Curiously, the pre-test effect vanished when the textual material had a different propositional focus than the post-test, regardless of the congruency between the pre-test and post-test. This experiment suggests that the pre-test effect is brittle and favors memorization over meaningful learning.

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(4014)

The Influence of Testing on Relational and Item-Specific Information. JOCELYN BRETON, SAMANTHA WASSERMAN, HILARY WOODWORTH, JULIANNE WIEBOLDT, HANNAH NEWMAN, MARIAM BOXWALA, NUTTIDA RUNGRATSAMEETAWEEMANA and JASON ARNDT, *Middlebury College*—We examined the effect of testing on item-specific and relational processing in a paradigm where participants learned English-Swahili word pairs. Word pairs were presented and either were repeatedly restudied or participants were prompted to recall the English word given the Swahili word as a retrieval cue. After a two-day retention interval, participants completed either a test of relational memory (associative recognition) or item memory (recognition of English and Swahili words in isolation). Results demonstrated that prior cued recall (testing) enhanced associative memory as well as item memory. Notably, testing enhanced item memory for both the to-be-recalled item (English words) and the recall cues (Swahili words). These results suggest that testing has wide-ranging effects that are not limited to enhancing only items that were retrieved from memory. Rather, testing also enhances memory for items that serves as cues for retrieval. Implications for theories of the testing effect will be discussed.

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(4015)

The Role of Temporal Context in Retrieval Practice Effects. JOSHUA W. WHIFFEN and *JEFFREY D. KARPICKE, *Purdue University*—A series of experiments tested the predictions made by the Temporal Context Theory (TCT) in regards to retrieval practice effects. Experiment 1 tested the prediction that retrieving the temporal context, accomplished with a list discrimination (LD) task, should lead to improved recall over a reread condition. This hypothesis was supported and further analyses with Adjusted Ratio of Clustering scores revealed temporally organized recall, which would be expected from a TCT perspective. Experiment 2 compared



LD to a pleasantness-rating task to explore how theoretically different types of processing influenced final recall and recall organization. Recall was equivalent, however ARC scores indicated different underlying mechanisms with LD recall more temporally organized than pleasantness. Experiment 3 examined retrieval of the temporal context using categorized word lists and an additional category judgment condition. This ensured that two possible recall organizations were present; temporal and categorical. Results again showed similar recall levels, but recall was temporally organized when making a LD and categorically organized for the other groups. All together these results provide initial support for the Temporal Context Theory.

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(4016)

Increasing Benefits in Learning With More Effortful Multiple Choice Tests. JESSICA M. LOGAN and ALDA G. RIVAS, *Rice University*—Repeated testing benefits memory more than re-studying information. Multiple choice tests generally yield reduced benefits of testing, compared to short answer tests, yet are still a very popular and convenient format for educators. The present study sought to increase the benefits of multiple choice tests by promoting more effortful retrieval while preserving their convenient form. Participants read four one-page essays and then either re-read the essay or completed tests that differed in the level of effort required to produce an answer (typical multiple choice or short answer). We also introduced a Multiple Choice-Generate format of testing, which required participants to generate an answer before choosing from the multiple choice options. After one week, participants took short answer tests for all essays. In addition to finding a testing effect, we found that initial short answer and multiple choice-generate tests produced the least forgetting over one week, while the typical multiple choice format produced the greatest forgetting. These findings offer a simple way to increase retrieval effort (and memory benefits) of a multiple choice test while maintaining its practical benefits in the classroom.

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(4017)

“All-of-the-Above”: When Multiple Correct Response Options Enhance the Testing Effect. ANTHONY J. BISHARA and LAUREN LANZO, *College of Charleston*—When multiple choice questions have more than one correct option, such questions may enhance the testing effect. In 3 experiments, we examined the influence of an initial test with an “all-of-the-above” (AOTA) option on later memory retention. The AOTA option enhanced memory retention as compared to both a no-test control condition and also a standard multiple choice condition, indicating that an AOTA option enhanced the testing effect. However, the benefit of an AOTA option only occurred when the option was correct, and thus multiple correct options appeared above it; an incorrect AOTA option led to similar testing effects as compared to

other conditions. Multiple correct options on an initial test may enhance learning and retention, perhaps as a result of deductive reasoning and/or additional familiarity.

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(4018)

Examining the Testing Effect Using the Dual-Process Signal Detection Model. NICOLE J. BIES-HERNANDEZ, *Northern Arizona University*, DAVID E. COPELAND and COLLEEN M. PARKS, *University of Nevada, Las Vegas*—This study examined whether the dual-process signal detection (DPSD) model (Yonelinas, 1994) offers a useful approach for investigating the testing effect (Roediger, Agarwal, Kang, & Marsh, 2010). Experiment 1 investigated whether the DPSD model could be used to examine the testing effect, and Experiments 2 and 3 investigated whether making the final test dependent on recollection would influence the magnitude of the testing effect and the parameter estimates of recollection and familiarity. The results demonstrated that when practice testing enhanced later memory, it also influenced the processes underlying the recognition memory judgments in a manner consistent with the DPSD model. Practice testing increased familiarity in all experiments and increased both familiarity and recollection when three practice tests were used. However, in a recollection-dependent final test format, differences between practice testing and restudying were only found with three practice sessions. Overall, this study demonstrated that the DPSD model can be used to examine the testing effect and may provide a useful approach for future research investigating the testing effect.

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(4019)

Testing Produces Transfer Using Authentic Educational Materials. KHUYEN NGUYEN and MARK A. MCDANIEL, *Washington University in St. Louis*—While testing has been shown to enhance memory for the tested information (i.e., testing effect), there is less empirical evidence that testing can produce transfer. Because authentic educational settings typically require students to be able to use learned information flexibly, it is important to investigate whether testing can produce transfer using authentic educational materials. Participants reading a chapter were assigned to either a highlighting condition or a testing condition. A week later they completed an exam that consisted of three types of questions: 1) questions verbatim to the quiz questions (quiz-verbatim), 2) questions using verbatim examples from the text (text-verbatim), and 3) new application questions (transfer). Our results indicated that testing enhanced performance on all three question types, with similar effect sizes for quiz-verbatim and transfer questions. Taken together, these results suggest that testing is capable of producing flexible knowledge that can be applied to new contexts.

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• ASSOCIATIVE LEARNING II •

(4020)

Sleep Enhancement of Visual Discrimination Performance is Modulated by Training Paradigm. STEVEN PAN and TIMOTHY C. RICKARD, *University of California, San Diego*—Previous studies indicate that performance on a visual texture discrimination task (TDT) is enhanced after a delay involving sleep. To further test that hypothesis, we applied a methodology used by Rickard et al. (2008) to study sleep and motor skills. All subjects underwent an evening TDT training session followed by a retest after a 24-hour delay involving normal sleep. We compared performance of a standard, massed training group to that of an optimized, spaced training group in which adaptation effects were reduced. Enhanced performance on the retest was observed in the standard training group but not the optimized training group. Retinotopic specificity was observed for both groups, indicating that training was sufficient to give rise to neural changes within the visual system. These findings invite a theoretical reinterpretation of prior results demonstrating enhanced visual discrimination performance following sleep. Email: Timothy Rickard, trickard@ucsd.edu

(4021)

Memory Consolidation During Rest: Replay and Reminding. JANE C. KOMSKY and COLLEEN M. KELLEY, *Florida State University*—Replay or reactivation of events during sleep may represent the process of memory consolidation. Wakeful rest periods also produce memory enhancement attributed to consolidation. The current study tests whether reactivation appears as conscious reminders during wakeful rest periods using verbal talk aloud protocols. Participants studied emotional and neutral pictures and took a recall test, followed by a period of rest, rest plus talk aloud, or the visual-spatial task of playing Tetris plus talk aloud, before being administered a second recall test. Talk aloud protocols during rest and Tetris both revealed that participants were reminded of the studied pictures, although the rate of reminders was much higher during rest than Tetris. Both the rest and the rest with protocols condition showed greater gains in recall from Test 1 to Test 2 than did the Tetris. Reminders during rest may contribute to the consolidation of memories. Email: Colleen Kelley, kelley@psy.fsu.edu

(4022)

Partial Memory Retrieval Leads to Inhibition of Cortical Memory Representations. JORDAN POPPENK and KENNETH A. NORMAN, *Princeton University*—Studies have linked moderate memory activation with impaired later memory retrieval. One explanation is moderate activation inhibits neural representations, making them harder to reactivate, but other explanations are possible. To assess these, we reactivated memories to differing degrees, then measured the impact on neural representations using fMRI. P¹s studied word-scene paired associates, and in a later RSVP task, monitored a word stream for fruits while word cues were presented for 600ms or 2000ms. We hypothesized short RSVP presentations would weakly activate memories and

later inhibit them, whereas longer RSVP presentations would elicit strong activity and cause no inhibition. We tested P¹s memory before and after RSVP, and assessed similarity of corresponding neural representations. For items omitted or cued strongly during RSVP, patterns better matched same-cue vs. other-cue patterns, indicating neural patterns retained item-specific information. Strikingly, we obtained the opposite pattern of results for items cued weakly during RSVP: patterns better matched other-cue patterns than same-cue patterns. Through simulation, we show that this pattern can only be obtained by inhibition of original neural representations. Email: Jordan Poppenk, jpoppenk@princeton.edu

(4023)

Learning and Forgetting in Visual Long-Term Memory. TIMOTHY F. LEW and EDWARD VUL, *University of California, San Diego*—The different kinds of errors people make when attempting to remember a fact demonstrate that accurate recall requires both the retrieval of a noisy memory and correctly associating various features of that memory. We asked subjects to learn and then recall the locations of different objects. Using a Gaussian mixture model, we then sorted their errors into those resulting from correct but noisy guesses, misassociations to other items and random guesses. We found that people easily formed accurate representations of locations that were retrievable for a long time despite additional decay in visual long-term memory while associations were formed slowly and quickly forgotten. Additionally, we found that random guessing reflects two distinct processes: the failure to retrieve a location memory or the failure to retrieve an association. Our results suggest that during both learning and forgetting, deteriorated memories may include high fidelity representations while losing the corresponding associations. Email: Timothy Lew, tflew@ucsd.edu

(4024)

The Importance of Contextual Variability in Word Learning. BRENDAN T. JOHNS, MELODY DYE and MICHAEL N. JONES, *Indiana University*—In a series of analyses over mega datasets, Jones, Johns, & Recchia (2012) and Johns, et al. (2012) found that a measure that takes into account the semantic variability of a word's contexts provides a better fit to both visual and spoken word data than word frequency or a context count. Jones, et al. (2012) strengthened this finding by conducting an artificial language experiment where it was found that processing savings for words only occurred when the repetition of a word was accompanied with a change of context. However, the importance of contextual variability has not yet been demonstrated empirically with natural language materials. To accomplish this, a set of low-frequency words were obtained. For each word, two sets of paragraphs were created: one set contained paragraphs from a single discourse topic (low variability) and one contained paragraphs from across topics (high variability). During training, each test word was replaced with a pseudoword. It was found that subjects were better able to learn new words when they were seen in the high contextual variability condition, and were also faster at processing them. A model of this result will be proposed. Email: Brendan Johns, johns4@indiana.edu



(4025)

Irrelevant Feature-Value Associations Intrude on Reward-Based Decision-Making. TIMOTHY J. VICKERY, *University of Delaware*—Many decisions depend on learning values reliably associated with features (e.g., color often predicts food quality). Human value-learning capabilities are well characterized by reinforcement learning (RL) models, which often assume that learners ignore irrelevant feature dimensions. A ‘four-armed bandit’ task was used to assess whether learning of irrelevant feature-value associations intrudes on decision-making. Four colors appeared in four locations, with the location of colors randomly determined on each trial. Participants selected an item and then were rewarded or not based on a probability that varied independently for each option over time. Reward probability was reliably associated with either color or location, and uncorrelated with the other dimension. Despite the fact that participants were fully informed of the relevant dimension, RL model comparisons suggest that they often inappropriately incorporated irrelevant and unreliable feature-value associations into decisions. These results suggest that feature-value associations may often be formed even when intentions and task demands encourage ignoring a dimension, sacrificing short-term gains in order to support flexible learning in an uncertain world.

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(4026)

The Role of Inhibition in Constraining Memory Binding Over Time: Age Differences in Cross-Pair Associations. KAREN L. CAMPBELL, *University of Cambridge*, LYNN HASHER, *University of Toronto* (Sponsored by Sara Shettleworth)—We recently demonstrated that older adults’ lessened inhibitory control leads them to form more extraneous associations between targets and simultaneously co-occurring distractors (Campbell, Hasher, & Thomas, 2010). The present study addressed whether inhibition is also needed to constrain memory binding over time. Specifically, we asked whether older adults form broad associations across memory trials on a learning task that typically requires the restriction of binding processes to individual pairs of items. Participants learned a list of word pairs and then received an associative recognition task in which rearranged pairs had originally occurred either close together or far apart in the study list. Older adults made more false alarms to near repairings than to far repairings, suggesting that these pairs seemed more familiar to them, possibly because they had formed associations across successive sets of pairs at study. Younger adults, on the other hand, showed no difference between the two types of rearranged pairs. These findings suggest that older adults, with their lessened ability to delete the recent past, may inadvertently form broader associations over time.

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(4027)

Statistical Learning and Visual Short-Term Memory Predict Acquisition of Chinese Literacy as a Second Language. UNA E.-Y. HSUAN, ESTHER H.-Y. SHIH and DAISY L. HUNG, *National Central University*, OVID J.-L.

TZENG, *Academia Sinica*, DENISE H. WU, *National Central University*—Learning to read a language is to connect word forms to their meanings, which requires mastering the systematic correlations among orthographic, phonological, morphological, and semantic properties of words. Previous research on young adults learning a second language indicated that literacy acquisition of both alphabetic (Hebrew) and non-alphabetic (Chinese) languages correlated with individuals’ sensitivity to implicit statistical regularities embedded in sequential visual stimuli, whose contribution was present even when the effects of non-verbal intelligence and working memory were controlled. Further results from native speakers of alphabetic languages learning to read Chinese revealed that in addition to individual difference of statistical learning, participants’ capacity of visual short-term memory also predicted their accuracy and fluency of reading Chinese characters. These findings highlight the universal significance of statistical learning in literacy acquisition of alphabetic and non-alphabetic languages alike. The results also point to specific importance of visual processing abilities in learning to read Chinese.

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• EXPLICIT MEMORY III •

(4028)

Tracking Compression and Expansion of Temporal Context in the Human Brain. TROY A. SMITH, VISHNU SREEKUMAR, SIMON DENNIS and PER B. SEDERBERG, *The Ohio State University*—To examine how long-range temporal context is 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 14-28 days. Approximately 2 weeks after the experience sampling phase, participants were presented with 120 images selected to serve as memory cues for specific episodes and asked to mentally “relive” the episodes while their brain activity was monitored using fMRI. Representational similarity analysis was used to identify brain regions where the pattern of differences in neural activity while remembering events correlated with the pattern of differences in the temporal distances between the original events. By using different measures of temporal distance (e.g., linear, logarithmic, and exponential), we were able to identify specific regions of the brain where the representation of retrieved temporal context is compressed and expanded.

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(4029)

FMRI Evidence for the Reinstatement of Encoding Mode During Retrieval. STACEY L. DANCKERT, COLIN M. MACLEOD and MYRA A. FERNANDES, *University of Waterloo* (Sponsored by Derek Besner)—Behavioral data from Jacoby’s memory-for-foils paradigm support the idea that a re-initiation of encoding-related processing occurs during a recognition test (Danckert et al, 2012; see also Jacoby

et al, 2005). We sought neural support with fMRI. Participants encoded a wordlist under deep (create an image) and another under shallow (picture the word in capital letters) instructions, and then performed separate recognition tests for the two lists. We identified brain regions, including temporal and frontal areas, related to encoding deep vs. shallow lists by contrasting BOLD signal for each study condition. To determine whether participants re-initiated task-related processing, we then contrasted activations for the lures from each test. We found that 10 of the 12 regions showing higher activation for deeply than shallowly studied words were again higher during the deep recognition test; similarly, all 4 regions showing higher activation for shallowly than deeply encoded words were active during the shallow recognition test. We argue that participants re-engage in the same processing during retrieval as they did during encoding, and that the same group of brain regions active at encoding become re-activated again during retrieval.

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(4030)

An fMRI Study of Temporal Memory in Absolute Identification. JUNGAA MOON and JOHN R. ANDERSON, *Carnegie Mellon University*—The current fMRI study investigated whether the same memory mechanisms can account for temporal and non-temporal information. Twenty participants performed absolute identification of time duration or length of the same stimuli. For both tasks, participants responded faster to the end items (the shortest or longest on that dimension) than to the middle items. Participants performed worse in the incongruent (mismatch between time and length magnitude) than in the congruent condition indicating cross-dimensional interference between time and length. There was greater fusiform activity for the end than middle items on the attended dimension, greater lateral inferior prefrontal activity in the incongruent than the congruent condition, and greater posterior parietal activity for the length than the time task. We developed an ACT-R model based on the base-level activation and spreading-activation mechanisms to explain those results. The results suggest that there are common memory principles for both temporal and non-temporal information.

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(4031)

Event-Related Potential Correlates of Individual Differences in Source Monitoring. JOHN E. KIAT and ROBERT F. BELLI, *University of Nebraska-Lincoln*—This study investigated event-related potential differences associated with individual variation in source monitoring ability. Seven participants were recruited based on prior performance on a picture-word source monitoring test (3 poor and 4 high performers) administered in an earlier study. These participants completed a imagined vs. shown word-pair based source monitoring paradigm during which event related potentials were recorded. Our results showed Late Positive Component (LPC) amplitude differences between false alarm responses made by poor and high performers. False alarm responses in poor performers were associated with a more positive LPC as

compared to false alarm responses made by high performers. No significant LPC differences between the two groups were observed in regard to hit, miss and correct rejection responses. These results suggest that individual differences in source monitoring performance may be associated with differences in the amount of recollection detail generated in false alarm responses.

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(4032)

Electrophysiological Evidence That Cues Presented During Short Retention Intervals Influence the Storage of Objects in Long-Term Memory. ASHLEIGH M. MAXCEY-RICHARD, *Manchester University*, KEISUKE FUKUDA and GEOFFREY F. WOODMAN, *Vanderbilt University*—As researchers who study working memory, we often assume that participants keep a representation in working memory when we present a cue that indicates it will be tested in a couple of seconds. This intuitively accounts for how well people can remember an item when the task relevance of that item is signaled by a cue relative to trials without cues. However, it is possible that this effect does not purely reflect a working memory process. We tested the hypothesis that cues presented during short retention intervals in a stream of items change how information is handled by long-term memory. We tested this hypothesis using a frontal event-related potential (ERP) component known to index a mechanism of long-term memory storage. We found that the frontal index of long-term memory was sensitive to the task relevance of visual objects signaled by auditory cues. However, behavior indicates that working memory dictates the pattern of cuing effects. Our findings indicate that assumptions of process purity in the study of visual working memory are problematic.

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(4033)

Part-Set Cuing Facilitation for Spatial Information. SYDNI COLE, *Lake Forest College*, MATTHEW REYSEN, *University of Mississippi*, MATTHEW R. KELLEY, *Lake Forest College*—Part-set cuing inhibition refers to the counterintuitive finding that hints—specifically, part of the set of to-be-remembered information—often impair memory performance in free recall tasks. Although inhibition is the most commonly reported result, part-set cuing facilitation has been shown with serial order tasks. The present study examined the influence of part-set cuing for spatial locations using novel methods and materials. Participants viewed the construction of Snap Circuit objects and then attempted to reconstruct the objects either in the presence or absence of part-set cues. Two experiments revealed robust part-set cuing facilitation on the spatial memory tasks. Generally, these results are consistent with the predictions of the retrieval strategy disruption hypothesis (e.g., Basden & Basden, 1995) and the two- and three-mechanism accounts of part-set cuing (Bäuml and Aslan, 2006; Bäuml & Samenieh, 2012).

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(4034)

Initiation and Effectiveness of Retrieval Monitoring Depends on Information Value. IAN M. MCDONOUGH, *University of Texas at Dallas*, DUNG C. BUI, *Washington University in St. Louis*, MICHAEL C. FRIEDMAN and ALAN D. CASTEL, *University of California, Los Angeles*—Valuable, or important, information can be processed deeply to increase later retrieval success. In turn, people expect to remember higher-value than lower-value information. While retrieval monitoring theories predict that higher-value information should lead to less false memories, recent evidence shows that higher-value information is associated with more false memories (Bui et al., 2013). We investigated how studying semantically-related words varying in value influenced retrieval monitoring. Compared with standard recognition memory tests, when asked to endorse old words and related words, people showed greater false recognition differences for lures associated with low than high-value words, suggesting that people engaged in more retrieval monitoring for low-value words (i.e., when least confident). However, when retrieval monitoring was encouraged across all values, monitoring was most effective for high-value words. Thus, while people do not initiate retrieval monitoring processes for higher-value information, once initiated, retrieval monitoring is most effective for higher-value information.

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(4035)

The Critical Role of Retrieval Processes in Release from Proactive Interference. OLIVER KLIEGL and KARL-HEINZ T. BÄUML, *Regensburg University* (Sponsored by Bernhard Pastötter)—Proactive interference (PI) refers to the finding that memory for recently studied (target) information can be vastly impaired by the previous study of other (nontarget) information. PI can be reduced in a number of ways, for instance, by directed forgetting of the prior nontarget information or the testing of the prior nontarget information. Here we report the results of two experiments, in which we demonstrate that release from PI, as induced by directed forgetting and interlist testing, is accompanied by a decrease in participants' response latencies. Because response latency is a sensitive index of the size of participants' mental search set, the results suggest that release from PI can reflect more focused memory search, with the previously studied nontarget items being largely eliminated from the search process. Our results provide direct evidence for a critical role of retrieval processes in PI release.

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(4036)

Identifying the Mechanism Behind the Retrieval Practice Effect: the Role of Temporal Context. MELISSA LEHMAN, MEGAN A. SMITH and *JEFFREY D. KARPICKE, *Purdue University*—Research has shown that retrieval practice improves retention, but not much theoretical progress has been made toward identifying the mechanisms that produce this benefit. Some theories suggest that retrieval strengthens a memory representation, but only a few have specified the

underlying mechanism that produces such strengthening; these include the encoding variability hypothesis, according to which retrieval produces a variable encoding situation that leads to greater encoding of target information, and the elaborative retrieval hypothesis, according to which retrieval produces semantic elaboration that increases the number of retrieval routes through which target information may be accessed. We present the results of a set of experiments showing that episodic retrieval activities increase later recall and temporal clustering, but other encoding activities, including elaboration, do not. We propose an alternative account, which assumes that contextual reinstatement during retrieval leads to changes in the representation of temporal context that increase retrieval in the future.

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(4037)

The Role of Retroactive Interference in Retrieval-Induced Forgetting. MAGDALENA ABEL and KARL-HEINZ T. BÄUML, *University of Regensburg*—When subjects study items from different categories and then repeatedly retrieve some of the items from some of the categories, retrieval practice typically improves recall of the practiced items but impairs recall of related unpracticed items, relative to control items from unpracticed categories. Here we report the results of two experiments, in which we examined practiced and unpracticed items' susceptibility to retroactive interference. Between retrieval practice and the final test, subjects were either asked to study additional material or to perform an unrelated distractor task. Experiment 1 applied semantic, Experiment 2 episodic categories as study material. In both experiments, control items showed the expected effect of retroactive interference, whereas no such effect was present for the practiced and related unpracticed items. The findings agree with results from recent testing-effect studies, which reported reduced retroactive interference for practiced items, and generalize the results to related unpracticed items.

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(4038)

Individual Differences in Retrieval Practice With Children. JANELL R. BLUNT and *JEFFREY D. KARPICKE, *Purdue University* (Sponsored by Peter Urcuioli)—Practicing retrieval is a powerful way to enhance memory. Typically, these benefits are examined in adults without taking into consideration individual differences in cognitive ability (such as reading comprehension). We examined the effects of retrieval practice in elementary aged children with varying cognitive abilities. In a series of experiments, children studied a list of words and engaged in retrieval for half of the words and restudied the other half. Children then took a final free recall test (Experiment 1 and 3) or recognition test (Experiment 2). As a measure of individual differences, we measured children's reading comprehension (Experiment 1 and 2) or processing speed (Experiment 3). Overall, children benefited from retrieval practice over restudy, but this effect was primarily driven by children with higher cognitive abilities. Children with high comprehension greatly benefited from retrieval

practice, whereas children with low comprehension did not. Retrieval practice improves children's memory, but students with varying cognitive abilities may not equally benefit from it. Email: Janell Blunt, jrlblunt@purdue.edu

(4039)

Examining the Role of Context in the Retrieval Dynamics of Free Recall Using Remember-Know Judgments. TALYA SADEH, RANI MORAN and YONATAN GOSHEN-GOTTSTEIN, *Tel-Aviv University*—Free-recall is typically assumed to rely uniformly on contextual processing. However, since Tulving's introduction of the Remember/Know paradigm in 1985, there have been sporadic indications that a non-trivial proportion of recalled words are perceived by rememberers as not being accompanied by contextual reinstatement (as indexed by 'Know' judgments). Furthermore, recent data suggests that Remember and Know Judgments in free-recall may differ with regard to reliance on their immediate encoding context. The current study focuses on an additional aspect of contextual retrieval, concerning the role of context in mediating the temporal dynamics between recall of multiple events. We capitalized on several effects known to capture this temporal aspect of context—both on short time-scales (e.g., the temporal-contiguity effect) and on larger time-scales (e.g., the long-term recency effect). Our results indicate that whereas remember responses show robust contextual effects, know responses show much reduced effects, and at times—none at all.

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(4040)

A Remember/Know Analysis of the Semantic Serial Position Function. MATTHEW R. KELLEY, *Lake Forest College*, IAN NEATH and AIMEE M. SURPRENANT, *Memorial University of Newfoundland*—We examine whether the serial position functions observed in certain semantic memory tasks (e.g., remembering the order of books or films) arose because the tasks tapped episodic memory rather than semantic memory. Subjects were asked to make remember/know judgments as they reconstructed the release order of (a) the seven Harry Potter books, and (b) two sets of movies. For both classes of stimuli, the "remember" and "know" serial position functions were indistinguishable and both showed the characteristic U-shape with marked primacy and recency effects. These results are inconsistent with the predictions of a multiple memory systems view, which predicts no recency effects for "know" responses. The data, however, are consistent with a general memory principle account and with the relative distinctiveness principle, which suggests that both episodic and semantic memory tasks arise from the same type of processing: items that are more separated from their close neighbors in psychological space at the time of recall will be better remembered.

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(4041)

Effects of Testing and Enactment on Episodic Memory: The Role of Cue Type. VEIT KUBIK and LARS-GÖRAN NILSSON, *Stockholm University*, MONIKA KNOPE, *Goethe-*

University, FREDRIK JÖNSSON, *Stockholm University*—Carpenter, Pashler, and Vul (2006) found increased retention of word pairs (train --> plane) after cued recall compared to restudying, and this irrespective whether final recall was assessed by the original cues (train --> ?) or by the targets (? --> plane). In the present study we tested whether cue type (verb vs. noun) moderates the enactment and testing effect. 68 participants studied a list of 40 action phrases (e.g., "lift the glass") in six trials either by enacting or reading them aloud. 20 action phrases were only studied and 20 action phrases were both studied and tested in alternation over trials. Everyone took final cued recall tests over short (2 minute) and long (1 week) retention intervals (RIs). Enactment and testing increased memory performance over both RIs compared to reading and study only respectively. For long-term retention, testing-plus-enactment led to significantly higher memory performance than testing and enactment alone. Importantly, cue type moderated the size of the testing effect, however, not the size of the enactment effect. To conclude, enactment and testing complement each other in improving long-term retention, and they are differentially moderated by cue type.

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(4042)

Updating Memory: Effects of Cuing With Outdated or New Information. WILLIAM B. LANDON and DANIEL R. KIMBALL, *University of Oklahoma*—In updating memory, forgetting outdated information is one way to reduce proactive interference that might disrupt new learning. In the present research, participants learned semantically related stimulus-response pairs, such that after learning one pair, the stimulus term was immediately re-paired with a new response to be learned, with an instruction either to remember or to forget the first association. We examined how retrieval of a stimulus-response association was affected by cuing with a competing association—during testing, we used the first-learned association to cue retrieval of the second-learned association and vice versa (cf. Postman, Stark, & Fraser, 1968)—and how an instruction to forget would impact such retrieval. Results showed that cuing with the second-learned association reduced retrieval of the first-learned association only when both associations were to be remembered, and not when the first-learned association was to be forgotten. Cuing with the first-learned association did not affect retrieval of the second-learned association regardless of the instruction to forget or remember the first-learned association. Results are discussed in terms of selective rehearsal and strategy disruption.

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(4043)

Emotional Arousal, Recollective Experience, and Context Binding in Episodic Memory. CHRISTIAN D. BOYWITT, *University of Mannheim*—Episodic remembering entails the retrieval of contextual information from the encoding episode, such as perceptual features or impressions associated with the event and at the same time such memories are often experienced vividly. Theorists have invoked the role of emotional arousal in order to explain why some events are later remembered in an episodic fashion while others are merely familiar. In the



present research the effects of emotional arousal on memory was investigated experimentally using neutral words and taboo words in a combined remember-know/source-memory paradigm. Results suggests that emotional arousal due to taboo words lead to increased rates of conscious recollection but to lower levels of context memory than for neutral words. Model-based results, however, indicate that in addition to increases in the probability of conscious recollection, taboo words also led to a more liberal response criterion than neutral words. Furthermore, the degree of stochastic dependency in context memory was comparable for neutral and taboo words, a result in contradiction with predictions of prominent accounts of emotion and memory.

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• WORKING MEMORY III •

(4044)

Time Space and Memory for Order. SIMON FISCHER-BAUM, *Rice University*, AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—Information about the order of items in a sequence can be conveyed either spatially or temporally. For example, we can read a comic strip in the paper or watch an animated version on television. The former relies on the spatial arrangement of the panels to convey the order of events, while the latter relies on temporal information. We investigated whether or not spatially- and temporally presented sequences share a common means of representation. In three immediate serial recall experiments, participants recalled lists of letters in the temporal order they appeared. Each letter in a to-be-remembered sequence was presented in a unique position, with the order progressing from left-to-right or from right-to-left. Temporal order recall was affected by the direction of spatial order presentation, with worse performance on right-to-left lists than left-to-right lists. These results suggest that spatial and temporal order information map onto a common representation.

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(4045)

Object-Based and Feature-Based Memory Search in Visual Working Memory. EVIE VERGAUWE and NELSON COWAN, *University of Missouri-Columbia*—Two contrasting views exist concerning how multi-featured objects are stored in visual working memory (VWM): as integrated objects or as independent features. Previous research investigating the basic unit of VWM has mainly focused on accuracy and error patterns in change detection tasks and yields contradictory results. Here, we propose a new, complementary approach that consists in studying the timing of error-free performance. Therefore, we used a long-term learning variant of the change detection paradigm. Response speeds to probes with color, shape or both were studied as a function of the number of memorized colored shapes. Results show that subjects can use either object-based or feature-based retrieval of information from VWM. The basic unit of VWM seems not to be fixed

but changes strategically. Search is object-based only when all factors support that basis of search, and then there is a disadvantage for finding isolated features.

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(4046)

Output Processes and the Frequency Effect in Serial Recall. LEONIE M. MILLER, STEVEN ROODENRYS and CLAIRE MOGENSEN, *University of Wollongong*—It is well established that the serial recall for high frequency (HF) words in lists where all items are HF is superior to the recall for low frequency (LF) words in pure lists. However, in the recall of mixed lists where HF and LF items are organised into contiguous segments (HHHLLL or LLLHHH) recall in the first half of these lists is identical to that of the pure lists commencing with the same frequency, but the frequency effect is absent in the second half of the list. We have argued that processes during output may be masking a frequency effect in these latter serial positions. As recall of these items necessarily follows the recall of the earlier items, differences in efficiency in the output of series of HF or LF words may be sufficient to eliminate differences in recall later on. In this experiment, participants were post-cued to perform either serial recall or serial probe recall of a single item to examine whether the absence of a frequency effect in these later positions is due to the overt output of previous items. Results show a frequency effect for items probed by the start-of-list only, suggesting that the effect, even for early serial positions, reflects differences in how initial items can be exploited in recall.

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(4047)

Capacity Limits to Representing Objects Still Within View. HIROYUKI TSUBOMI, *University of Toyama*, KEISUKE FUKUDA, *Vanderbilt University*, KATSUMI WATANABE, *The University of Tokyo*, EDWARD K. VOGEL, *University of Oregon*—Visual working memory is known for its capacity limits and sustained neural activity to hold memory representations over a delay period. In this study, we examined whether such empirical characteristics are exclusively for maintaining items that are no longer present, or if similar limitations are observed for items that are continuously visible. To do this, we presented participants with displays of simple objects and asked them to remember the colors of each item until the presentation of a test probe that appeared at the position of one of the items. The memory array was presented for either 100ms or 1000ms, which resulted in blank retention intervals of 900ms or 0ms. Surprisingly, we found equivalent capacity limits for items and sustained neural activity across the conditions. Thus, capacity limits for simultaneously representing multiple items are not exclusive to information that is no longer there, but also extend to perceptually present items.

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(4048)

Measuring the Working Memory Requirements of Mental Arithmetic. THOMAS J. FAULKENBERRY, *Tarleton State University*, SARAH A. MONTGOMERY, *University of Nevada*,

Las Vegas—We used working memory capacity measures (Cowan, 2001) to estimate the visual storage requirements of vertically presented 2-by-1 digit addition problems. We obtained capacity estimates for 27 participants in two conditions. In a control condition, participants completed a change-detection task, responding same or different depending on the color of a single probe square. In the second condition, participants completed a change detection task with an addition problem weaved in between the two phases of the change-detection task. We also manipulated the difficulty of the addition problem, where “easy” problems required no carry (e.g., 42+3) and “hard” problems required a single carry (e.g., 42+9). We found that WMC measures were smaller when participants completed addition problems, indicating that some number of available slots was used in the computation. We also found that hard problems required more available capacity than easy problems, presumably because the carried digit was stored as a visual artifact during the solution process.

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(4049)

Whole-Report Procedures Reveal Bimodal Distribution of Visual Memory Precision Within Arrays. KIRSTEN C.S. ADAM, IRIDA MANCE, EDWARD AWH and EDWARD K. VOGEL, *University of Oregon*—Single probe procedures have dominated estimates of visual working memory, in part because of concerns about output interference. Here, we measured memory performance with a whole-report procedure to directly examine output interference and variations in memory quality within set-size arrays. Participants reported a precise feature (color or orientation) for all items presented in a single array. The order of response was either (1) randomly chosen by the computer or (2) freely chosen by the participant. Critically, no reliable effects of response order were observed with random recall order, indicating that output interference alone does not alter representational quality in this task. Free recall responses, on the other hand, revealed systematic variability in representational quality. A bimodal pattern of high- and low-precision representations was directly related to individual estimates of capacity and to subjects’ confidence of item memory. Together, these results provide support for a model that includes both discrete items and variability in mnemonic precision among items.

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(4050)

The Effect of Proactive Interference and Modality on Short-Term Performance. GEORGINA A. TOLAN and NATALIE MORGAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*—An immediate cued recall task was used to explore proactive interference (PI). PI occurs when past information interferes with current information. Stimuli consisted of two blocks of four words each. PI was manipulated by placing a foil in the first block of words that shared category membership with the target in the second block of words. Additionally a rhyme or semantic associate of the foil was placed in the second block. Twenty participants read the first block of items aloud and the second block

silently. The reverse occurred for a further twenty participants. At recall a cue was presented and participants were required to produce the category instance from the second block. PI effects emerged under aloud-silent conditions with the rhyme condition producing the most interference. Immunity to PI was observed in the silent-aloud condition. Reading aloud produced stronger phonemic representation than the rhyme or semantic associate.

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(4051)

The Broken Record Effect: Unexpected Distractor Repetitions Disrupt the Maintenance of Items in Short-Term Memory. JAN P. RÖER, RAOUL BELL and AXEL BUCHNER, *Heinrich Heine University Düsseldorf*—Task-irrelevant sound disrupts serial recall. Typically the magnitude of disruption increases with the acoustic variability of a sequence. According to the changing state hypothesis abrupt changes between adjacent distractors are crucial to the size of the irrelevant sound effect, whereas within attentional explanations the match or mismatch to prior stimulation is the key determinant. Four experiments demonstrate that distractor repetitions can be more disruptive than changing state sequences when the former violate expectations about the continuation of an auditory sequence. This was shown for music and speech sequences. The disruptive effect of the distractor repetitions also persisted when they were played in a retention interval, indicating that the items’ maintenance was disrupted and not only their encoding. With repeated presentations the expectancy violation effect decreased. This pattern of results suggests that the disruption of short-term memory is primarily determined by violations of expectations, not by acoustic variability.

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(4052)

Rewarding the Serial Position Curve: Flexible Resource Allocation in the Focus of Attention for Sequential Verbal Information. JOSHUA D. SANDRY, *Kessler Foundation Research Center; UMDNJ–New Jersey Medical School*, JEREMY D. SCHWARK and JUSTIN MACDONALD, *New Mexico State University*—Behavioral and brain imaging studies have provided some evidence that the focus of attention is a static element within working memory when verbal information is serially presented. The last item in the list (i.e., the most recent serial position) maintains a privileged status in working memory. It is the fastest and most accurate item retrieved, suggesting the focus of attention is limited to a single-item. Presently, we manipulated the reward associated with early and medial list positions and found evidence that these list positions could be retrieved faster and more accurately when the reward associated with these positions was high. Additionally, the capacity of the focus of attention seems to be restricted to a single item for sequentially presented information, even when multiple list positions were worth a similar high reward. The process underlying retrieval cannot be attributed to subvocal rehearsal, leaving attentional



refreshing more likely. These findings suggest that the focus of attention is a flexible resource that can maintain early and medial list items at the expense of other list items.

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(4053)

Maintaining Verbal-Spatial Associations in Working Memory: The Influence of Encoding Time. NAOMI LANGEROCK, *University of Geneva*, EVIE VERGAUWE, *University of Missouri*, PIERRE BARROUILLET, *University of Geneva*—The integrated presentation of features has often been shown to result in better memory performance than a separated presentation. In the present study, we tested the influence of encoding time on memory performance for integrated versus separated presentation of verbal and spatial features. In the first study, each separated feature was presented half the time of the integrated object, resulting in an equal global encoding time in both conditions. In the second study, each separated feature was presented as long as the integrated object, resulting thus in a doubling of the global encoding time. While we observed a clear memory advantage of the integrated presentations in the first study, this advantage completely disappeared in the second study. The implications for the underlying representations of integrated information in working memory are discussed.

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(4054)

Presentation Method Influences Time-Based Forgetting through Working Memory Consolidation. TIMOTHY J. RICKER and NELSON COWAN, *University of Missouri*—The role of time in forgetting over the short-term has been a controversial topic in recent years with disagreement on basic issues. We believe this is largely due to methodological differences in experimentation, especially when it comes to presentation method. Those researchers who present memory items sequentially tend to find no effect of the length of retention time on forgetting, while those that present items simultaneously tend to find that the amount of forgetting observed is reliably related to the length of the retention interval. The four experiments presented here systematically manipulate presentation method to find the locus of the difference in time-based forgetting rates. We find that the method of memory item presentation is critical in determining the overall rate of time-based forgetting. Further, we show that this difference can be attributed to differences in the time allowed for working-memory consolidation, a process functionally distinct from working memory encoding.

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(4055)

The Binding Pool Model of Visual Working Memory. GARRETT S. SWAN and BRAD WYBLE, *The Pennsylvania State University*—Visual working memory (VWM) is the complex process of encoding, storing, and retrieving visual information. The two prevalent models that describe this process assume that information is either stored in discrete slots or within a limited pool of resources. To develop the theoretical landscape further, we are proposing a Binding Pool

model that details how items can be encoded and retrieved individually yet are subject to interactions with other items in VWM. The Binding Pool model is a neural network that describes a mechanism for indexing a resource pool using a Type/Token architecture (Kanwisher 1987; Mozer 1989). This particular mechanism provides a framework for exploring a variety of VWM tasks, such as the change detection and continuous report paradigms, and can be used to predict behavior in a variety of task manipulations, including ensemble effects.

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(4056)

Mechanisms in Visuo-Spatial STM for Serial Order—Different Than in Verbal STM? MATHANGI SELVAMENAN and ELISABET SERVICE, *McMaster University*—In serial order STM, verbal sequences containing repeated items are recalled less well than ones with unique items (the Ranschburg effect). We assessed the locus of the impairments within visuospatial sequences. Sequences of black dots were presented in different locations for immediate serial recall. Results replicated earlier findings in the verbal domain showing impaired recall for sequences with repetition relative to no repetition. In particular, errors arose from difficulties in remembering the serial positions of the repeated items. However, recall of the item following the first occurrence of the repeated item was facilitated whereas recall of the item following the second occurrence of the repeated item was impaired as compared to items in corresponding positions in sequences with no repetition. This effect still held when the repeated items were correctly recalled ruling out fill-in explanations. This pattern of results suggests differences between verbal and spatial sequence recall.

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• ATTENTION AND AGING •

(4057)

Aging and Probabilistic Visual Search. DANIEL R. BUTTACCIO, SOWON HAHN, ELIZABETH BRAND and WILLIAM HUFFMAN, *University of Oklahoma*—We compared younger and older adults' performance in a probabilistic visual search task. In the task, participants reported the orientation of a rotated "T" that was embedded in a search array amongst rotated "L" characters. Each of the items in the search array was unique in color and certain colors were more likely to be associated with the target than other colors. Relative to younger participants, older participants had more difficulty utilizing the target color base-rate information to drive search behavior as evidenced by slowed RTs. Although a number of previous studies suggest that implicit learning is relatively unimpaired with aging, the present study demonstrates older adults' deficits in exploiting statistical regularities to improve visual search. Additionally,

performance of younger and older adults performance in a cued-recall visual search experiment (called the Retrieval Guidance Paradigm) will be discussed.

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(4058)

Disentangling Theories of Cognitive Aging: Mouse Tracking Differences Between Younger and Older Adults' Performance in a Stroop Task. SARA INCERA, MAURA L. KRESTAR, TERESA A. MARKIS and CONOR T. MCLENNAN, *Cleveland State University*—In the present study, we used mouse tracking to examine younger and older adults' performance in a Stroop task. Previous mouse tracking studies demonstrate that hand movements during psychological tasks reflect real-time mental processes. Based on previous work, we predicted differences in inhibition, processing speed, and response style. We argue that mouse tracking provides separate measures of these constructs. In particular, we used area under the curve to measure inhibition, such that greater area indicates stronger attraction towards the incorrect response, and thus a lack of inhibition. We used maximum velocity time to measure processing speed, such that late occurring maximum velocity indicates slow processing. Finally, we examined several measures of response style, including the time between arriving at – and clicking on – the correct response (verification time), and the complexity of the movements (x-flips). The present study should contribute to a greater understanding of the mechanisms underlying cognitive aging.

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(4059)

Age Differences in Executive Engagement During Working Memory Updating Depend on Memory Load. MICHEL L. ISINGRINI, LUCIE ANGEL, SEVERINE FAY, LAURENCE TACONNAT, SANDRINE VANNESTE and BADIAA BOUAZZAOU, *University of Tours*—Applying the rational of the Compensation-Related Utilization of Neural Circuits Hypothesis (CRUNCH; Reuter-Lorenz and Cappell, 2008) model to the the involvement of executive-control processing in an updating working memory task, we used a cognitive-correlational approach to test the hypothesis that age-related differences in working memory-executive control correlations may vary as a function of memory load. Consistent with CRUNCH predictions results support the idea that older adults show greater recourse to executive control at lower memory loads, when in young adults this phenomenon appeared only at high memory loads. They also show that age-related differences in the reliance to executive-control can better be attributed to individual variations in working memory span. Finally, in older adults, greater recourse to executive-control at low memory loads was associated to equivalent performance across age groups, suggesting that the greater recourse to executive control in older adults may serve a compensatory function when task demand is low. Overall these results support the validity of CRUNCH model also as an account of age-related differences in executive control engagement.

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(4060)

An ERP Study of Conflict Adaptation Effects During Strategy Execution in Young and Older Adults. THOMAS HINAULT and PATRICK LEMAIRE, *Aix-Marseille University; CNRS*—Following previous findings of conflict adaptation effects (CAEs) during strategy execution (Lemaire & Hinault, submitted), we tested ERPs of these CAEs in young and older adults who showed comparable strategy CAEs. Participants accomplished a computational estimation task (i.e., provide approximate products to two-digit multiplication problems like 38x74) and were cued which one of two rounding strategies they had to execute on each problem. The ERP data revealed that adjustments of cognitive control across trials were associated with frontal slow waves and age-related differences in electrophysiological signatures of strategy CAEs. These findings have important implications for further understanding time-course of control processes during strategy execution and age-related differences in it.

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(4061)

Aging, Emotional Congruence Effects, and Automaticity. PHILIP A. ALLEN, *University of Akron*, MEI-CHING LIEN, *Oregon State University*, CHRISTOPHER BUZZELLI and HALLEY COOPER-SHUMWAY, *University of Akron*—Previous studies suggest that older adults have an enhanced performance for positive emotion relative to negative emotion, whereas younger adults show the reverse effect. We examined whether the age-related positivity effect occurs in a psychological refractory period (PRP) paradigm. In Experiment 1, Task 1 was sound discrimination (laugh, punch, or cork pop) and Task 2 was emotional face discrimination (happy vs. angry faces). In Experiment 2, the order of tasks was reversed so that the “punch” sound duration would be adequate for identification. In both experiments for positively valenced stimuli, both younger and older adults showed better Task 1 performance when Task 2 emotional valence was congruent with Task 1 emotional valence (e.g., laugh/happy or happy/laugh). The positivity effect was larger when temporal overlap between both tasks increased. However, the negative effect (elicited by the negatively valenced stimuli at shorter SOAs) was evident only for younger adults but not in older adults in Experiment 2. We concluded that processing emotional information changes with age, with more efficient processing of positively valenced relative to negatively valenced stimuli for older adults.

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(4062)

The Effect of Age on Attentional Processes Across Memory and Perception: An Extension of the Attention-to-Memory Hypothesis. BUDDHIKA BELLANA, *University of Toronto*, CHERYL L. GRADY, *Rotman Research Institute*, MORRIS MOSCOVITCH, *University of Toronto*—The posterior parietal cortices (PPC) are known to play a critical role in the spatial orienting of visual attention. A functional division of the PPC has been proposed, where dorsal regions tend to be engaged by top-down attention, while ventral regions are recruited by bottom-up attention (Corbetta & Shulman,



2002). A parallel functional PPC organization has been reported in memory, when attention is allocated internally during episodic recall (Ciaramelli et al., 2008; Cabeza et al., 2008). The current behavioural paradigm examines this parallel in the context of ageing. Ageing is associated with increased visuospatial cueing effects (valid minus invalid), yet it is unknown whether memory is affected similarly. Younger and older adults performed a cued recognition memory and visuospatial attention task, both derived from traditional Posner spatial cueing designs. Ageing was associated with increased cueing effects in visuospatial attention but not memory. Ageing-related implications for parietal attentional processes are discussed.

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• HUMAN LEARNING AND INSTRUCTION II •

(4063)

The Effect of Training and Cognitive Load on Route Memory: Behavioural and fMRI evidence. ERIN L. BEATTY, ALEXANDRA MULLER-GASS, DOROTHY WOJTAROWICZ, MARIE-EVE JOBIDON, INGRID SMITH, QUAN LAM and OSHIN VARTANIAN, *Defence Research and Development Canada*—Navigation is the process of planning, controlling or monitoring movement along a route. People commonly execute multiple tasks while navigating, which can result in impaired performance due to divided attention. Participants (N = 24) were presented with 40 maps displaying a major route and three landmarks. Half were instructed to memorize the route while the other half memorized the landmarks. Both groups were trained until they reached criterion. The next day participants were tested to determine their ability to distinguish previously studied maps from new unfamiliar maps under conditions of high and low working memory load (WML). Outcome measures were collected in the functional magnetic resonance imaging (fMRI) scanner to assess the contribution of neural structures that underlie route memory—such as the hippocampus and the parahippocampal gyrus—to superior performance. As predicted, high WML conditions resulted in slower response times than low WML conditions. Importantly, an interaction between WML and training condition revealed that under high WML conditions those who studied the route performed at chance while those that studied landmarks were significantly better than chance. The fMRI data analysis is ongoing.

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(4064)

Role of Sleep Spindles and Slow-Wave Activity in Integrating New Information in Semantic Memory. JAKKE TAMMINEN, *Royal Holloway, University of London*, MATTHEW A. LAMBON RALPH and PENELOPE A. LEWIS, *University of Manchester* (Sponsored by Kathleen Rastle)—Assimilating new information into existing knowledge is a fundamental part of consolidating new memories. This is particularly vital for conceptual knowledge (semantic

memory). Sleep is important for memory consolidation but its impact upon assimilation of new information into existing semantic knowledge is largely unknown. We trained participants on novel words whose meanings fell into densely or sparsely populated areas of semantic memory. Overnight sleep was monitored after training, and recall was tested immediately after training and after sleep. Measures of word recognition speed showed a disadvantage for novel words in dense semantic neighbourhoods, presumably due to interference from many semantically related concepts suggesting that the words had been integrated into semantic memory. Critically, neighbourhood density influenced sleep, with participants exhibiting more sleep spindles and slow-wave activity after learning the sparse compared to dense neighbourhood words. This suggests that spindles and slow-wave activity mediate integration of new information into existing semantic networks.

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(4065)

Transfer of Spatial Associations to the Vocal Simon Task. MOTONORI YAMAGUCHI, *Vanderbilt University*, ROBERT W. PROCTOR, *Purdue University*—With manual keypresses, spatially incompatible S-R associations transfer to the Simon task, eliminating the Simon effect, when stimuli in practice and transfer phases are the same (both physical locations or both location words) but not when they are different. The present study used vocal responses to assess whether transfer is determined by set-level compatibility or feature overlap between practice and transfer. The transfer of incompatible associations to the Simon task depended on feature overlap, and longer practice was needed to obtain the transfer effect when stimuli were location words than when they were physical locations, replicating the results obtained with keypresses. We also tested conditions in which response modalities changed between manual keypresses and vocal utterances, and found that transfer of incompatible associations occurred when responses changed from manual to vocal, but not vice versa. The asymmetry poses a challenge to the explanation based on simple feature overlap.

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(4066)

Gesturing Intentionally During Encoding: Effects of Fluid Intelligence and Spontaneous Gesture Rate. STEPHANI FORAKER and CARLA KUHL, *University at Buffalo, SUNY*—How effective are hand gestures as an intentional encoding device, and for whom? Gesturing could fare better than mental imagery because it provides an additional, external representational format that facilitates or entails imagery (Hostetter & Alibali, 2008; de Ruijter, 2008). However, imagery alone may be a more distinctive and flexible form. Two possible modulators were also investigated: independently measured spontaneous gesture rate, as those who gesture more may produce more effective gestures on demand, and fluid intelligence, which is positively associated with producing movement gestures (Sassenburg et al., 2011; Wartenburger et al., 2010). Participants memorized unassociated word pairs

by imagining or gesturing a relationship between the words. Imagery produced better cued recall accuracy than gesturing, as did higher fluid intelligence, both immediately and two days later. Higher gesture rates did increase accuracy, but only for the immediate test, and this effect was not specific to the gesturing group. Producing effective gestures is more difficult than images, but is supported by greater fluid intelligence, which may be reflected in spontaneous gesture rate.

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(4067)

Specificity and Transfer in Following Navigation Instructions Varying in Words and Wordiness. VIVIAN I. SCHNEIDER and ALICE F. HEALY, *University of Colorado*, IMMANUEL BARSHI, *NASA Ames Research Center*—Two experiments examined whether learning to follow navigation instructions is specific to the words and wordiness of the instructions. College students followed navigation instructions for movement in grids on a computer screen by mouse clicking on the grids. Students were trained to make movements in one condition, given a distractor task, and then tested in either the same or a different condition. The instructions included 1-6 commands. In Experiment 1, one set of 4-word commands (e.g., turn left two squares) was compared to another set (e.g., slide left two cells), whereas in Experiment 2, 2-word commands (e.g., left two) were compared to 4-word commands (e.g., turn left two squares). Transfer was found in Experiment 1, but only for one word set. Specificity was found in Experiment 2, but only for 4-word commands. The results were interpreted in terms of the similarity and uniqueness of the procedures used for processing the commands.

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(4068)

Talk This Way: The Effect of Prosodically Conveyed Semantic Information on Memory for Novel Words. HADAS SHINTEL, *Center for Academic Studies*, NATHAN ANDERSON and KIMBERLY M. FENN, *Michigan State University*—Recent research has shown that speakers modulate prosodic intonation not only to accent speech, but also to represent semantic information (e.g. raising pitch for upward motion), which can help listeners infer meaning. Work investigating the communicative properties of prosody has focused on comprehension and potential mnemonic benefits remain unexplored. We investigated the effect of semantically congruent prosody on word learning. Participants viewed images that represented word definitions and heard sentences that were spoken with either congruent or incongruent prosody. Prosody was not needed to infer meaning. Participants completed two tests, either after learning or after 24-hours. In a 4AFC definition test, performance was better for congruent than incongruent items. In a 2AFC image-selection test, performance was similar at immediate test but incongruent items showed greater loss with time. This suggests that listeners extract semantic information from prosody even when prosody is redundant and prosody can enhance memory, beyond simple comprehension.

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(4069)

Explaining Arithmetic Algorithms. PATRICIA BAGGETT, *New Mexico State University*, ANDRZEJ EHRENFEUCHT, *University of Colorado-Boulder*—There are two ways of explaining arithmetic algorithms. The first way, used in schools, matches operations on numbers with operations on quantities represented by numbers (numerosities, lengths, volumes, ...). The second, which forms the foundation of the modern theory of algorithms, describes algorithms as “board games” governed by rules that are not related to properties of the quantities represented. We used the second method to provide a description of arithmetic algorithms for addition, subtraction, multiplication, and division, based on John Napier’s work on “location numbers” described in his 1617 *Rabdology*. We will present theoretical reasons for both approaches and show constructions of Napier’s counting board and our counting boards. We will also report results of using some of them with college students, mostly future teachers. Students were tested for skills in working with boards and asked their opinions about using this method to teach arithmetic algorithms in schools. Finally we will briefly compare both ways of explaining algorithms and present some reasons for favoring the second one.

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(4070)

Effect of Not-A-but-B Presentation on Word Reading Learning. SACHIKO KIYOKAWA, *Nagoya University*, TAKUYA TOMATSU, *Chubu University*—In the present study, we investigated whether the not-A-but-B presentation is effective in facilitating the learning of reading Chinese characters. We hypothesized that presenting correct and typically incorrect words would lead one to compare them and pay attention to the important features, thereby learning to read the correct word effectively. The participants were asked to memorize readings of 12 Chinese characters. In the not-A-but-B condition, correct and typically incorrect readings were shown and the correct character was pointed out. In the control condition, only the correct readings were presented twice. Participants were tested immediately after a 5-minute filler task and after about a month. The results showed that participants in the not-A-but-B condition learnt to read more characters than those in the control condition. It can therefore be concluded that the not-A-but-B presentation is an effective method for learning to read Chinese characters.

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(4071)

The Effect of Presentation Rate on Foreign Language Vocabulary Learning. MARIO DE JONGE, HUIB TABBERS, DIANE PECHER and RENE ZEELLENBERG, *Erasmus University Rotterdam*—The present study examined the effect of presentation rate on foreign vocabulary learning (e.g. kikker [Dutch] -frog [English]). Experiment 1 varied presentation duration from 1 s to 16 s per pair while keeping the total study time per pair constant. Speakers of English studied Dutch-English translation pairs for 16 x 1 s, 8 x 2 s, 4 x 4 s, 2 x 8 s or 1 x 16 s. The results showed a nonmonotonic relation



between presentation duration and translation recall for both language directions (Dutch - English and English - Dutch). Performance was best for intermediate presentation durations and dropped off for short (1 s) or long (16 s) presentation durations. Experiment 2 showed that the nonmonotonic relation between presentation duration and translation recall was still present after a 1-day retention interval.

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(4072)

Can Pinyin Knowledge Really Facilitate Chinese Reading Development? DUSTIN KAI-YAN LAU, *Hong Kong Institute of Education*, MAN-TAK LEUNG, *Hong Kong Polytechnic University*, YUAN LIANG, *Shenzhen University*, JASON LO, *Hong Kong Institute of Education*, SAM PO LAW, *University of Hong Kong*—It is generally believed that the phonetic instructions through teaching Pinyin on Mainland China help facilitate children's reading development. The current study attempts to verify this belief. Three hundred children studying in mainstream primary schools in mainland were recruited. Their reading abilities, Pinyin knowledge and metalinguistic awareness were assessed and corresponding quantified data were obtained. Measures of Pinyin knowledge include children's ability to name Pinyin symbols in isolation (PY_Iso) and their ability to blend sounds to assemble the pronunciations of pseudo-syllables. Multiple regression results shows that only PY_Iso is significant in predicting Chinese character naming after age, non-verbal IQ and RAN are controlled. Further analyses showed that the PY_Iso only significantly predicts the naming of non-phonetic compounds and irregular phonetic compounds characters but not regular phonetic compounds characters. Results suggest that the PY_Iso reflects the ability of pair associate learning instead of a phonetic skill. Educational implications are discussed.

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(4073)

Comparison and Contrast in young children's shape categorization. LINSEY SMITH, *Northwestern University*, MICAH B. GOLDWATER, *University of Sydney*, BRYAN MATLEN, *Northwestern University*, RAEDY PING and SUSAN LEVINE, *The University of Chicago*, DEDRE GENTNER, *Northwestern University*—Creating correct geometric shape categories requires children to overcome reliance on perceptual similarities and learn abstract category defining rules (e.g., a triangle is an enclosed 3-sided shape). In two studies we attempted to improve children's shape categorizations by presenting structurally aligned comparisons that either compared common structure (two category exemplars) or highlighted a contrasting structure (an exemplar vs. a non-exemplar). We orthogonally varied surface structure across pairs. We hypothesized that low similarity common-structure comparisons would extend categories beyond prototypical exemplars while high similarity contrastive alignments would highlight category boundaries. Study 1 showed that high similarity contrasts led to significant improvements in categorization performance: children both increased hit rate and reduced false alarms.

Unexpectedly common-structure comparisons did not improve performance. Study 2 aims to replicate and clarify these results. Implications and future directions are discussed.
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(4074)

When Should Clicker Questions be Presented During a Lecture? Effects on Exam Performance. SHAW L. KETELS, MATT JONES, ALICE F. HEALY and DIANE K. MARTICHUSKI, *University of Colorado-Boulder*—We manipulated the schedule of in-class "clicker" questions presented in two statistics classes offered by the Department of Psychology and Neuroscience at the University of Colorado at Boulder, in the Spring 2013 semester. Clicker questions from a given lecture were either all presented at the end of the lecture (delayed), or interspersed throughout the lecture (interleaved). In a given week, one class received delayed clicker questions, the other received interleaved, and this scheduling contrast was alternated each week. Performance on midterm and final exams was measured from both classes. Superior test performance can be predicted for material presented in the interleaved condition, based on previous research showing that activities interrupting a monotonous task (such as a lecture) provide a cognitive antidote to boredom that increases engagement. In contrast, superior performance can be predicted for material presented in the delayed condition, based on research showing that spaced practice (in this case, spacing between instruction and clicker questions) produces more durable knowledge.

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(4075)

Illusions of Learning Produced by Watching Educational Videos. LUDMILA D. NUNES and *JEFFREY D. KARPICKE, *Purdue University*—As massive online courses and multimedia learning tools are developed, questions arise concerning their efficacy. Our goal in this study was to evaluate the efficacy of one video-based learning tool and compare it to simply reading a text about the same topic. We also assessed students' beliefs about the relative effectiveness of videos and texts. Each subject watched a video on one scientific topic and read a text on a different scientific topic. After studying each scientific topic participants were asked to indicate their judgments of learning (JOLs) and to rate their interest on the topic. Consistent with an ease-of-processing heuristic (e.g., Benjamin et al., 1998), JOLs were higher for topics learned from the video than for the topics learned from the text. However there were no differences between the actual performances. This discrepancy between the beliefs about educational videos utility and their real utility may have important educational effects.

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(4076)

Assessing Pedagogical Content Knowledge Utilized in an Educational Setting: Investigation of a Tutoring Scenario Method. TATSUSHI FUKAYA, *Japan Society for the Promotion of Science; Hosei University*, YURI UESAKA, *The University of Tokyo*—Much research investigating pedagogical

content knowledge (PCK) has been conducted but, except for some case studies, little has examined how (pre-service) teachers utilize their PCK in real educational settings. We examined PCK through a tutoring scenario method, in which a description was provided of a girl who had difficulty in understanding fraction and incorrectly solved a problem ($1/2 + 1/3 = 2/2 = 1$). This method enabled us to assess PCK activated in a hypothetical educational setting from three aspects of teaching: assessment, explanation, and strategy instruction. Undergraduate students in a teacher-training course ($n = 128$) described how they would respond to her problem. Results showed that (1) 48% of the students did not make any inferences about her misconception or ask how she solved the problem, (2) 36 % taught only the procedure without explaining the conceptual meaning of a fraction, and (3) only 2% taught her a problem solving skill such as drawing a diagram.

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(4077)

How and How Much Do Students Really Study? Tracking Study Habits With the Diary Method. YANA WEINSTEIN, JASON S. LAWRENCE and NELLIE TRAN, *University of Massachusetts Lowell*—We obtained information about how students study by using the diary method, a common technique in social, personality, and clinical psychology. After an initial session where 24 students answered questionnaires about their personality, attitudes, study habits, and intended preparation for their upcoming exams, we checked in with these students every day for up to 9 days while they prepared for college finals. We asked students detailed questions about how much – and how – they studied for each exam. Students also made judgments about their performance on each exam, both in terms of predictions (before the exam) and postdictions (after the exam). We achieved a 90% completion rate, providing us with a total of 171 daily samples. Here we report the details of this novel method as well as preliminary findings on the evolving relationship between study habits and predictions/postdictions of exam performance.

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• SELECTIVE ATTENTION II •

(4078)

Inhibition of Return in Everyday Search. JANICE J. SNYDER, *University of British Columbia Okanagan Campus*, WALTER F. BISCHOF, *University of Alberta*—Inhibition of return (IOR) is considered to be a primarily reflexive mechanism that facilitates foraging in visual search. However, there are few studies demonstrating that IOR generalizes from the typically used attentional cuing paradigm to settings that are closer to our everyday search reality. Participants searched 96 unique photographed indoor/outdoor scenes for a key, which was hidden under one of the objects, by executing 1–4 mouse-clicks over the object(s). IOR was assessed with a subsequent probe-detection task. We also investigated whether IOR varies in magnitude when search is successfully completed (i.e., the

target is detected) vs. when it is interrupted (i.e., prior to target detection). The probe-detection task revealed IOR of equal magnitude at all searched locations regardless of whether the probe occurred at the penultimate, anteultimate, or pre-anteultimate mouse-clicked object or whether the search was completed or interrupted, supporting the idea of IOR as a foraging facilitator.

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(4079)

Distractor Influences on Antisaccade Curvature and Landing Position. KAITLIN LAIDLAW, MONA ZHU and ALAN KINGSTONE, *University of British Columbia* (Sponsored by Walter Bischof)—In order to make a saccade to a target, it is often a requirement that we also ignore other distracting information in the environment. Even when we successfully look to our goal, the curvature and landing position of the saccade can be influenced by distractors located near the target. In past investigations, the location of the target signal and the location of the saccadic goal have been the same, and thus it has been unclear whether distractors exert their influence because of their physical proximity to the target signal or to the saccadic goal. Here, we disentangle the two by investigating how distractors influence saccade planning and execution when the target stimulus signals for a saccade to be made to the location mirror opposite the target. Results indicate that saccades are more strongly affected by distractors when they are near the goal of a saccade, opposite from the target signal.

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(4080)

Influence of Emotional Expression on Gaze Cueing Effects in School Children. ANNA PECCHINENDA and SERENA SPOSATO, *Sapienza University of Rome*—Adults and children show reciprocal influences between the perception of gaze direction and facial expression: gaze direction affects the perception of facial expression and facial expression affects the perception of gaze direction (Rhodes et al. 2012). This is not surprising as the meaning of one social signal can vary greatly depending on the value of the other. In contrast, allocation of spatial attention in adults is based on gaze alone and both cues are used only when there is top-down modulation (Pecchinenda et al. 2008). We investigated gaze cueing effects with happy, neutral or disgusted faces in 3 groups of school children. Findings showed greater gaze-cueing effects with happy faces for 7 and 9 year-old children but not for 6-year old. The present findings suggest a critical period during which children are more receptive to social cues, which probably declines in adulthood (Slessor et al. 2010).

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(4081)

The Role of Eye Contact on Memory Performance. SOPHIE LANTHIER, MONA ZHU and CRYSTAL BYUN, *University of British Columbia*, MICHELLE JARICK, *MacEwan University*, ALAN KINGSTONE, *University of British Columbia*—Participants remember words better when they



are spoken by an experimenter who first lifts the head and makes eye contact. Does this memory effect arise due to eye contact, or because lifting the head signals that a participant should pay attention? In the present study an experimenter read words aloud to two participants. While reading the words the experimenter alternated making eye contact with one participant and then the other, or looked away from both participants (baseline condition). Word recognition improved when a participant received eye contact. Moreover, word recognition was worse than baseline when eye contact was directed at the other participant. Our study indicates that eye contact, and not merely perceiving a head-lift, improves memory. Our study also suggests that social exclusion may interfere with memory.

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(4082)

Validating the Use of a Consumer Webcam for Eye Monitoring in Cognitive Science Experiments. MICHAEL A. LAWRENCE and ANNE JOHNSON, *Dalhousie University* (Sponsored by Tracy Taylor)—Many experiments in cognitive science necessitate the monitoring of gaze position and/or pupil size, yet the gold-standard equipment to achieve these measurements is prohibitively expensive for some researchers. We introduce a much cheaper solution, employing a consumer webcam and open-source tracking software, and present the results of a head-to-head evaluation of this solution against a gold-standard system.

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(4083)

Task Switching and Visual Behavior. MARK MILLS, *University of Nebraska-Lincoln*, STEFAN VAN DER STIGCHEL, *Utrecht University*, MICHAEL D. DODD, *University of Nebraska-Lincoln*—During early scene viewing, eye movements tend to be characterized by long-range saccades, separated by brief fixations. Later during viewing, saccades tend to be shorter and fixations longer. This pattern is generally held to reflect the theme that visual processing proceeds global-to-local. As recent work indicates that the temporal transition from global-to-local depends on task-set, the present study investigated how switching tasks influences the temporal dynamics of this processing shift. Participants performed search, memorization, and pleasantness-rating tasks in either a blocked or mixed fashion. Of interest was the comparison of temporal gaze behavior between task-switches and task-repetitions. Multivariate analysis of change in fixation duration and saccade amplitude over a six second viewing period indicated that the transition from global-to-local took less time for repeat than for switch trials, suggesting a) task-repetitions facilitate transition to local processing, and/or b) task-switches delay transition to local processing.

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(4084)

Flow States Experienced by Expert Action Video-Game Players. TAKASHI OBANA, *National University of Singapore*, MARIA KOZHEVNIKOV, *National University of Singapore*; *Harvard Medical School*—Although researchers have

speculated that action video-gaming might produce the state of “flow” experience, the previous experimental studies have thus far focused primarily on the long-term (trait) effects that result from action video gaming, while overlooking possible short-term effects characterizing the state of “flow”. This research investigates whether action video-gaming can induce the state of flow characterized by increase attentional capacities. We compared baseline performance of experienced action videogame players on a number of visual imagery, attentional network, and attentional blink tasks with their performances on these tasks immediately after half an hour of action videogaming, and then after half an hour of rest. The results indicate dramatic improvement in performance on the tasks that require selective attention (visual memory, executive network, attentional blink) immediately after video-game playing. However, the improvement is temporary and dissipates after half an hour of rest. The findings indicate the existence of flow states characterized by enhanced selective attention and imply possibility of consciously accessing the latent resources of our brain to boost temporarily our attentional capacity upon demand.

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(4085)

Do Habitual Video-Game Players Show Improved Spatial Attention? JAMES W. PATTEN and THOMAS M. SPALEK, *Simon Fraser University*—Attention researchers have hypothesized that individuals who play action-oriented video games may exhibit improved spatial attention due to practice. The extant literature, however, provides evidence both for and against this hypothesis. The present study was designed to address this inconsistency. Both video-game players and non-video-game players were tested on two flanker-interference tasks (Green & Bavelier, 2006; Eriksen & Eriksen, 1974). Relative to non-players, video-game players showed improved performance in the Green and Bavelier task but not in the Eriksen and Eriksen task. One of the notable differences between the two tasks is that the location of the target is variable in the Green and Bavelier task, but is fixed in the Eriksen and Eriksen task. This suggests that the players’ advantage may be more specific than previously hypothesized.

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(4086)

Predictive Congruency Cues Affect Flanker Interference and Negative Priming. SUZANNA L. POWELL and KEITH A. HUTCHISON, *Montana State University*—The present study examined peoples’ use of predictive environmental cues to exert proactive control in preparation for early selection of target information. Participants performed a modified Eriksen flanker task (e.g., ABA) in which they were given the preparatory cues “easy” and “hard,” which signaled (with 70% validity) the probability upcoming flankers would be congruent. We found a significant Cue x Congruence interaction, with reduced flanker interference following “hard” cues. In addition, we examined negative priming effects (i.e., slower responding when the target on trial N was the distractor on trial N-1, ABA-CAC). As predicted, we found

greater negative priming following “hard” cues. These results suggest that the predictive “hard” cue enhances participants’ early selection of target information and suppression of distracting information. Future directions include examining physiological measures and aging effects.

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(4087)

The Implicit Learning of Subtle Timing Constraints Influences the Magnitude of the Attentional Blink.

JACQUELINE C. SHIN, *Indiana State University*, SEAH CHANG and YANG SEOK CHO, *Korea University*—

According to recent theories of the attentional blink (AB) phenomenon, AB is an outcome of adaptive attentional control processes. The purpose of this study was to investigate whether attentional control processes could adapt to subtle temporal constraints through implicit learning. In an RSVP paradigm we presented two letter targets among numeral distractors and varied the stimulus onset interval following the first target (SOA1) to be 70, 98, or 126 ms. Furthermore, these SOA1s were either fixed within each block (the blocked condition) or varied randomly from trial to trial (the random condition). Practice over three consecutive days led to increased identification for both targets and a reduction in the magnitude of AB in both conditions. In addition, the blocked condition showed a consistently greater reduction in AB magnitude for the longest SOA1 relative to shorter SOA1s, pointing to adaptive changes in attentional control based on the implicit learning of SOA1s.

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(4088)

The Importance of Visual Working Memory Load in Observing Distractor Devaluation.

BILJANA STEVANOVSKI and PAMELA L. STEVENSON, *University of New Brunswick*—The present work examined how visual working memory is involved in distractor devaluation. Distractor devaluation refers to the finding that ignored distractor items are devalued (e.g., liked less) than attended target items. Researchers have proposed that distractor devaluation occurs due to attentional inhibition that is linked to the distractor in visual working memory. Although evidence suggests that a visual working memory load impacts distractor devaluation, it remains unclear at what point a concurrent memory load becomes problematic for distractor devaluation. Participants performed a selective attention task (indicating whether a target was presented to the left or to the right) and then evaluated the cheeriness of either the target or the distractor. Sometimes, they maintained a concurrent visual working memory load that was presented either prior to the selective attention task or after the selective attention task. Results are discussed with respect to their impact on current theories of distractor devaluation.

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(4089)

Interactions Between Irrelevant Central Cues, Attentional Allocation, and Memory Performance. GERALD P. MCDONNELL, AARON P. MARTINEZ and MICHAEL

D. DODD, *University of Nebraska–Lincoln* (Sponsored by John Flowers)—Given the recent finding that holding an irrelevant gaze cue in memory during a target detection task influences reaction time in a counterintuitive manner (McDonnell et al., 2013, the present study examines the influence of other irrelevant symbolic cues on attention and memory. In Experiment 1, participants completed an item recall test in which an irrelevant gaze cue (looking left/right and with a happy or sad expression) preceded the presentation of a to-be-memorized item (positive or negative word). In Experiment 2, the gaze cue was replaced by high/low numbers to determine whether other symbolic cues also influence memory similarly. Item memory was enhanced when gaze direction and item location were congruent, as well as when the facial expression of the gaze cue and word valence were incongruent, but numerical magnitude did not influence recollection. In Experiment 3, participants memorized a number string or emotion based gaze cue while completing a target detection task to determine how holding numbers or valenced cues in working memory influences attention. The present experiments provide an important dissociation between perceiving irrelevant spatial cues on-line vs. holding them in memory.

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(4090)

The Impact of Surprise and Expectancy on the Emotional Modulation of the Attentional Blink.

HELEN TIBBOEL and JAN DE HOUWER, *Ghent University*—The attentional blink effect (AB; Raymond, Shapiro, & Arnell, 1992) is diminished when T2 is an arousing stimulus (e.g., Anderson, 2005; Keil & Ihssen, 2004). It is commonly assumed that arousing stimuli are salient and have a lower threshold to gain access into awareness (i.e., this effect is due to bottom-up attentional capture). We examined whether T2 stimuli indeed need to be intrinsically salient to “survive” the AB, or whether non-salient stimuli can gain a special attentional status as well by manipulating top-down processes. More precisely, we examined the role of coherence (i.e., do T2 stimuli form a clear coherent category?) and participants’ expectancies (i.e., do participants expect to encounter specific types of T2 stimuli?).

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(4091)

Cognitive Perspective-Taking During Scene Perception in Autism Spectrum Disorder: Evidence From Eye Movements.

SHEENA K. AU-YEUNG, *University of Southampton*, JOHANNA K. KAAKINEN, *University of Turku*, VALERIE BENSON, *University of Southampton*—We examined how eye movements during scene viewing are modulated by adopting psychological perspectives, in both adults with Autism Spectrum Disorders (ASD) and typically developed (TD) adults. Participants viewed house scenes with either non-perspective-taking (look for valuable items/features of the house that need fixing) or perspective-taking (imagine that you are a burglar/repairman) instructions while their eye movements were recorded. The data revealed that for the “look for the valuable items” and burglar perspective task the ASD group showed typical relevance effects in



their eye movements. However, we found subtle processing differences between the groups that were related to initial orienting to and processing of schema relevant items for the “look for the features that need fixing” and the repairman perspective-taking task. There was an absence of a relevance effect for the ASD group for the repairman perspective and its non-perspective-taking equivalent instruction showing that the identification of items relevant to those schemas was more difficult for the ASD group. The present findings suggest that resolving ambiguity may be a defining feature of complex information processing deficits in ASD.
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(4092)

Inhibition, Imitation, and Joint Action Representation.

PAUL A. SKARRATT, *University of Hull*, ALAN KINGSTONE, *University of British Columbia*, GEOFF G. COLE, *University of Essex*—In a typical joint action paradigm, two participants are seated in close proximity and engage in a shared visuomotor task. Results show that the response behavior of one participant can influence the performance of the other, often irrespective of whether the two participants have the same or even different task goals. Two explanations for this interference effect have been put forward: 1) humans have a natural tendency to imitate one another, so an observed action is automatically encoded and a corresponding action readily prepared. 2) the visual transients generated by an observed action activate inhibitory mechanisms, modulating visuomotor behaviour in a manner akin to inhibition of return (IOR). These competing explanations offer different predictions regarding sex differences. On the imitation account, females should show larger interference effects due to their greater empathizing abilities. The inhibition account, however, makes no predictions regarding sex differences. Our results indicate that although joint action tasks can generate IOR, the effect size does not differ between the sexes. Importantly, females do show an additive interference effect which supports the imitation account.
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• DIVIDED ATTENTION •

(4093)

Strategic versus Automatic Parallelism in Dual-Task Performance. SANDRA J. THOMSON, LILA K. DANIS, KARIN R. HUMPHREYS and SCOTT WATTER, *McMaster University*—The relative efficiency of parallel versus serial processing in dual-task performance depends on the experimentally-selected distribution of SOAs in a psychological refractory period (PRP) paradigm, with predominantly short SOAs favoring a more parallel mode. This mode of processing results in longer Task 1 RT and shallower PRP slopes in Task 2 RT (Miller, Ulrich, & Rolke, 2009). We replicate these findings and extend them to a PRP paradigm with alternating blocked and mixed SOAs. However, we also show in both experiments that a marker of more automatic parallel response activation, the backward response compatibility effect (BCE), does not

vary with the SOA context. These findings indicate that the more or less parallel overt dual-task performance revealed by PRP slope effects on Task 2 RT is mechanistically distinct from processes generating automatic parallel response activation in Task 2.

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(4094)

Multitasking Across Modalities: Serial or Parallel Response Selection?

ALEKSANDRA PIECZYKOLAN and LYNN HUESTEGGE, *University of Würzburg*—Dual-task performance has usually been studied within an experimental setup in which task overlap is manipulated by varying the onset interval between two stimuli. The typical finding that response times of the second task increase for large task overlap is usually interpreted as evidence for serial processing caused by a bottleneck at the selection stage. However, sequential stimulus presentation might inherently induce a serial processing strategy, thus not reflecting a generic cognitive mechanism. In the present study participants executed responses towards a single auditory stimulus in single- and dual-task conditions. To vary task overlap selection stage duration was manipulated using specific S-R compatibility conditions: While half of the participants responded spatially compatible in task A (e.g., saccade) and incompatible in task B (e.g., vocal response), the other half responded with inverted mappings. We conducted 3 Experiments using pairwise combinations of saccades, manual responses, and vocal responses. The comparison of single- and dual-task conditions across experiments revealed that dual-task costs were not generally affected by task overlap, indicating limitations of basic response selection bottleneck accounts.

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(4095)

Stimulus Modality and Attention Sharing in Time Estimation: A Dissociation.

ANDRÉE-ANNE OUELLET and CLAUDETTE FORTIN, *Université Laval*—Disruption in timing can occur either when expecting a signal during an interval production or when producing two simultaneous intervals. In both cases, disruption results in longer productions, presumably because of attention sharing. Twenty-four participants produced two partially overlapping 2.5-s intervals during which auditory or visual signals were presented. The overlap varied with stimulus onset asynchrony (SOA= 750, 1250, 1750 ms). This design allows measuring effects of signal expectancy in first productions (during the SOA) and of simultaneous timing in second productions (during the overlap) of the trials. First productions lengthened proportionally with increasing SOA duration, an effect that was stronger in the visual modality. Second productions also lengthened with longer overlap, but this effect was equivalent in both modalities. As modality influences only expectancy taking place during the SOA, we suggest that attention sharing in timing related to expectancy and to simultaneous processing relies on different processes.

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(4096)

Modality Dominance Among Effector Systems. LYNN HUESTEGGE, *University of Würzburg*, IRING KOCH, *RWTH Aachen University*—Flexibility in configuring task-sets allows us to adequately respond to environmental stimuli in different contexts, such as in dual-task situations. In the present study, we examined to what extent response control is influenced by the modality of a concurrently executed response. In Experiment 1, participants responded to auditory stimuli with either vocal responses and/or saccades. In Experiment 2, vocal responses were combined with manual responses. In both experiments, we found asymmetric dual-response costs, that is, the response time difference between single- and dual-response conditions varied between response modalities. Importantly, the same (vocal) response showed substantial dual-response costs when combined with saccades (Experiment 1), but no such costs when combined with manual responses (Experiment 2). Experiment 3, combining saccades with manual responses, revealed stronger dual-response costs for manual responses than for saccades. Together, these findings suggest an ordinal dominance pattern among response modalities, representing flexible, response-based resource scheduling during task-set configuration.

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(4097)

Personality Predicts Attentional Performance During a Change Detection Task. SOWON HAHN, DANIEL R. BUTTACCIO and JUNGWON HAHN, *University of Oklahoma*—It has been known that neuroticism is positively correlated with anxiety and depressive disorders and often associated with adverse effects on cognitive performance. This is particularly true when a task requires focused attention. The present study, however, demonstrates that higher levels of neuroticism can actually be beneficial in attentional performance during a change detection task. We employed a flicker paradigm in which an original and a modified image were displayed in alternation, separated by a blank interval. Eighty participants conducted the change detection task and were administered in the Eysenck Personality Questionnaire. Individuals with a higher level of neuroticism were faster at detecting the changes compared to individuals with a lower level of neuroticism. Additionally, a higher level of neuroticism was also associated with a smaller number of fixations. The results are discussed in the context of attentional control theory that anxiety impairs goal-directed attention but increases stimulus-driven attention.

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• COGNITIVE CONTROL II •

(4098)

Biasing the Decision Process in Perceptual and Conceptual Tasks. PABLO GOMEZ, CHRISTINE REYNA and NADJA MAIMONIS, *DePaul University*—We present a series of experiments ranging from an antisaccade task to a lexical

decision to an implicit association task (IAT). In them, which we manipulated the proportion of correct responses associated to each of the alternatives. For example, in the antisaccade task we showed the target on one of the sides 76% of the trials, and on the other 24% of the trials; while in the IAT we showed one of the two valences (positive or negative) more often than the other. Accumulation of evidence models can account for these type of manipulations assuming either a bias in the accumulation of evidence (drift rates in a diffusion model), or a change in the starting point of the accumulation process (z parameter in a diffusion model). We found that the proportion of items manipulation affects performance in our tasks in quite different ways. While in the antisaccade task the more frequent alternative seems to attract attentional resources, in the lexical decision and the IAT the manipulation seems to affect the decisional process.

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(4099)

How Response-Sets Are Represented Determines the Domain of Control. SANGA KIM, SANG HO LEE, SU JIN KIM and YANG SEOK CHO, *Korea University*—It has been suggested that the reduced congruency effect after incongruent trials is due to control processes. The present study examined whether control processes are response mode-specific. In two experiments, participants performed Simon and spatial Stroop tasks alternately in a trial-by-trial manner. They were to respond with index and middle fingers of their dominant hand for one task and ring and little fingers for the other task in Experiment 1, and with both index fingers for one task and both middle fingers for the other task in Experiment 2. No sequential congruency effect was found between the two congruencies, even when responses were executed with one effector. However, a significant sequential effect was obtained without response repetition when the laterality of the response alternatives in each task was evident. These findings suggest that control processes exert on basic salient features defining all response alternatives in each task.

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(4100)

Positional Priming Effects in Rapid Action Sequences. KRISTY M. SNYDER and GORDON D. LOGAN, *Vanderbilt University*—The ability to rapidly execute specific sequences of actions (e.g., skilled typing) is a remarkable feat of cognitive control. We conducted four experiments to investigate how keystroke sequences are prepared. Typists were asked to prepare to type a prime word and then type a subsequently presented target word. Experiment 1 investigated whether priming a different sequence of the target's keystrokes (i.e., anagram) would facilitate first keystroke reaction time (RT1). Experiments 2 and 3 investigated whether priming specific positions of two keystrokes that are shared between the prime and target (Experiment 2: SSDD, DDSS; Experiment 3: SDDS, DSSD) would influence RT1. Experiment 4 investigated whether the number of shared keystroke positions (i.e., SDDD, SSDD, SSSD) would influence RT1. Findings suggest that preparing an action sequence facilitates execution of a second



sequence when the sequences share actions that occupy the same serial positions, shared positions occur at the beginning of the sequence, and shared positions progress temporally.

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(4101)

Associatively Mediated Stopping: A Novel Paradigm. WILLIAM A. BOWDITCH, FREDERICK VERBRUGGEN and IAN P.L. MCLAREN, *University of Exeter* (Sponsored by Stephen Monsell)—Successful response inhibition is typically assumed to be a goal-driven act of control; where the suppression of bottom-up associatively cued schemas are modulated by top-down executive processes. However, recent evidence suggests that inhibition can be triggered in a bottom-up fashion, through the retrieval of previously acquired stimulus-stop associations. Here we present a novel paradigm for investigating associatively cued stopping, in which colored stimuli are stochastically related to withholding (or enacting) a response. Evidence of associatively mediated stopping was found in both a go/no-go and stop-signal version of our task. Interestingly, only the participants able to articulate the relationship between color and response demonstrated significant stimulus-stop learning in the go/no-go variant, but the effect in the stop-signal variant was present regardless of awareness.

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(4102)

The Role for Working Memory Capacity and Interference Resolution in Task Switching, in Both Young and Older Adults. CORINNE PETTIGREW, *Johns Hopkins University School of Medicine*, RANDI C. MARTIN, *Rice University*—Theories of shifting have incorporated multiple mechanisms, including maintenance of task-relevant representations, conflict resolution, and inhibition of previously relevant tasks, among others. In an individual differences study with 158 younger and older adults, we examined whether three aspects of working memory (WM) – WM capacity, response-distractor inhibition, and resistance to proactive interference – could be related to these theoretical shifting mechanisms. Costs hypothesized to tap the three mechanisms were calculated: global switch costs (maintenance of task-relevant representations), congruency effects (conflict resolution), and backward inhibition (inhibition of no longer relevant tasks). The results of regression analyses showed that WM capacity best predicted global switch costs, response-distractor inhibition best predicted congruency effects, and resistance to PI best predicted backward inhibition, though the direction of this latter relationship differed by age. These results provide experimental support for existence of these different aspects of shifting, which are supported by different aspects of WM.

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(4103)

Symbolic Processing Mediates the Relationship Between Math Anxiety and Mental Arithmetic Performance. HYE-SANG CHANG, *The University of Chicago*, IAN M. LYONS, *Western University*, SIAN L. BEILOCK, *The University of Chicago*—Math anxiety is related to temporary reductions in

the working-memory needed for complex mental arithmetic. Math anxiety is also related to deficits in basic numerical symbol-processing (numerical comparison) thought not to rely heavily on working-memory. We ask whether the deficits in numerical symbol-processing seen in math anxious individuals are due to poor numerical representation or to a temporary disruption of more general working-memory-related symbolic retrieval processes. To do this, we examined whether numerical and non-numerical symbol-processing (and nonsymbolic magnitude-processing) mediated the relation between math anxiety and mental arithmetic performance. Math anxiety was not significantly associated with nonsymbolic processing; it was related to both numerical and non-numerical symbol-processing. Decrements in overall symbolic processing fully mediated the negative relation between math anxiety and mental arithmetic, even when controlling for nonsymbolic processing. Math anxious individuals' poor performance in mental arithmetic may be attributable to their reduced efficiency in generalized controlled retrieval mechanisms during symbolic processing, rather than to impairments in numerical representations per se.

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(4104)

Stimulus-Driven Control of Explicitly Induced Attention Filtering Demands. MATTHEW J.C. CRUMP, *Brooklyn College of CUNY*—Demonstrations of item/context-specific proportion congruent (PC) effects suggest that early stimulus processing can rapidly control attention filtering (see Bugg & Crump, 2012). Yet, PC manipulations are typically confounded with item-frequency, and PC effects may be driven by a learning process sensitive to item-frequencies. The present work examines whether explicitly induced attention filtering demands can transition from strategic to stimulus-driven control without manipulating PC or biasing item-frequencies. Several web-based flanker studies were conducted via Amazon Mechanical Turk. Each involved a 50/50 PC design. Attention filtering demands were induced by a 1-back memory task following each trial prompting recall of the last target or flanking letter. Blocking recall demands produced list-wide PC-like effects with larger flanker effects for flanker than target recall conditions. Mixing recall demands and associating them with particular stimulus-cues (location, color, letters, font) produced item/context-specific PC-like effects, and show novel unambiguous evidence for stimulus-driven control of attention filtering.

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(4105)

How Fluency of Processing Modulates Sequential Conflict Adaptation. GESINE DREISBACH, *Regensburg University*, RICO FISCHER, *Technische Universität Dresden*, JULIA FRITZ, *Regensburg University*—Cognitive control enables adaptive behavior in a dynamically changing environment. In this context, one prominent adaptation effect is the sequential conflict adjustment, i.e. the observation of reduced response interference on trials following conflict trials. Increasing evidence suggests that such response conflicts are registered

as aversive signals. So far, however, the functional role of this aversive signal for conflict adaptation to occur has not been put to test directly. In two Experiments, the affective valence of conflict stimuli was manipulated by fluency of processing (stimulus contrast). Experiment 1 used a flanker interference task, Experiment 2 a color-word Stroop task. In Experiment 1, a conflict adaptation effect was only found in the error data for fluent trials but was absent on disfluent (i.e. aversive) trials. The same higher order interaction was also found in Experiment 2 in the RT data. Results thus speak against the simple idea that any aversive stimulus feature is suited to promote specific control adjustments. Two alternative but not mutually exclusive accounts, namely resource competition and adaptation-by-motivation, will be discussed.

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(4106)

Context-Sensitive Adjustment of Cognitive Control in Dual-Task Performance. RICO FISCHER and CAROLINE GOTTSCHALK, *Technische Universität Dresden*, GESINE DREISBACH, *University of Regensburg*—Performing two similar tasks at the same time requires to shield prioritized primary task processing from between-task interference caused by secondary task processing. The authors investigated how implicitly and explicitly delivered information promote the flexible online adjustment of task shielding. Context-specific implicit activation of cognitive control was implemented by location-dependent frequency manipulations of between-task interference (i.e., locations with high vs. low proportions of between-task interference trials). Following practice, between-task interference was reduced in a subsequent test session for locations associated with high (compared to locations with low) task shielding demands, indicating that the cognitive system can utilize incidental context-features (Exp. 1&2). In Experiments 3, explicit cues validly predicting the interference level failed to further optimize context-specific task shielding. Explicit cues indicating the location of subsequent stimulus presentation resulted in an instant adjustment of task shielding also in the first part of the experiment. Results highlight the role of implicit and explicit context-information in the flexible adjustment of task shielding in dual-task performance.

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(4107)

Statistical Regularities Modulate the Flexibility of Attentional Control. ANTHONY W. SALI, BRIAN A. ANDERSON and STEVEN YANTIS, *Johns Hopkins University*—Recent evidence suggests that cognitive flexibility can fluctuate spontaneously. We examined whether learned knowledge of the statistical regularities in an environment can modulate flexibility. In response to visual cues, participants shifted or maintained attention among two rapid serial visual presentation streams of alphanumeric characters. Behavioral response times to identify target stimuli immediately following a cue were measured. We varied the frequency of shift and hold cues as a function of time or across color-defined contexts. The relative cost to perform a shift of attention was greater for temporal intervals and contexts in which shift

cues were less frequent than when they were more frequent. We also examined how reward contingencies influenced the efficiency of shifting or holding attention. Our results suggest that knowledge of statistical regularities can systematically modulate preparatory control.

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(4108)

Conflict Adaptation Depending on a Sequential Change in Conflict Frequency. KEI KURATOMI and KAZUHITO YOSHIZAKI, *Aichi Shukutoku University*—We investigated whether sequential change of conflict frequency modulates compatibility effect. In the three experiments, participants completed a flanker task with compatible and incompatible stimulus arrays. We divided a trial-block into three phases in Experiment 1 or four phases in Experiment 2 and 3. Compatibility ratio in each phase was varied with 75%, 50%, and 25% as low, middle, and high conflict frequency, respectively. In Experiment 1 and 2, conflict frequency was varied among the phases and a sequential order of conflict frequency in each phase was manipulated. In Experiment 3, conflict frequency was constant among phases. The results showed that compatibility effect was modulated according to the conflict frequency in each phase, regardless of the sequential order of conflict frequency. Thus, the compatibility effect was reduced in high conflict phase than in low conflict phase. The finding suggested that participants adapt to sequential change of conflict frequency.

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(4109)

Dual-Tasking Under Stress: Context-Sensitive Adjustment of Task Shielding in Conditions of Acute Stress. FRANZISKA PLESSOW, *Harvard Medical School; Dresden University of Technology*, SUSANN SCHADE, CLEMENS KIRSCHBAUM and RICO FISCHER, *Dresden University of Technology*—In dual-task performance, recent research showed increased between-task interference reflecting more parallel task processing in conditions of acute stress. We investigated whether this represents a stress-related impairment of cognitive control, or a resource-saving strategy of favouring a more parallel over a more serial task processing mode. Fifty-six participants were exposed to either a psychosocial stress induction protocol (Trier Social Stress Test) or a standardised control situation prior to a dual task. In different blocks, they were instructed to perform the dual task either in a parallel or in a serial task processing mode allowing for increased or decreased between-task interference, respectively. After successful stress induction as indicated by elevated salivary α -amylase and cortisol levels, the stress group displayed an instruction-specific adaptation of the amount of between-task interference that did not differ from the control group. Our finding that stressed individuals can flexibly adopt both task processing modes speaks against a stress-induced impaired control regulation in dual tasks. Instead, we suggest that acute stress experience acts as a trigger for a context-sensitive adjustment of cognitive control.

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(4110)

Effects of Inhibitory Control Processes And Startle Reactivity in the Go/NoGo Task. JESSICA WASHINGTON and TERRY D. BLUMENTHAL, *Wake Forest University*—This study ($N = 43$) aimed to elucidate how failures of inhibition may be affected by startle reactivity, and vice versa. We used a simple version of the Go/NoGo response time task, with green (Go) or red (NoGo) circles presented concurrently, on some trials, with a 100 dB acoustic startle stimulus. Measures included reaction time and accuracy, as well as startle eyeblink reactivity from the orbicularis oculi muscle below the eye. We also distinguished between overt errors (button press) and covert errors (muscle activity from the responding hand). Although very few overt errors were made on NoGo trials, covert errors were more common, and were increased by the presentation of a startle stimulus. Startle stimuli also sped reaction time on correct trials, and the presentation of visual stimuli (either Go or NoGo) increased startle magnitude, both examples of an accessory stimulus effect. The increased covert error rate in the presence of a startle stimulus has implications for the relationship between frontal lobe inhibitory circuitry and the brain stem startle circuit, implying that even an “inhibited” response can be released by a sufficiently intense accessory stimulus.

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(4111)

Erotica Enhances Attentional Disengagement and Reorienting: The Roles of Arousal, Pleasantness, and Goal Relevance. ROBERT DOWMAN, ALYSSA TOIA, ARTHUR DEFRUSCIO and PAUL COLBERT, *Clarkson University*—The ability of biologically relevant visual stimuli to disengage and reorient attention was investigated using a spatial cuing task. A symbolic cue given at the beginning of each trial correctly signaled the location of the upcoming target on most (validly cued) but not all (invalidly cued) of the trials. Participants indicated the location of the target using a key press. The target pictures included erotica, neutral human bodies (body neutral), and neutral scenes devoid of human bodies (non-body neutral). Separate experiments compared the erotica and body neutral targets to the non-body neutral targets, and the erotica to the body neutral targets. Reaction times were faster for the erotica targets than the non-body neutral targets in the invalidly cued condition, but were the same in the validly cued condition. This result suggests that the erotica targets were more effective at disengaging and reorienting attention than the non-body neutral targets. Surprisingly, this effect was not related to the arousal or pleasantness ratings of the erotica targets. Furthermore, the invalidly cued reaction times for the body neutral targets were faster when presented with the erotica targets than when presented with the non-body neutral targets. These findings suggest that activation of templates involved in body recognition are more effective at disengaging and reorienting attention when a subset of the bodies are relevant to personal goals.

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(4112)

Hierarchical Control and Driving. NATHAN MEDEIROS-WARD, *University of Illinois at Urbana-Champaign*, DAVID L. STRAYER, *University of Utah*—Complex skills are thought to be organized hierarchically (Logan & Crump, 2011). Here we report two studies that manipulated primary task predictability and secondary task workload in the context of driving an automobile. As the driving task became less predictable (by adding wind gusts), more attention was required to maintain lane position. When drivers concurrently engaged in a secondary cognitive task, attention was diverted from driving and the ability to maintain lane position was degraded. By contrast, when the driving task was predictable (no wind), lane maintenance actually improved when a secondary cognitive task diverted attention from driving. These data provide evidence for a hierarchical control system that benefits when attention is allocated to the outer loop and suffers when attention is allocated to the inner loop.

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(4113)

The Role of Language in Dimensional Categorization: Evidence From Transcranial Direct Current Stimulation. LYNN K. PERRY and GARY LUPYAN, *University of Wisconsin-Madison*—Categories differ in the extent to which they require cognitive control to selectively focus on relevant properties and ignore irrelevant ones. The category of birds is high-dimensional with many relevant properties (feathers, two-legs, etc.); while a category green-things is low-dimensional, having one relevant property. Language impairments have been linked to selective categorization impairments, e.g., people with aphasia are impaired at low- but not high-dimensional categorization. We examine the role of labels in categorization by perturbing activity (via transcranial direct current stimulation) in Wernicke’s area—associated with verbal labeling—and observe effects on category learning. We trained participants on a perceptual categorization task in which the categories were ambiguously specified by a 1- or 2-dimensional categorization rule. Down-regulation of Wernicke’s area reduced reliance on a unitary dimension suggesting that language is recruited in forming low-dimensional categories and showing tDCS to be a useful tool for studying effects of language on cognition.

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(4114)

Towards a Time Course of Decision Making under Risk. MICHAEL DAMBACHER and RONALD HÜBNER, *Universität Konstanz*—Psychoeconomic theories account for human choices in risky decisions, but it is largely unknown how these choices evolve over time. Here, we used a speeded lottery choice task to uncover the time course of decision making under risk. In separate gain and loss conditions, we assessed response times (RTs) from subjects choosing between a fixed amount of money and a lottery with a lower, equal, or higher expected value than the fixed amount. Faster RTs for risk-averse choices in the gain condition and for risk-seeking choices in the loss condition demonstrated that risk preferences are also reflected in processing speed. Further,

risk preferences were particularly pronounced in the fastest choices, suggesting that risk-aversion and risk-seeking are driven by fast automatic processes, whereas slower decisions are more balanced. Our study advances the understanding of decision processes under risk and presents a viable approach towards a time course of economic decision making.

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(4115)

Dangerous Times: How Timing and Temporal Reports Threaten “Free Will”. EVE A. ISHAM, *Center for Mind and Brain*—Libet et al. observed that the moment of intention to act (W) was experienced at approximately 200 ms before the action. Critically, W was significantly later than the onset of the movement-related readiness potential (RP). Due to the latency of W, one interpretation of the results is that intent has no causal role in action planning and therefore free will is epiphenomenon. However, there are critical methodological concerns with the paradigm. We present here new evidence that perceived times of action and intent are experienced but cannot be accurately expressed (Exps.1,2), and that a perceptual bias in the timing device (i.e., Libet’s rotating-spot clock) facilitates the latency of W (Exps.3-5). Subsequently, we offer an alternative approach using eye movement parameters to temporally index the moment of intent (Exp.6). Preliminary results show that this moment precedes the typical onset of the RP, implying that conscious thought may in fact cause behavior.

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(4116)

Puzzle Video Game Training Improves Executive Function. ADAM C. OEI and MICHAEL D. PATTERSON, *Nanyang Technological University*—Although perceptual improvement has often been demonstrated after training using action video-games, executive function improvement has been inconsistent. In the current study, we compared training using action and non-action games that placed different emphasis on executive control skills. Inexperienced video game players played one of four different games: an action video game (Modern Combat), a physics-based puzzle game (Cut the Rope), a real-time strategy game (Starfront Collision), and a fast paced arcade game (Fruit Ninja) for 20 hours. We tested transfer effects by administering a task-switching task, a flanker and a response inhibition task before and after training. Only the group that trained on the physics-based puzzle game significantly improved in all three tasks relative to the pre-test. No training-related improvements were seen in other groups. These results suggest that playing a complex puzzle game that demands strategizing, reframing, and planning improves several aspects of executive function

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(4117)

Using Delta Plots to Assess the Time-Course of Conflict Adaptation. THOMAS G. HUTCHEON and DANIEL H. SPIELER, *Georgia Institute of Technology*—We construct Delta plots of congruency effects by computing the difference

between congruent and incongruent quantiles of response time distributions. In this way, delta plots can provide information about how the congruency varies over the course of a trial. In the Stroop task, the slope of the delta plot is typically positive, indicating that the amount of interference increases as RT increases. Here, we examined the influence of the condition of the prior trial. When the prior trial is congruent, the slope of the delta plot is positive, however, when the prior trial is incongruent the slope of the delta plot approaches zero. This pattern is consistent with an increase in control over the course of the trial, when the previous trial is incongruent.

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(4118)

Memory and Language Improvements Following Cognitive Control Training. ERIKA HUSSEY, *University of Illinois at Urbana-Champaign*, ISAAH HARBISON and ALAN MISHLER, *Center for Advanced Study of Language*, SUSAN TEUBNER-RHODES and KAYLA VELNOSKEY, *University of Maryland, College Park*, JARED NOVICK, *Center for Advanced Study of Language*—Cognitive control (CC) is the ability to adjust mental activity when confronted with information-conflict. For language processing, CC helps revise misinterpretations during comprehension and generate one word among competing alternatives during production. In memory, CC facilitates recognition despite conflict from familiar but non-target memoranda. We tested if practice engaging CC modulates information-processing in language and memory under high conflict-resolution demands. Trainees completed novel pre/post assessments and one of three N-back regimens (8 hours): N-back-with-lures (High-Conflict), N-back-without-lures (No-Conflict), and 3-back-without-lures. During N-back, subjects viewed letters sequentially, indicating whether items appeared N trials previously. Only High-Conflict trainees encountered recent items in non-N positions (lures), honing CC. All groups improved N-back performance, but at posttest only High-Conflict trainees were faster to re-read ambiguous sentences upon detecting misinterpretation, produce words despite many associates/competitors, and recognize familiar-but-irrelevant memoranda as non-targets. We observed no changes for task conditions not requiring CC, suggesting selective plasticity.

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• BILINGUALISM II •

(4119)

The Effect of Teaching Foreign Language Vocabulary in Semantic Groups: A Study of Vocabulary Acquisition in Russian Language-Learners. KATE WHITE and LUDMILA ISURIN, *The Ohio State University*—A long-standing assumption in the field of second language acquisition is that learning vocabulary in semantic groupings has a positive effect on acquisition and retention. However, studies have shown that grouping words semantically for word-learning



is problematic (Erten & Tekin, 2008; Finkbeiner & Nicol, 2003; Papathanasiou, 2009). The purpose of this study was to explore the issue of semantic groupings while considering inconsistencies in previous methodologies and to contribute data from a new language, Russian. A word-learning task was presented twice (semantic and random groupings) in the classroom to Russian language-learners at two proficiency levels. Early and late post-tests included production (picture-naming) and recognition (word-decision) tasks. The participants performed with significantly greater accuracy for words in random groupings in both post-tests. Semantic groupings negatively affected learning. This study contributes data from learners of Russian, who were enrolled at the time of the experiment and learned words in a classroom setting.

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(4120)

Individual Differences in Second Language Ability and Executive Control Modulate Voice Onset Time During Bilingual Speech. ANNIE C. GILBERT, IRINA PIVNEVA and DEBRA TITONE, *McGill University*—Many languages share phonemes, however, shared phonemes are often acoustically realized differently. For example, voice onset times (VOTs) for stop consonants (/p/, /t/, /k/) produced in English are significantly longer than those produced in French. An open question is how bilinguals accommodate such differences when they produce first and second language (L1 & L2) speech. Here, we investigate whether L2 ability and executive control capacity modulate spontaneously produced VOT durations for 24 French-English bilinguals (12 French L1; 12 English L1). As expected, VOTs were significantly longer for English L1 speakers producing English than for French L1 speakers producing French. However, English L1 speakers producing French showed shorter French-like VOT durations as L2 ability or executive control capacity increased. Similarly, French L1 speakers producing English showed longer English-like VOT durations overall (they were higher L2 proficient overall), however, VOTs were even longer as L2 ability and executive control increased. Thus, as with speech planning (e.g., Pivneva, Palmer & Titone, 2012), both L2 ability and executive control capacity modulate the acoustic realization of bilingual spontaneous speech output.

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(4121)

Effects of Immersion, Language, and Learner Variables on Lexical Category Convergence. BENJAMIN ZINSZER, *The Pennsylvania State University*, BARBARA MALT, *Lehigh University*, EEF AMEEL, *Leuven University*, PING LI, *The Pennsylvania State University*—Cross-language differences in lexical categorization pose a challenge to second language (L2) learners. For example, Chinese 瓶子 is commonly translated as English “bottle”, but it includes things called “can” and excludes things called “bottle” that are less round. To identify determinants of native-like naming in L2, we tested students in China and USA who named pictures of 67 dishes (e.g., cups, plates, bowls) in English. Both language- and learner-specific variables uniquely predicted the bilinguals’ similarity to the monolingual word use patterns. Naming agreement in each

language competitively influenced L2 naming, but immersion experience boosts the relative weight of the L2 norms in this competition. Further, code-switching frequency interacts with age of onset and learning experience in predicting the bilinguals’ L2 native-likeness, suggesting a highly interactive and dynamic trajectory of second language acquisition. We conclude with suggestions for improving L2 mastery through exposure to language norms in simulated immersion environments.

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(4122)

Proficiency and Age of Acquisition Independently Modulate Brain Activity in Mandarin-English Bilinguals.

EMILY S. NICHOLS and MARC F. JOANISSE, *The University of Western Ontario*—Past research investigating the neural correlates of second language (L2) processing has separately examined effects of age of acquisition (AoA) and proficiency. In the current study we examine the two factors in parallel by considering early/late acquisition and high/low proficiency in adult native Mandarin speakers who were L2 English speakers. Subjects performed a picture-word matching task while undergoing fMRI scanning. We also obtained behavioral measures of language proficiency and AoA from all subjects. Brain activity during L2 English processing was shown to be independently affected by AoA and proficiency; activity in the left superior temporal gyrus and right parahippocampal gyrus was modulated by AoA, while activity in the right insula, right middle temporal gyrus, and right parahippocampal gyrus was modulated by proficiency. These results suggest that brain organization of L2 lexico-semantic processing is not wholly influenced by age-dependent learning, but is also susceptible to native and L2 language ability levels.

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(4123)

Effects of Color-Grapheme Synesthesia on Vocabulary Learning.

REBECCA HAMMARLUND and JANET L. MCDONALD, *Louisiana State University*—Synesthetic color-grapheme associations can facilitate delayed recall of verbal information such as digits and names (Smilek et al., 2002; Mills et al., 2006). These findings suggest color-grapheme associations may play a role in foreign language vocabulary learning. LK, a color-grapheme synesthete who also reports color-meaning associations, learned English-nonce word pairs. Using his synesthetic associations, we created eight lists by crossing the factors of Color Cause (orthography vs. meaning), Word Color (pairs match vs. mismatch) and Listwise Color (same vs. different). Overall immediate recall was better for orthographic than meaning Color Cause with best performance when Word Color mismatched and Listwise Color was different; this was also true for delayed recall. Delayed recall for meaning Color Cause was best if the Word Color matched and Listwise Color was different. Results support previous findings that associations with orthography are stronger than those with meaning, and that synesthetic distinctiveness provides cues for memory.

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(4124)

Using ERPS to Investigate a Bilingual Advantage in Word Learning. CARI A. BOGULSKI and JUDITH F. KROLL, *The Pennsylvania State University*—Skilled second language (L2) learners more easily acquire new vocabulary in an unfamiliar language than novice L2 learners (e.g., Kaushanskaya & Marian, 2009). The present study investigated the neural correlates of this bilingual advantage in foreign language vocabulary learning using event-related potentials (ERPs), which have previously been used to detect language learning sensitivity before expression in behavior (e.g., McLaughlin et al., 2004). Experienced and inexperienced foreign language learners were taught and tested on vocabulary in an unfamiliar language. Performance on a lexical decision task demonstrated that the experienced L2 learners exhibited enhanced sensitivity to pseudo-words relative to real words at earlier stages of vocabulary learning. These findings further suggest that the bilingual advantage in foreign language vocabulary learning extends to even the earliest stages of L2 vocabulary acquisition, lending support to the notion that the experience of learning an L2 fundamentally changes the way the brain processes novel language input.
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(4125)

The Influence of Cultural Context on Language Activation in Korean-English Bilinguals. MATTHIAS BERKES and ELLEN BIALYSTOK, *York University*—Both languages for bilinguals are jointly activated even when performance is clearly restricted to one. The present study investigated the role of cultural cues on the relative level of joint linguistic activation. Twenty-two Korean-English bilinguals were presented with a picture and an audio cue and indicated via button press whether the heard label named the depicted object while EEG was recorded. In the critical blocks, the pictures represented exemplars that were more typically English or Korean, even though both exemplars take the same name in both languages (e.g., North American “soup” vs. Korean “soup”). English or Korean labels for the same set of pictures were presented separate blocks. RTs were significantly faster for trials in which the auditory stimulus correctly named the object and the language matched the cultural bias. Providing the correct label in either language significantly attenuated the N400 with no evidence of cultural bias in this effect. Therefore, the effect of cultural context and semantic integration appear to be separate.
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(4126)

L1 Probabilistic Phonotactics May (Not) be Useful in L2 Listening. MICHAEL C.W. YIP, *The Hong Kong Institute of Education*—This study investigates whether Cantonese-English bilingual listeners make use of their L1 probabilistic phonotactics in the segmentation process of English continuous speech (L2). Previous research in different languages demonstrated that probabilistic phonotactics could serve as a useful cue to locate the possible word boundary in continuous speech. The use of these kinds of information in L1 can also be easily transferred to deal with L2 listening

for bilingual listeners. In the present study, a word-spotting experiment was conducted to examine this issue and the results revealed that the Cantonese-English bilingual listeners might not make use of all their L1 probabilistic phonotactics in segmenting the L2 speech.

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(4127)

Use of Vowel Length in Voicing Categorization by Spanish-English Bilinguals. ANNIE J. OLMSTEAD, *State University of New York-New Paltz*, NAVIN VISWANATHAN, *State University of New York-New Paltz; Haskins Laboratories*, JULIANNE REILLY, *State University of New York-New Paltz*, M. PILAR AIVAR, *Universidad Autónoma de Madrid*—In English, syllable initial unvoiced stops have long-lag VOTs whereas voiced stops have short lag VOTs. In Spanish, unvoiced stops have short-lag VOTs and voiced stops are prevoiced. Therefore, short-lag stops are often categorized as unvoiced by Spanish speakers, but voiced by English speakers. Another difference between the languages is that, in English, but not in Spanish, vowels following voiced stops tend to be longer than those following unvoiced stops. Consequently, English speakers use vowel length information when categorizing voiced and unvoiced stops, whereas Spanish speakers do not. In this study, we examine how Spanish-English bilinguals negotiate these differences in their two languages. We had Spanish-English bilinguals categorize a [ba]–[pa] continuum. The consonants varied from prevoiced to long-lag VOTs and were either followed by a long or a short vowel. Categorization and discrimination tasks established the voicing category boundaries. Participants also imitated each token used in the perception tasks. Results suggest that while bilinguals’ patterns of categorization and discrimination differ from monolinguals’, their sensitivity to vowel length information is similar to that of monolingual English speakers.
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(4128)

Do Spanish-Basque and French-Basque Simultaneous Bilinguals Perceive Basque Dialectal Variation Differently? SAIOA LARRAZA and ARTHUR G. SAMUEL, *Basque Center on Cognition, Brain and Language* (Sponsored by Jean Vroomen)—Standard Basque has a phonetic contrast between two sibilants (laminal “z” versus apical “s”), while Spanish only has apical “s”, and French only has laminal “z”. The Biscayan dialect of Basque neutralizes the contrast, using only apical “s”. We tested whether Spanish-Basque and French-Basque simultaneous bilinguals differentially perceive the neutralization in the Biscayan dialect. An AXB discrimination task tested acoustic-phonetic encoding, while lexical processing was assessed using auditory lexical decision and auditory semantic priming. At the acoustic-phonetic level, our results show that both groups can discriminate the “z”-“s” contrast that exists in standard Basque (but does not exist either in Spanish or French). In contrast, they perform differently when accessing Biscayan variants at the lexical



level. These results indicate that simultaneous bilinguals' unshared L1 alters the recognition and lexical activation of dialect variants in the shared language.

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(4129)

Masked Language-Switching Priming Effects in Trilingual Readers. ENEKO ANTÓN, AINA CASAPONSA, MARÍA DIMITROPOULOU, MANUEL CARREIRAS and JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain and Language*—Recent electrophysiological research has shown that bilinguals are highly sensitive to unconsciously perceived changes between the language of the primes and the targets in visual masked priming paradigms. However, little is known regarding how each of the languages that a trilingual knows influences the others. We ran an ERP experiment in which target words from the second language were briefly preceded either by L2 unrelated masked primes (non-switch trials) or by L1 or L3 unrelated primes (switch trials). While the N250 component showed similar switching costs for both L1 and L3 primes as compared to L2 primes, the N400 component showed significant switching cost exclusively for L3 primes. These results suggest that in an L2-reading context, L1 words need to be strongly inhibited given that the inherent level of general basal activation of the L1 lexicon is certainly high, while this is not the case for L3 words.

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(4130)

Lingering Inhibition During Language Switching: Specifying the Dynamics of Bilingual Inhibitory Control. JARED A. LINCK, *University of Maryland Center for Advanced Study of Language*, ALISON SHELL and L. ROBERT SLEVC, *University of Maryland*—A prominent account of bilingual language control suggests that the need to inhibit a non-target language produces lingering inhibition that can influence subsequent production, although the precise dynamics of this account remain largely untested. The current study employed a dual-task design to test whether taxing domain-general inhibitory resources would attenuate inhibition of the non-target language on the current or subsequent trial. Advanced second language learners named pictures in their first or second language, while simultaneously performing a non-linguistic directional Stroop task. By the lingering inhibition account, taxing inhibitory resources by responding to incongruent Stroop stimuli should cause relatively reduced inhibition of the non-target language on that trial, and therefore also less lingering inhibition on the subsequent trial. Indeed, language-switching costs were systematically affected by additional non-linguistic demands on inhibitory resources. We discuss the implications for the temporal dynamics of inhibition in theoretical accounts of bilingual inhibitory control.

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(4131)

Bilingual Inhibitory Control: What Can (and Cannot) Be Explained by Retrieval-induced Forgetting. JARED A. LINCK, *University of Maryland Center for Advanced Study of Language*, JUDITH F. KROLL, *The Pennsylvania State*

University—Research on bilingual speech production suggests inhibitory control supports language control. Levy et al. (2007) reported evidence of cross-language retrieval induced forgetting (RIF) on a phonological rhyme task following repeated language switching, providing one potential mechanism. But it is unclear where RIF operates within the bilingual lexicon (i.e., phonology, orthography). In this study, we revised Levy et al.'s test task to allow precise specification of the locus of RIF effects. Across three experiments involving language processing test tasks, we failed to find RIF effects—if anything, we found evidence of facilitation, rather than inhibition. In a direct replication, preliminary results suggest we can detect RIF effects with Levy et al.'s phonological rhyme task, indicating that the null results in our first three experiments are not due to our materials. We discuss implications for constraints on the specific mechanisms behind inhibitory control during bilingual speech production.

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(4132)

Inhibitory Control Mechanisms of Balanced and Unbalanced Bilinguals in Language Production. EVA VAN ASSCHE and WOUTER DUYCK, *Ghent University*, TAMAR H. GOLLAN, *University of California* (Sponsored by Robert Hartsuiker)—The present study investigated the scope of language control in bilingual language production differentiating between whole-language control involving control of an entire lexicon specific to one language, and lexical-level control involving only a restricted set of lexical representations. We specifically tested how contextual factors (e.g., frequent language switching) and language proficiency influence language control. The participants were 60 early, balanced Turkish-Dutch bilinguals, 60 late, unbalanced Dutch-French bilinguals and 60 early, balanced Dutch-French bilinguals. They performed letter fluency tasks in which they produced words starting with a specific letter first in one language, and then either (a) words starting with the same letters, or (b) different letters in their other language. Language testing order effect for production of words starting with different letters across language blocks reveals the presence of whole-language control in bilingual production, whereas production of words starting with the same letters across language blocks reveals item-specific control. The results of the different subject groups are interpreted within current accounts of bilingual language production (e.g., Green, 1998).

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(4133)

Effects of Translation Ambiguity in Bilingual Word Association. KATHARINE DONNELLY ADAMS and JANET G. VAN HELL, *The Pennsylvania State University*, NATASHA TOKOWICZ, *University of Pittsburgh*—The English word “jam” can be translated into the Spanish word “mermelada,” but also “atasco.” This one word to many words mapping situation, known as translation ambiguity, can create difficulty for L2 speakers. Words with translation ambiguity are more difficult to learn (Degani & Tokowicz, 2010), but the L2 speaker may also miss nuances of meaning. Previous research shows that cognate status, concreteness, and part of speech

affect bilinguals' conceptual representations across languages (van Hell & de Groot, 1998). In this study, we investigated the effects of translational ambiguity on bilingual representation and retrieval of word meanings and their associations across languages. We asked English-Spanish bilinguals to give single word associations for 45 translationally ambiguous and 45 unambiguous words, to examine degrees of shared conceptual representations and speed of associations within and across languages. Implications of the results for models of conceptual representation in bilingual memory will be discussed.

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(4134)

Lexical Ambiguity Within and Across Languages: Facilitation or Interference? CAITLIN Y. TING, *The Pennsylvania State University*, JANET G. VAN HELL, *The Pennsylvania State University*; Radboud University Nijmegen—In two experiments we examined lexical ambiguity during bilingual and monolingual word recognition. Studies on lexical ambiguity in bilingual word recognition typically focused on interlingual homograph processing in the second language, and found interference: interlingual homographs were recognized slower than unambiguous control words. Research on lexical ambiguity in monolingual word recognition has observed both interference and facilitation, depending on overlap between a homograph's meanings. We examined interlingual and intralingual homograph processing in the first language (bilinguals and monolinguals) and second language (bilinguals) in lexical decision-making, and whether relative proficiency in a bilingual's two languages modulates lexical ambiguity effects. We found facilitation for interlingual and intralingual homograph processing in the first language, in bilinguals and monolinguals. However, in the second language, preliminary findings indicate interference for interlingual homographs and facilitation for intralingual homograph processing. These findings suggest that lexical ambiguity resolution differs in a bilingual's first and second languages.

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(4135)

Leche or Lemonade? Bilinguals' Category Accessibility Across Languages and Conceptual Domains. BELEM LOPEZ and JYOTSNA VAID, *Texas A&M University*—How many and which exemplars of a category (e.g., beverages) most readily come to mind reflects in part one's early cultural and linguistic learning experiences (Roberts & LeDorze, 1997; Ward, Chu, Vaid, & Heredia, 2009). A previous study reported that bilinguals with prior language brokering experience generated significantly more category exemplars and showed greater cross-language overlap in the exemplars produced than bilinguals without such experience (Vaid, Lopez & Tosun, 2011). The present study sought to determine if language brokering/informal translation experience also affects category accessibility (the frequency and order of mention of exemplars of a category) and whether relative category accessibility differs by conceptual domain. Two groups of proficient Spanish-English bilingual adults

(“brokers” and “non-brokers”) generated exemplars for the following categories in each language: animals, beverages, breakfast foods, colors, holidays, moral values, sports, music, vegetables, and weather. The findings suggest that category accessibility varies by conceptual domain, language and brokering status.

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• PSYCHOLINGUISTICS III •

(4137)

Language Universals Engage Broca's Area. IRIS BERENT and XU ZHAO, *Northeastern University*, HONG PAN, JANE EPSTEIN and EMILY STERN, *Harvard Medical School*—It is well known that natural languages share significant aspects of their design. For example, across languages, syllables like blif are preferred to lbif. But whether these observations reflect universal linguistic principles or shared sensory-motor pressures remains unknown. To address this question, we used fMRI to investigate brain activation associated with encoding four syllable types, arrayed on their linguistic well-formedness (e.g., blif>bnif>bdif>lbif, where > indicates preference). Results showed that syllable structure monotonically modulated hemodynamic response in Broca's area, and its pattern mirrored participants' behavioral preferences. In contrast, ill-formed syllables did not systematically tax sensorimotor regions—while such syllables engaged primary auditory cortex, they tended to disengage (rather than activate) articulatory motor regions. The convergence between the cross-linguistic preferences and English participants' hemodynamic and behavioral responses is remarkable given that most of these syllables are unattested in their language. We conclude that people encode broad linguistic restrictions on syllable structure.

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(4138)

Separating Groom From Bride When Inferring Gender From a Text Corpus. LANCE W. HAHN and JOSHUA Z. MANSFIELD, *Western Kentucky University*—Hahn (2011), created a computational metric to predict the gender-association of a word based on the word's co-occurrence with the pronouns “he” and “she”. One failing of the metric was the inability to separate antonym pairs that commonly co-occur (e.g., groom and bride). We hypothesized that adding such antonym pairs to reinforce the he-she dichotomy would improve the computational metric. Co-occurrences were measured between 232 target words and four antonym pairs that were included in human ratings reported by Kennison and Trofe (2003). After removing co-occurrences derived from idioms (bride and groom) we calculated the conditional probability of the antonym word given each target word. An improved metric ($r=.484$) was generated by normalizing and combining the new conditional probabilities and Hahn's



(2011) measure. We conclude that inferring the gender-association of a word with a computational metric can be improved by strategically enlarging the gender model.

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(4139)

Typing English Compounds: Effects of Semantic Transparency and Semantic Priming. CHRISTINA L. GAGNE, THOMAS L. SPALDING and KELLY NISBET, *University of Alberta*—During the comprehension of compounds, many representations are activated, including the representations of the compounds' constituent words. However, are the constituent representations activated during compound production? If so, do semantically opaque constituents (i.e., constituents that do not contribute to a compound's meaning) have a negative impact? In two experiments, we assessed whether the availability of the first constituent influences the production of a compound (as measured by inter-letter typing speed), and, if so, whether this influence depends on the semantic transparency of the first and second constituents. Each compound was preceded by a brief presentation of a word that was semantically related or unrelated to the compound's first constituent. Presentation of a related prime aided the production of compounds with transparent heads but hindered the production of compounds with opaque heads. Surprisingly, the same pattern was observed regardless of the transparency of the primed constituent. These results indicate that the morphemic structure affects compound production, but that semantic transparency of the head determines the extent to which constituent priming affects production.

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(4140)

Using Text Instead of Pictures in the Visual World Paradigm: Phonological, Semantic, and Perceptual Similarity Effects. CHRISTOPHER R. BROZDOWSKI and JONATHAN GORDILS, *University of Connecticut*, JAMES S. MAGNUSON, *University of Connecticut; Haskins Laboratories*—In the visual world paradigm, an array of visual objects is presented to a subject who then hears utterances about those items. Using pictures constrains displayed items to highly imageable, concrete nouns. If we could use printed words, we could use abstract words and parts of speech other than nouns. Two studies have examined whether visual world effects generalize to text presentation (McQueen & Viebahn, 2007; Salverda & Tanenhaus, 2010), both focused on phonological effects (and interactions with orthography, in the latter case). We examined whether several visual world effects would replicate with text instead of pictures, including effects of phonological similarity (Alloppenna et al., 1998), semantic neighborhood density (Mirman & Magnuson, 2008), and semantic and shape similarity (Huettig & Altmann, 2005; Yee & Sedivy, 2006). Phonological effects replicated, shape effects did not (unsurprisingly). Semantic effects were mixed. We discuss the implications for using text in the visual world paradigm.

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(4141)

Sarcasm in the Workplace: It All Depends on Your Perspective. DAWN G. BLASKO, VICTORIA A. KAZMERSKI, SHARIFFAH SHEIK DAWOOD, MARGARET EIMERS and KATELYN MARSH, *The Pennsylvania State University, Erie*—Viewing late night television would suggest that sarcasm is a great way to criticize the boss, however, this could be a dangerous move if the work relationship is to be maintained. Participants read scenarios involving two people who were either in an unequal (boss-worker) or equal (worker-worker) power relationship at work. Context determined whether the final remark was likely to be sarcastic or sincere. After reading, they rated each remark on how insulting, humorous and sarcastic it seemed. Participants completed a cultural dimension scale (power distance, uncertainty avoidance, masculinity, collectivism, long-term orientation), empathy scale, and sarcasm self-report scale. Reading times were longest when the participants were taking the listener's perspective and the boss was being sarcastic. Sarcasm is rated as less humorous and more insulting from the listeners than the speaker's perspective. These results demonstrate the importance of a variety of social-cultural factors in non-literal language processing.

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(4142)

Audience Design and Attentional Suppression. TIMOTHY M. GANN, *University of California, Merced*—When speakers are instructed to conceal privileged information in an interaction, they are more likely to refer to it because it is "ironically" made more accessible (Lane, Groisman and Ferreira, 2006). What about when privileged information is not made more salient? Do speakers direct attention away from privileged competitors and thus reduce the change that they will inappropriately refer to them? This study used a referential communication task in which the speaker sometimes had a privileged competitor. In the last few trials, the addressee was moved to a different position so they could share the speaker's perspective. After moving, speakers continued to ignore the formerly privileged competitors at first (as evidenced by speech and gaze), and frequently only incorporated a contrasting adjective as part of a post-nominal repair. The persistence of speakers' redirection of attention away from privileged items influences their ability to adjust to newly shared perspectives.

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(4143)

Working Memory and Syntactic Planning During Sentence Production. HAO YAN, TATIANA SCHNUR and RANDI MARTIN, *Rice University*—Speakers plan words in advance before they start producing sentences. What type of working memory store is used to hold the planned information before speaking? To address this question, we had participants hold semantic, phonological or spatial information in working memory while producing sentences that began with either a complex or a simple initial noun phrase but were matched in overall complexity. Although we found that participants had longer onset latencies for sentences beginning with complex

noun phrases, consistent with a phrasal scope of planning, this complexity effect was not affected by any type of working memory load. However, participants made more syntactic errors (but not lexical errors) for sentences beginning with a complex noun phrase, suggesting that advance planning for these phrases occurs at a syntactic rather than lexical-semantic level, which may account for the lack of effect with various types of working memory load in the current study.
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(4144)

Together, Producers and Comprehenders Prefer SVO: Evidence From Elicited Pantomime. MATTHEW L. HALL and VICTOR S. FERREIRA, *University of California, San Diego*—Studies of language emergence and experiments using elicited pantomime both suggest that young languages will tend to be SOV (Subject-Object-Verb, like Korean). Yet over time, languages tend to change toward SVO (like English). Such patterns may represent a least-joint-effort tradeoff between constituent order preferences in production vs. comprehension. To test this, pairs of naïve participants described pictures in pantomime. Each participant took four turns as a producer and as a comprehender. A group of solo participants described the same pictures, but without a partner. The least-joint-effort hypothesis predicts an increase in SVO across rounds, and more SVO in pairs than in solo participants. These predictions were supported by Study 1. Study 2 demonstrates that this rise in SVO is driven by the presence of semantically reversible events (human agent & human patient). These data support the claim that grammars change in response to the joint needs of production and comprehension.

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(4145)

Tip-of-the-Tongue States in Bilinguals: The Role of Second Language Proficiency and Cross-Language Lexical-Semantic Overlap. FATEMEH ABDOLLAHI and JANET VAN HELL, *The Pennsylvania State University* (Sponsored by Natasha Tokowicz)—Tip-of-the-Tongue states (TOTs) occur when a speaker fails to retrieve a word or a name, though retrieval feels imminent. Highly fluent bilinguals have been found to have more TOTs than monolinguals, unless the target items were cognates (Gollan & Acenas, 2004). To further examine the role of second language (L2) proficiency and form and meaning overlap across languages, we induced TOTs in Dutch-English bilinguals at different levels of L2 proficiency, using picture stimuli with cognate, homophone, and noncognate names. TOT rates were lower in the higher proficiency bilinguals. Cognate pictures induced significantly fewer TOTs than noncognate pictures, but homophones tended to elicit more TOTs than noncognates. The results suggest that lexical retrieval failure is affected by L2 proficiency and cross-language form and meaning overlap. Theoretical implications for bilingual language production (including phonological blocking, frequency-lag, and weaker links accounts) will be discussed.

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(4146)

Language Proficiency Modulates Frequency Effects in Speech Production and Recognition. JENS SCHMIDTKE, *Michigan State University* (Sponsored by Laura Dilley)—Lexical access in bilingual speakers is slowed down compared to monolingual speakers even when bilinguals are tested in their first and dominant language. To investigate the origin of these differences, the present study used an individual differences design with a sample of 31 English-Spanish bilingual speakers who differed in their language dominance. Language proficiency in English and Spanish was assessed with a standardized test. In Experiment 1, subjects named pictures in English and a regression analysis of naming latencies showed a significant word frequency by English language proficiency interaction. In Experiment 2, subjects saw a visual display of four semantically and phonologically unrelated pictures and heard instructions to click on one of the pictures. A regression analysis of target picture fixations again revealed a significant interaction between frequency and language proficiency. These findings support accounts that attribute the bilingual disadvantage in lexical access to reduced language experience of bilinguals rather than qualitative differences between bilingual and monolingual speakers.

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(4147)

CLEARPOND: Cross-Linguistic Easy-Access Resource for Phonological and Orthographic Neighborhood Densities. ANTHONY SHOOK, SARAH CHABAL, JAMES BARTOLOTTI and VIORICA MARIAN, *Northwestern University*—Past research has shown that neighborhood variables (e.g., neighborhood density) can influence lexical processing (Andrews, 1989; Vitevitch & Luce, 1999) and have distinct effects for different languages (Vitevitch & Stamer, 2006). To examine how neighborhoods and their effects can vary both within and across multiple languages, we have developed the Cross-Linguistic, Easy-Access Resource for Phonological and Orthographic Neighborhood Densities (CLEARPOND), an online database of phonological and orthographic neighborhood information for five languages: Dutch, English, French, German, and Spanish. Analyses using CLEARPOND revealed consistent effects of lexical frequency and word-length on neighborhood size across languages, while also highlighting how languages differ in the distribution of different types of neighbors. CLEARPOND provides an important resource for researchers, allowing for the control of psycholinguistic variables across multiple languages. CLEARPOND is freely-available as a searchable online database at <http://clearpond.northwestern.edu>.

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(4148)

What do Speakers Know About the Sound Structure of Language Beyond Articulation? XU ZHAO and IRIS BERENT, *Northeastern University*—Across languages, certain onsets are systematically preferred to others (e.g., blif>lbif). Moreover, similar preferences are evident in the behavior of individual speakers even when none of these structures exists in their language. This convergence suggests the possibility



of universal grammatical constraints on language structures. But on an alternative account, these preferences might be only due to auditory and articulatory factors. Our past research has challenged the auditory explanation by replicating these preferences with printed materials. It is possible, however, that people's preferences might be informed by subvocal articulation of these stimuli. To test this explanation, we gauge people's linguistic preferences while suppressing their articulation using tongue depressors. Results demonstrate either full or nearly full sensitivity to linguistic structure, with only minimal effects of suppression. These findings suggest that speakers possess broad phonological preferences that are inexplicable by articulatory factors.

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(4149)

Lexical Access to Signs is Automatic. AMANDA L. DUPUIS and IRIS BERENT, *Northeastern University*—An encounter with a spoken word's form automatically activates its meaning—the large Stroop literature attests to this fact. Here, we ask whether the capacity to automatically link arbitrary forms and meanings is a general property of language. To this end, we examine the propensity of signs in American Sign Language (ASL) to induce Stroop interference. Our study presented monochromatic videos featuring ASL color signs (green, yellow, blue) along with a neutral XX sign, such that the sign was congruent, incongruent or unrelated to its color. Participants—Deaf native signers of ASL—were asked to sign back the color of the video as quickly and accurately as possible. Results showed robust color-sign incongruency. The replication of this effect regardless of the presence of congruent trials, and even when response was given by a button-press demonstrates that it is not due to response strategy or response competition. These results suggest that Deaf native signers of ASL automatically retrieve signs' meanings. We conclude that the automaticity of lexical access is an amodal property of language processing, regardless of modality.

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• SPEECH PERCEPTION II •

(4150)

Seeing a Speaker Provides Speaking Rate Information for Phoneme Recognition. ALEXANDRA JESSE, *University of Massachusetts Amherst*, ROCHELLE S. NEWMAN, *University of Maryland*—When listening to speech, listeners evaluate durational cues to phoneme identity within the context of the speaker's rate of articulation. In face-to-face conversations, speech is processed from hearing and seeing the speaker talk. We examined whether visual speech also provides speaking rate information for segmental recognition. We manipulated the rate of a visual-only carrier sentence. The sentence preceded steps of an auditory voice onset time (VOT) continuum ("bin"–"pin"), which were presented along with a visual "pin" ("bin" and "pin" are visually indistinguishable). As predicted, listeners categorized more items as "p" (perceived VOT as longer) after a sped-up than a slowed-down visual

speech context. A similar-sized rate effect was also found when showing a moving dot (animated to follow changes in lip opening) instead of the talking face. Visual context thus provides speaking rate cues that help listeners with phoneme recognition, even when it is not processed phonetically.

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(4151)

Do Listeners Use Visually Specified Information about Coarticulation in Speech Perception? NAVIN VISWANATHAN, *State University of New York-New Paltz; Haskins Laboratories*, JOSEPH D.W. STEPHENS, *North Carolina A&T University*—The classic McGurk effect, in speech perception, demonstrates that visual information about vocal gestures of a given phonetic segment, influences listeners' perception of the same segment (McGurk & MacDonald, 1976). The question of whether visual information about a preceding segment influences the perception of a target segment has yielded inconclusive answers with some studies demonstrating visual precursor effects (e.g., Fowler et al., 2000) and others failing to find such an effect (e.g., Holt, Stephens, & Lotto, 2005). We reexamined this question by using stimuli from past studies (Fowler et al., 2000) with controls designed to address specific criticisms of Holt et al. (2003). Through our results, we identify specific conditions that either elicit or fail to elicit visual influences of the precursor on target speech perception. We discuss the implications of our findings on the past debate and, in general, for accounts of speech perception.

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(4152)

Contributions of Sleep and Exposure to Talker-Specific Adaptation. ALISON M. TRUDE and SARAH BROWN-SCHMIDT, *University of Illinois at Urbana-Champaign*, KIMBERLY M. FENN, *Michigan State University*—Previous research suggests sleep is crucial for integrating novel words into the lexicon. Less is known about how listeners learn novel phonological variants. We tested the role of sleep in learning talker-specific variants. Participants completed 2 sessions separated by 12hr of sleep or wakefulness (or 24hr control). At each test, eye-tracked participants heard 2 talkers, one with an accent where /æ/ raises to [eɪ] before /g/ (e.g., bag [betg]). Gaze at images of –ag-words (bag) and same-onset –ake-words (bake) was measured as one talker named an image. For –ag-word trials, we predicted participants would fixate the accented talker's –ag words more after sleep. All participants increased consideration of the accented talker's –ag words at Session 2, indicating exposure, not sleep, was most important for learning novel pronunciations. However, Session 2 talker-independent improvement was also observed, but only for those who slept, suggesting sleep confers general benefits to spoken word recognition.

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(4153)

Do Prosodic Cues Reflect Perceived Color Brightness? CHRISTINA Y. TZENG, JOSEPHINE DUAN, LAURA L. NAMY and LYNNE C. NYGAARD, *Emory University*—Prosody (timing, rhythm, and intonation of speech) has

traditionally been assumed to convey information regarding linguistic structure and speakers' emotional state. However, recent studies have shown that speakers also use prosody to convey meaning and that listeners infer semantic information from these prosodic cues. The current study examined the extent to which speakers spontaneously produce prosodic correlates to color brightness. In Experiment 1, participants produced English color names while viewing three brightness levels of five different colors. In Experiment 2, participants performed a similar task using novel words as color labels. Although acoustic analyses in Experiment 1 showed that speakers' prosody did not reliably differ across brightness levels, speakers' utterances in Experiment 2 varied as a function of brightness such that labels for brighter shades were higher pitched, and those for darker shades were lower pitched. Findings suggest that prosody provides an additional channel of semantic information that may reflect cross-modal correspondences between auditory and visual domains in spoken language. These data imply that the relation between sound and meaning in spoken language is not entirely arbitrary.

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(4154)

Modeling Implicit Measures of Receptive Vocabulary Knowledge in Normal Adults. EMILY L. CODERRE, LAURA BOSLEY, MARIYA CHERNENOK, BARRY GORDON and KERRY LEDOUX, *Johns Hopkins University*—Implicit measures of receptive language hold potential for assessing vocabulary knowledge in populations unable to give overt behavioral responses. We used eye movements (EMs), pupillary dilation (PD), and event-related potentials (ERPs) as implicit measures of vocabulary knowledge in normal adults during a forced-choice recognition task (EM and PD) and a congruity task (ERP) with high-frequency 'known' words and low-frequency 'unknown' words. Known words showed faster EMs, more frequent end-of-trial EM fixations, and greater mean PDs than unknown words. An N400 congruency effect occurred only for known words. A regression model was fit using these measures as predictors of participants' explicit word knowledge ratings. The predicted knowledge ratings from the model were then used to re-code words as 'known' or 'unknown'. Stronger effects occurred after re-coding, demonstrating that these implicit measures could accurately predict knowledge ratings and may be useful measures of vocabulary knowledge in the absence of overt responses.

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(4155)

Phoneme Transposition Effects in Spoken Word Recognition. ANISH M. KURIAN, JINGJING ZHAO, JAMES MAGNUSON and JAY RUECKL, *University of Connecticut*—The current experiments investigated if the presence of a phoneme transposition effect (the spoken word form of letter transposition effects). Is the transposed version of a baseword (baseword: debacle, transposed form: decable) more difficult to detect than a replaced phoneme version (replaced form: detadle) of the same word? A change detection task and lexical decision task were used to

investigate this question. The change detection task presented participants with a sequence of 10 tokens and they were to indicate whether or not they heard a change within the trial. The second task was a traditional auditory lexical decision (LD) task. If a phoneme transposition effect does exist accuracy would be lower for transposed phoneme (TP) items when compared to equivalently different replaced phoneme (RP) item accuracy, and reaction times for correct trials in the LD task would be slower for the TP condition than the RP condition. Preliminary evidence suggests that phoneme transposition effects do exist (lower accuracy & longer RT for TP vs. RP conditions), and that models of speech perception need to be adjusted to account for these findings. Currently, an ERP task looking at P300 is being run to find converging neural evidence.

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(4156)

The Role of Intonation in Speech Segmentation in German 9.5- to 10.5-Month-Olds. BETTINA BRAUN and MUNA POHL, *University of Konstanz* (Sponsored by Michael Dambacher)—Studies on infant speech segmentation show that stressed syllables, which are often accompanied by high pitch, are preferred word onsets (Jusczyk, Houston, & Newsome, 1999). However, pitch peaks can be early, medial or late relative to the stressed syllable. We therefore test whether German 10 month olds are more sensitive to high pitch or to word stress. Using the headturn preference procedure, 9.5-10.5 month old German infants were familiarized with 2 trisyllabic target words with penultimate stress (e.g. Lagune), embedded 6 times in short text passages. The target words were presented either with early or with medial peaks. In the test phase, orientation times to word lists were measured, comparing lists repeating the 2 final syllables of the target words (e.g. gune) to lists of unfamiliar trochaic sound sequences (e.g. sino). Pitch range was matched across the early and medial peak familiarization passages and across test lists. Average orientation times show a familiarity effect for the medial peak condition, where stress and pitch are aligned (9.2 vs 7.4s), but not for the misaligned early peak condition (10.9 vs 10.8s). Our preliminary results suggest that intonation is more important for segmentation than stress.

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(4157)

Relevance of Native Language Categorization to Nonnative Speech Processing. ERIKO ATAGI, *Indiana University* (Sponsored by Tessa Bent)—Enhanced encoding of indexical speech features such as talker-specific features can facilitate linguistic processing of speech – including speech comprehension, identification, and discrimination (e.g., Samuel & Kraljic, 2009). For nonnative speech, accurate categorization of nonnative talkers by native language background could benefit linguistic processing. To investigate this hypothesis, listeners completed a native language categorization task and a nonnative speech-in-noise transcription task. Listeners were above chance at the categorization task; performance on the two tasks, however, was not correlated. Compared to listeners who had studied



one foreign language, listeners who had studied two foreign languages were significantly better at native language categorization but demonstrated similar transcription performance. Unlike the benefits found for the encoding of talker-specific features, the ability to categorize nonnative talkers by native language did not enhance linguistic processing of nonnative speech. Familiarity with multiple foreign languages, however, may increase listeners' awareness of phonological differences across diverse native language backgrounds.

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(4158)

Phonetic Variation in Speech Cues Emotions and Words Simultaneously and Independently. SEUNG KYUNG KIM and MEGHAN SUMNER, *Stanford University*—Phonetic variation in speech informs listeners about sounds and words and about talkers (e.g. emotion). In speech perception, this indexical variation is accommodated via an exemplar lexicon. This assumes that lexical and indexical information are coupled. We investigate the effect of words produced with different emotions on the recognition of spoken words. First, we compared the recognition of emotion word targets (UPSET) preceded by semantically unrelated primes spoken with emotionally related or unrelated prosody (pineapple_[AngryVoice] or pineapple_[NeutralVoice]). Second, we investigated the effects of emotion on semantic priming (pineapple_[AngryVoice]/[NeutralVoice] - FRUIT). Recognition of both emotionally related and semantically related targets were facilitated by primes with angry prosody. These data suggest that indexical variation in speech influences the recognition process beyond detailed lexical representations. We suggest listeners simultaneously process acoustic variation in speech for indexical and lexical meaning and argue that emotional prosody activates emotion features and categories, independent of lexical access.

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(4159)

How Well Can Listeners Distinguish Dialects and Unfamiliar Languages? NEIL W. KIRK, VERA KEMPE and KENNETH SCOTT-BROWN, *University of Abertay Dundee*—Although the ability to identify dialects and languages is regarded as crucial for establishing geographical and social group membership of interlocutors, the use of indexical features of speech has so far received little attention in psycholinguistic research. In this study, participants from various linguistic backgrounds heard words pronounced either in Standard Scottish English or in local Scots dialect and had to distinguish them by variety. Results showed that after just a few months of exposure participants were able to reliably distinguish both Scottish varieties, regardless of native language. More surprisingly, participants with no noteworthy exposure to two unfamiliar varieties – Russian and German – performed above chance when assigning cognates and interlingual homophones to either language based on accent. These findings demonstrate that adults can rapidly acquire

implicit knowledge about the phonetic properties of different linguistic varieties. Future research will explore which specific cues and which cognitive pre-requisites facilitate this ability.

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(4160)

Monolinguals' and Bilingual's Ability to Process Speech in Noise. GIOVANNA MORINI and ROCHELLE S. NEWMAN, *University of Maryland*—Listeners are regularly faced with speech heard in the presence of background-noise. When presented with competing auditory signals, listeners must separate the sound-streams and selectively attend to the target signal. To accomplish this, listeners must rely on cognitive skills such as selective attention and inhibition. Bilinguals are required to “manage” two linguistic systems; this means monitoring (and switching between) two languages regularly. This practice generally results in cognitive advantages in inhibitory control. We examine whether monolinguals and bilinguals differ in their ability to learn new words in noise. Adult listeners were taught non-words corresponding to novel objects either in noise or in silence. Preliminary data from the monolingual group (n=14) suggests that while response times are comparable across conditions (1.17sec vs. 1.18sec) accuracy appears to be worse in the noise condition (33% vs. 57% in quiet). Bilingual data and additional monolingual data will be presented in November.

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(4161)

Seeing Spaces: An Eye-tracking Study of Audiovisual Speech Segmentation. AARON D. MITCHEL and LAINA G. LUSK, *Bucknell University*—A growing body of literature has investigated the role of faces during speech segmentation. In particular, a recent study (Mitchel & Weiss, 2013) established that adults can utilize facial cues (i.e. visual prosody) to identify word boundaries in fluent speech. However, it remains unclear which facial cues were utilized by learners; thus, the present study used an eye-tracker to identify the features to which learners attend during segmentation. Results revealed that participants fixated on the mouth significantly longer than the eyes or nose. In addition, eye-gaze patterns changed across familiarization, initially fixating on the mouth but shifting to the eyes in the final block, suggesting that participants view the mouth when speech is ambiguous, but attend to the eyes once the ambiguity is resolved. Subsequent research will examine the reliance on individual cues by systematically obscuring features (mouth, eyes, and frame) and assessing the impact on segmentation.

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(4162)

Can We Hear Morphologically Complex Words Before They Are Complex? LAURA BLAZEJ and ARIEL M. COHEN-GOLDBERG, *Tufts University*—Research by Davis et al. (2002) has shown that listeners can use acoustic cues to distinguish onset-embedded words (captain) from free-standing words (cap) before they diverge phonemically. This study examines whether listeners can determine similar facts about multimorphemic words. Having heard only /

klu/, can listeners determine whether they are hearing a monomorphemic word (clue) or a suffixed word (clueless)? Following Davis et al. (2002), we constructed sentence frames that were identical until after the root (e.g., There was a clue to the scavenger hunt in the closet/There was a clueless student in the classroom). Sentences were recorded and the identical portion was extracted (There was a clue). In Experiment 1, subjects were presented with one of the sentences from each pair and given a forced choice to decide whether the last word was mono- or multimorphemic (clue/clueless). In Experiment 2, the same words were used but sentence frames were altered to control for coarticulation (There was a clueless/clue left). Subjects were significantly above chance in both experiments (accuracy: 68%; 63%). This indicates that listeners are able to infer facts about morphological structure before they encounter a suffix.

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(4163)

Reading Ability and Auditory Imagery During Silent Reading. JESSICA E.D. ALEXANDER and KIMBERLY D. CLINE, *Concord University*—Auditory imagery during silent reading has been shown to be related to both text difficulty and individual differences in imagery ability. The current study examined individual differences in reading ability and auditory imagery for talker’s voice during silent reading. After being familiarized with two talkers (one fast and one slow) by listening to a recording of a casual conversation, participants silently read a passage “written” by one of the two talkers. Passage “author” influenced reading times when compared to a baseline passage, but only for readers who scored high on a test of reading fluency. Recent research has shown links between language ability and identification of talker’s voice (Perrachione, Del Tufo, & Gabrieli, 2011), with dyslexic participants showing impairments in talker recognition. The current study builds on these findings, demonstrating differences in auditory imagery for talker’s voice for good and poor readers more broadly.

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(4164)

Self and Other Laughter Affect Tension and Playfulness Differently. CHARLOTTE A. ZEAMER and JEAN E. FOX TREE, *University of California, Santa Cruz*—Laughter is an interactional move that signals to others the nonthreatening nature of some unexpected event in the environment. We tested the effect of self laughter, other laughter, and no laughter on the perceived tension and perceived playfulness of heard conversations that varied in tenseness. When listening to high tension conversations, laughter both from others and from the speaker reduced tension, with the laughter of others having the greatest effect. In contrast, only other laughter increased playfulness. Mid-level tension conversations were similar with respect to self and other laughter’s reducing tension, but other laughter no longer increased playfulness. Instead, playfulness was similar across conditions. In the low-tension condition, only self-laughter reduced tension, but both self and other laughter increased playfulness. These findings support the hypothesis that laughter serves the relationship

management functions of (1) making serious social breaches less dangerous to relationships and (2) signaling a safe space to engage in unconventional behavior that would otherwise seem threatening.

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• JUDGMENT AND DECISION MAKING II •

(4165)

Adjustments to Choice Preference: Neural and Behavioral Correlates of Stimulus and Response Information Across Different Decision Tasks. COREY N. WHITE, *Syracuse University*, RUSSELL A. POLDRACK, *University of Texas at Austin*—Humans have a remarkable ability to adjust behavior based on different types of information. We explored how such information is used to adjust different decision components using cognitive modeling and fMRI. Participants performed a recognition memory task and an emotion task, which required them to classify words as either safe or emotionally upsetting. Stimulus and response information was presented before each trial. Trials differed between strong and weak values along the critical dimension (i.e., memory strength or emotionality), and also based on which response was more likely to be correct. This novel design allowed dissociation of adjustments to stimulus and response components of the decision process, which were quantified by fitting drift diffusion models to the behavioral data and used to probe the fMRI data. Stimulus and response information mapped onto distinct parameters in the diffusion model (i.e., drift rates and starting point), and were related to both task-dependent and task-independent neural systems. Our results provide novel insight into how the brain maps information into appropriate action and support the existence of general neural systems for decision processes. Email: Corey White, coreywhite.1198@gmail.com

(4166)

When and How Are Optimal Choice Strategies Learned under Risk and Uncertainty? CHRISTIN SCHULZE, *University of New South Wales*, DON VAN RAVENZWAAIJ, *The University of Newcastle*, BEN R. NEWELL, *University of New South Wales*—Learning to choose adaptively when faced with uncertain and risky situations is a central challenge for decision makers. We examine choice behavior in sequential binary decision tasks with probabilistic outcomes that reinforce one of two strategies. Probability maximizing is optimal when isolated decision makers face serially independent outcomes. Probability matching is superior when ecologically valid pressures, such as competition for monetary resources with other decision makers or sequential dependencies between outcomes and prior decisions, are introduced to the choice environment. We observe accurate asymptotic strategy use contingent on the requirements of the respective choice settings. Moreover, these results emphasize that “irrational” probability matching can be adaptive once ecologically valid pressures are taken into account. To describe the parameters of choice behavior within these environments more holistically,



we apply computational models of reinforcement learning that aim to illuminate the general adaptability of binary choice behavior under risk and uncertainty.

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(4167)

A Quasi-Bayesian Cascaded Inference Model of Causal Power. COLIN S. BEAM and JOHN M. MIYAMOTO, *University of Washington*—We examine models of the causal strength of a single cause for a given outcome. Cheng's power PC model is among the best known in this domain, but a number of alternative models have also been proposed. In contrast to a normative Bayesian model that would require the computation of a multivariate posterior distribution, we propose a cascaded inference model in which some of the distributional inferences are replaced by point summaries. The cascaded inference model greatly reduces the cognitive complexity while closely approximating the predictions of a Bayesian model. When applied to Perales and Shanks (2007) meta-analysis data, our model provides a better fit than the evidence integration rule and Lu et al.'s (2008) Bayesian SS Model II. Our model also gives a straightforward explanation for the "frequency illusion" in which judged causal strength decreases with a decreasing base rate when delta-p equals zero (Griffiths and Tenenbaum, 2005).

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(4168)

Social Transmission of Intertemporal Preferences During Collaborative Decision Making. MICHAEL T. BIXTER, ELIZABETH M. TRIMBER and CHRISTIAN C. LUHMANN, *Stony Brook University*—Prior research has provided substantial insight into individuals' intertemporal preferences; preferences about delayed rewards. The present study instead investigated the preferences of small groups of individuals asked to express collective intertemporal decisions. The paradigm consisted of three phases. During the Pre-Collaboration and Post-Collaboration phases participants completed an intertemporal matching task individually. During the Collaboration phase participants completed a similar task in small groups, reaching mutually agreed-upon decisions. Results suggest that group preferences were systematically related to group members' Pre-Collaboration preferences. In addition, collaborative decision making altered group members' intertemporal preferences. Specifically, individuals' Post-Collaboration preferences converged towards the preferences of their respective groups. Furthermore, it was found that individuals' Post-Collaboration preferences were independently related to both their Pre-Collaboration preferences and their group's preferences, suggesting that individuals' Post-Collaboration preferences represented a revision of their Pre-Collaboration preferences based on the preferences observed in other group members.

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(4169)

The Role of Outcome Feedback in Descriptive and Experiential Decision Making. CRISTINA G. WILSON, JOHN M. HINSON and PAUL WHITNEY, *Washington*

State University—Choices in risky decision tasks often differ based on whether options are described or learned through experience. This so-called description-experience gap is commonly attributed to differences in the way probabilities of rare events are weighed when described rather than experienced. However, factors other than probability weighting may be important. The current study examined the role of choice outcome feedback in the description-experience gap. We compared choices in risky decision framing tasks that were either description-based or experience-based and manipulated the degree of outcome feedback after choices. We found that experience-based choices were driven mostly by the gain or loss frame, while description-based choices were driven by both the frame and the value of the gamble option. Omission of outcome feedback increased the influence of the frame. These results show that outcome feedback can contribute to choice differences in both description-based and experience-based tasks.

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(4170)

Discounting of Delayed Gains and Losses: A Simple and Reliable New Measurement Approach. JOEL MYERSON, ANA BAUMANN and LEONARD GREEN, *Washington University in St. Louis*—129 participants completed Kirby's questionnaire, which involves choices between immediate and delayed gains, and an analogous new questionnaire we have developed that involves delayed losses. Responses were scored using logistic regression to estimate discounting rates and by simply summing the number of choices of delayed outcomes. For gains, the two methods correlated $>.95$, and the simple sums for small, medium, and large gains were strongly correlated ($r_s > .80$), suggesting that the ease of the simple sum measure does not require sacrificing reliability. For losses, the simple sums for small, medium, and large amounts were strongly correlated ($r_s > .80$), but the number of choices of delayed gains was only marginally correlated with choices of delayed losses. Consistent amount effects were observed for delayed gains, but not for delayed losses, replicating previous findings and providing further validation of both our new questionnaire and the simple sum approach to measuring discounting.

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(4171)

Dissociating Cognitive and Affective Empathy: Implications for Mood Disorders. W. JAKE THOMPSON and EVANGELIA G. CHRYSIKOU, *University of Kansas*—Empathy is a psychological construct comprising a cognitive (i.e., recognizing emotions) and an affective (i.e., responding to emotions) component, each associated with activity in ventromedial and dorsolateral prefrontal cortical regions, respectively. As an aspect of higher order social cognition, deficits in empathy have been linked to executive dysfunction in depression that might underlie a patient's interpersonal difficulties. However, most studies measure empathy through the Interpersonal Reactivity Index (IRI), which may not accurately capture affective empathy. Critically, prior studies have not examined a potential dissociation between cognitive

and affective empathy in depressed individuals. In Study 1, a factor analysis determined the appropriateness of using the IRI to measure affective empathy. Results showed poor model fit with the affective empathy factor. In Study 2, a battery of empathy measures was administered to explore differences in empathic abilities between healthy and depressed individuals. Results revealed lower affective but normal cognitive empathy in depression. We discuss the implications of these findings for depression treatment, with an emphasis on developing a valid measure of affective empathy.

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(4172)

The Multi-Attribute Linear Ballistic Accumulator Model: A Dynamic Account of Context Effects in Decision-Making.

JENNIFER S. TRUEBLOOD, *University of California, Irvine*, SCOTT D. BROWN and ANDREW HEATHCOTE, *The University of Newcastle*—Context effects occur when preferences are influenced by the availability of other options. Six major context effects -- similarity, compromise, attraction, status quo bias, improvements versus tradeoffs, and advantages/disadvantages -- have wide ranging implications across applied and theoretical domains, and are typically attributed to loss aversion. We provide experimental evidence that all six effects arise in simple perceptual decision-making tasks. This casts doubt on explanations such as loss aversion, which are limited to high-level decisions, and indicates that context effects may be amenable to a general explanation at the level of the basic decision process. We propose the Multi-attribute Linear Ballistic Accumulator (MLBA), a new dynamic model that provides a quantitative account of context effects not only in traditional paradigms involving choices among hedonic stimuli but also demonstrations of these effects with non-hedonic stimuli. Because of its computational tractability, the MLBA model is more easily applied than previous dynamic models.

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(4173)

Immediate Emotional States as Predictors of Risk Preferences.

RENATA M. HEILMAN, *Babes-Bolyai University; City University London*, PETKO KUSEV, *Kingston University*—The interaction between emotions and cognitive processes has been one of the most investigated topics in last decades, with particular attention being paid to emotional influences in decision making. More recently, the processes by which people control and regulate their emotional states also became a topic of interest. The aim of the current study was to investigate how underlying immediate emotional states and communication of risk impact participants' risk preferences for gambles. In one study we measured positive and negative immediate affective states and choice preferences under risk. Specifically, participants were presented with abstract monetary gambles in which they were required to choose between a probabilistic gain or loss and a certain option. We found that positive and negative emotional states as well as communication format of risk influenced behavioural

patterns of preferences. Future research can build on these results and include emotion based parameters in decision making models.

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(4174)

Testing Theories of Intertemporal Choice.

JEFFREY R. STEVENS, *University of Nebraska-Lincoln*, MICHEL REGENWETTER, YING GUO, ANA POPOVA and CHRIS ZWILLING, *University of Illinois at Urbana-Champaign*—Intertemporal choices involve decisions between rewards available at different times. For instance, would you prefer to receive \$100 today or \$150 in one year? Most models of intertemporal choice focus on temporal discounting as an explanation of choice. Discounting involves subjectively devaluing future rewards. Recently, however, an alternative to discounting has emerged. Attribute-based models such as lexicographic models compare the reward amounts and compare the time delays to make a choice. Although these models have been tested for decades, few tests include probabilistic components of choice, despite the obviously noisy nature of empirical data. Here we test probabilistic versions of discounting and lexicographic models of intertemporal choice using the decision software QTEST. This analysis yields more stringent tests of these models than previously conducted. We found clear individual differences in which models best fit participant choice, with both discounting and lexicographic models fitting some participants. Both types of models, however, performed poorly in predicting choices in new data sets. These probabilistic analyses open up novel possibilities for testing models of intertemporal choice.

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(4175)

Decision Field Theory-Dynamic: A Cognitive Model of Planning On-The-Fly.

JARED M. HOTALING and JEROME R. BUSEMEYER, *Indiana University*—In complex environments, where individuals must plan a series of choices to obtain some goal, entire sequences of events, including one's future decisions, should be considered before taking an action. Backward induction provides a normative strategy for planning, in which one works backward from the end of a scenario. However, it often fails to account for human behavior. We propose a new model, Decision Field Theory-Dynamic (DFT-D), which posits that individuals plan future choices on the fly through repeated mental simulations. As they imagine likely sequences of events, they compare potential outcomes and accumulate preference for one action over another. A key prediction of DFT-D is that payoff variability produces noisy simulations and reduces sensitivity to mean utility differences. We tested this prediction with two experiments in which participants completed a series of multistage decision trees. Our results indicate a multi-stage payoff variability effect, wherein choice proportions move toward convergence at 0.50 as outcome variability increased. Model fits confirm that DFT-D can account for this result. Its parameter values also give insight into the strategies that people used to plan and allocate cognitive resources.

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(4176)

A Time-series Eye-tracking Analysis of Context Effects in Multi-attribute Decision Making. TAKASHI TSUZUKI, *Rikkyo University*, MOTOYASU HONMA, *National Center of Neurology and Psychiatry*—Attraction and compromise effects warrant special attention in multi-attribute decision making, because they violate the principles of rational choice. To investigate the underlying mechanism of these two context effects concurrently, we examined participants' information search and acquisition while recording their eye movements. We randomly assigned 20 undergraduates to the two context effect conditions. Participants were requested to solve 12 hypothetical purchase problems that had three alternatives described along two attribute dimensions. We found that adding a third alternative had significant effects on choice proportions in both conditions. In addition, fixation times for the best option were significantly longer and the frequencies of saccades within the best option were significantly higher in both conditions. The frequencies of saccades between two options were also significantly higher in both conditions when the best option was included. Furthermore, a time-series analysis of saccades between two options revealed the dynamic temporal aspects that important saccades increased while unimportant saccades decreased. These results suggest that the empirical examination of computational models based on multiple simultaneous measures is imperative to reveal the mechanisms underlying context effects in multi-alternative decision making.

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(4177)

Context Effects on Reproduced Magnitudes From Short-Term and Long-Term Memory. DOUGLAS H. WEDELL and JONGWAN KIM, *University of South Carolina*—Extant research has demonstrated strong contextual dependencies in reproducing magnitudes of perceptual stimuli from short-term memory. In these studies, context can have three sources: a) distributional properties such as the mean, b) values of anchor stimuli used in the reproduction task, and c) stimulus values from the most recent trials. An experiment was conducted to distinguish how context effects on reproducing stimulus magnitudes differ when based on long-term or short-term memory representations. Participants first learned to associate labels with squares. They then reproduced square sizes based on either the label cues, a long-term memory task, or based on a brief presentation of the square, a short-term memory task. Results from the short-term memory task showed assimilative effects of all three contextual sources: distribution mean, anchor value and recent stimulus values. Results from the long-term memory task showed assimilation for the anchor stimuli but strong distributional contrast effects that were well explained by a model that codes stimulus values by ranks. The combined results showed that there are multiple sources of context effects in estimation and that distribution effects depend critically on memory retrieval factors.

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(4178)

Tracing Activations of Diagnostic Hypotheses Reveals Memory Dynamics of a Primacy Order Effect. FELIX G. REBITSCHKEK, *University of Greifswald*, JOSEF F. KREMS, *Chemnitz University of Technology*, GEORG JAHN, *University of Greifswald*—In sequential diagnostic reasoning, the first observed piece of evidence activates one or more hypotheses about possible causes in long-term memory. If an initial hypothesis that is strongly supported by the first piece of evidence is finally preferred over a then equally supported, but later activated hypothesis, a primacy order effect is present. To investigate how varying activations of contending hypotheses during the reasoning process contribute to the primacy effect, we used a probe reaction task. Generally, an activated hypothesis is available for facilitated access. Hence, probes representing activated hypotheses were expected to be responded to faster than probes representing less activated contenders. The probe task was included in an experimental scenario of chemicals causing symptoms that patients present with. In each trial, participants evaluated a sequence of four symptoms and a probe was presented after one of the symptoms. Probes that represented the hypothesis chosen as the final diagnosis were responded to faster than probes representing finally equally supported but rejected hypotheses from the first symptom onwards. Hence, the probe reaction task illuminates how memory activation induces a primacy effect.

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• CONCEPTS AND CATEGORIES II •

(4179)

Category Learning Strategies in Two-Dimensional, Two-Modality Learning Tasks. JOSEPH BOOMER, ALEXANDRIA C. ZAKRZEWSKI, JENNIFER R. JOHNSTON and BARBARA A. CHURCH, *University at Buffalo, SUNY*, ROBERT MUSGRAVE and GREG ASHBY, *University of California, Santa Barbara*, DAVID SMITH, *University at Buffalo, SUNY*—An influential theory of category learning that draws a sharp distinction between explicit and implicit systems has been extensively tested within the visual sensory domain. Although this approach has been fruitful, little research has been done to extend this approach to other modalities. We extended the well-tested paradigm to include the auditory domain and examined cross-modal integration. We divided participants into groups completing either a Rule-Based (RB) task or an Information-Integration (II) task. A series of experiments tested category learning when category members were stimuli that varied on a visual and an auditory dimension. We demonstrated that participants can selectively respond to task-relevant dimensions in either modality. We also demonstrated that participants can integrate information across the two modalities. We discuss the results in terms of extending the multiple systems theory of category learning and the cognitive processes involved.

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(4180)

The Role of Multiple Factors in Promoting Rule-Abstraction versus Memorization in Category Learning.

JERI L. LITTLE and MARK A. MCDANIEL, *Washington University in St. Louis*—Recent work has suggested that individuals can approach the same categorization task with qualitatively different strategies: some learners try to abstract a rule whereas others focus upon memorizing the instances. In the present study, learners completed two tasks that involved category learning of distinctive instances for which a rule defined category membership. For one task, training consisted of 8 instances; for the other, 24. Following each training phase, learners categorized ambiguous transfer items that differed from a trained instance in one attribute, with memorization and rule-abstraction strategies promoting opposing category designations. Overall, learners were pushed towards memorizing in the 8-instance condition and rule-abstraction in the 24-instance condition, but strategy varied among individuals in each condition. Additionally, the first task influenced learning strategy in the second task. The present study suggests that learning strategy in categorization tasks may develop from a combination of task demands, individual preferences, and prior experience.

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(4181)

Weighing Common and Distinctive Features in a Free Categorization Task.

JOHN P. CLAPPER, BENJAMIN A. MILLER and GREGORY J. SMITH, *California State University, San Bernardino*—How do people weigh individual similarities and differences when deciding whether to place two novel objects into the same category? In these experiments, participants saw visual displays consisting of 16 objects from three novel superordinate categories, and were asked to generate binomial labels for each object. The objects within each category were generally alignable but did not share any specific features, except a single target pair that shared one to four (out of four) discrete features. People were more likely to assign objects sharing one or more discrete features (the target pair) to their own separate subcategory (i.e., assign them the same binomial label), with a larger increase for sharing all four features, but showed little or no sensitivity to different levels of match in between. We discuss the possible causes of this pattern of results (match sensitivity function), as well as its implications for models of unsupervised categorization.

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(4182)

Learning Categories by Generating Examples.

KENNETH J. KURTZ and NOLAN B. CONAWAY, *Binghamton University, SUNY*, KIMERY R. LEVERING, *Middlebury College*, EMILY EISENBERG, *Binghamton University, SUNY*—We investigate a mode of category learning inspired by the distinction in machine learning between generative (learning about the basis of categories) and discriminative (learning how to tell categories apart) methods. Whereas the most commonly studied mode of human category learning (classification) is strongly discriminative, a strongly generative task is one in which the learner creates examples of categories. On each

learning trial, a minimal featural cue is the starting point for building a complete member of a target category. The learner receives feedback on whether the generated example is a category member. In a 2x3 design, we manipulated the type of learning (generation vs. classification) for three different elemental category structures based on three binary features. Using a set of test measures, we found differences in the quality of category knowledge for the two learning modes that were consistent with the generative/discriminative framework.

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(4183)

The Use of Executive Functions to Transition Between Category Learning Systems.

SARAH J. MILES and JOHN PAUL MINDA, *University of Western Ontario*—Research on the cognitive processes underlying category learning provides evidence for a verbal system that learns rule-defined categories and a nonverbal system learns non-rule-defined categories. The current study investigates whether executive functions are used to transition away from the dominant verbal system and engage the nonverbal system. Participants learned a non-rule-defined or a rule-defined category while executive functions were untaxed, taxed temporarily or taxed continuously. When executive functions were continuously taxed during non-rule-defined categorization, participants were less likely to use a nonverbal categorization strategy than when executive functions were temporarily taxed, suggesting that when executive functions were unavailable, the transition to the nonverbal system was hindered. For the verbal system, temporary and continuous interference had similar effects on categorization performance and on strategy use, illustrating that executive functions play an important but different role in each of the category learning systems.

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(4184)

Complex Rule-Based Category Learning is Related to Depressive Symptoms and Positive Mood.

RUBY T. NADLER, *University of Western Ontario* (Sponsored by Ken McRae)—Two studies investigated the relationship between depressive symptoms and category learning performance. In the first study 95 participants completed several mood-related questionnaires including the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996), and the General Behavior Inventory (GBI; Depue, 1987) before completing one of three category learning tasks: simple rule-based (ERB), complex rule-based (HRB), and non-rule-based (NRB). Depressive and hypomanic symptoms were negatively related to HRB performance, but not to ERB or NRB performance. In the second study 82 participants completed the same questionnaires but with an additional positive and negative mood measure before completing either a complex RB, or NRB task. Depressive symptoms and positive mood were related to RB performance but not NRB performance. Positive mood contributed more unique variance to RB performance than depressive symptoms in a regression, suggesting that positive mood plays a key role in category learning that benefits from cognitive flexibility.

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(4185)

Contrast Class Constraints on Explanation in Category Learning. SETH CHIN-PARKER, *Denison University*—Engaging in explanation during category learning (compared to description and think-aloud protocols) leads to higher rates of learning a perfectly predictive, but less salient, rule for categorization (Williams & Lombrozo, 2010). This finding was taken to support a subsumptive constraints account; explanatory processes guide the participant to seek information that is shared across the members of the category and thus unify those instances into a category. In the current experiment, I present evidence that this account by itself is not sufficient to capture the processes involved when participants learn about categories by means of explanation. Critically, I manipulated the contrastive category as participants learned about a target category. In this case, participants in the explanation learning conditions did not learn about features shared by all members of the target category if those features were not diagnostic of the category (i.e. the features were shared by members of the contrast category). I propose that these results support an account that includes establishing a contrast class as a critical initial step in the processes involved in explanation generation (Chin-Parker & Bradner, 2010).
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(4186)

Learning Relational and Feature-Based Categories From Matched or Contrasting Comparisons. DANIEL CORRAL, *University of Colorado–Boulder*, KENNETH J. KURTZ, *Binghamton University, SUNY*, MATT JONES, *University of Colorado–Boulder*—Structure-mapping theory holds that learning relational categories is aided by comparing two items from the same category, because this highlights their shared structure. In contrast, learning feature-based categories should be easier when comparing items from opposite categories, because such contrasts direct attention to diagnostic features. These predictions were tested using a category-learning task in which two items were presented on every trial. Every subject learned either two relational categories or two feature-based categories and was in either a match or a contrast condition. Subjects in the match condition decided whether the items on each trial were both from Category A or both from Category B. Subjects in the contrast condition decided which item was from Category A and which was from Category B. The results show that feature- and relation-based categories were both learned better in the contrast condition. It is possible that the relations in this study (e.g., brighter, larger) were simple enough that subjects processed them as features, making alignment between stimuli unnecessary for learning. In ongoing follow-up experiments we test whether an advantage for the match condition arises with higher-order relations.
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(4187)

Analogical Reinforcement Learning. JAMES M. FOSTER and MATT JONES, *University of Colorado–Boulder*—The goal of the present work is to develop a computational understanding of how people learn abstract concepts. Research in analogical reasoning suggests that higher-order cognitive functions such

as abstract reasoning, far transfer, and creativity are founded on recognizing structural similarities among relational systems. However, we argue a critical element is missing from these theories, in that their operation is essentially unsupervised, merely seeking patterns that recur in the environment, rather than focusing on the ones that are predictive of reward or other important outcomes. Here we integrate theories of analogy with the computational framework of reinforcement learning (RL). We propose a computational synergy between analogy and RL, in which analogical comparison provides the RL learning algorithm with a measure of relational similarity, and RL provides feedback signals that can drive analogical learning. We formalized this integration in a model that learns to play tic-tac-toe.

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(4188)

Does Base-rate Sensitivity Rely on Implicit Learning? ANDREW J. WISMER and COREY J. BOHIL, *University of Central Florida*—We explored the possibility that implicit learning underlies base-rate sensitivity during category learning tasks. Paralleling studies of implicit learning in the categorization literature, we had participants complete category learning under unequal base-rates (relative exemplar frequencies) with different response types (categorization response vs. observational learning), feedback delays (immediate vs. a 5 second delay), base-rate ratios (2:1, 3:1), discriminability levels ($d^2=1, 2$), and training conditions (pre-trained on category structures or not). In conditions where the task was more difficult (e.g., $d^2=1$; no pre-training on category structure), we found that performance in response conditions was closer to optimal than performance in the observational-learning conditions. In other words, when there was a chance to give a categorization response by pressing a button on each trial, participants were more sensitive to base-rate differences, as reflected in their observed decision criteria (betas). This suggests a role for implicit learning (or procedural learning) of base-rate information.
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(4189)

The Effects of Dual Verbal and Visual Tasks on Featural vs. Relational Category Learning. WOOKYOUNG JUNG and JOHN E. HUMMEL, *University of Illinois at Urbana-Champaign*—Many studies have examined the distinction between feature- and relation-based categories (Gentner, 2005; Genter & Kurtz, 2005; Jung & Hummel, 2009; Tomlinson & Love, 2011). Those findings suggest that featural and relational categories have fundamentally different learning algorithms, where relational categories rely on explicit representations and thus require working memory and attention, as opposed to featural categories which may be learned more implicitly. In this study, we investigated further the distinction between feature- and relation-based category learning using a dual task methodology. Our results revealed an interaction: featural category learning was more impaired by a visuospatial dual task than by a verbal dual task, whereas relational category learning was more impaired by the verbal dual task. Our results suggest that in contrast to featural category learning,



which may involve mainly non-verbal mechanisms, relational category learning appears to place greater demands on more explicit and attention-demanding verbal or verbally related learning mechanisms.

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(4190)

Learning and Generalization Within a Biological Hierarchy.

MATTHEW LANCASTER and DONALD HOMA, *Arizona State University*—How previous learning generalizes to new learning situations and content was explored by analyzing transfer to related categories within a hierarchal taxonomy. Previous studies have found divergent results, sometimes revealing transfer to closely related subordinate categories. The current research used multiple convergent measures to assess the degree of transfer to biological categories following selective training. Participants learned subordinate, family level categories composed of photographs of birds and were then tested on other family level categories of the same order, of the same class but different order, or were outside the class of the learned categories. Transfer was tested using a discrimination test and further learning. Other participants multidimensionally scaled these categories following selective or no learning. Results showed substantial transfer to new instances of the learned categories but little transfer to related categories. The impact of prior learning on the scaling of these stimuli produced lawful changes in the space.

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(4191-4192)

Grant Funding Agencies. Information about various grant funding opportunities is available. Representatives will be present throughout the conference.



POSTER SESSION V

Saturday Evening,

Sheraton Centre Toronto Hotel, Sheraton Hall

Viewing 4:00 p.m.-7:30 p.m., Author Present 6:00 p.m.-7:30 p.m.

• MUSIC PERCEPTION •

(5001)

Key Generalization of Recognition Memory for Melodies.

ABIGAIL L. KLEINSMITH, JEFFREY M. BOSTWICK, GEORGE A. SEROR and W. TRAMMELL NEILL, *University at Albany, SUNY*—People easily recognize a melody in a previously unheard key, but they also retain some key-specific information. We tested the hypothesis that people compare a melody to a memory “prototype” representing the central tendency of experienced exemplars. We familiarized subjects with a simple eight-note melody in two closely separated keys (C, D), and tested discrimination of that melody from slightly altered melodies. Test and foil melodies included ones in C# (the “average” of pitch heights in C and D), and G (more distant in pitch height). Hit rates and discriminability (d') were better in C# than G. In a follow-up experiment, the melody was familiarized in two more widely separated keys (C, F#). Recognition was better for melodies a semitone away from the familiarized melodies (C#, G) than for the “average” (D#). The results suggest that melody recognition depends on proximity to pitch-specific memories, rather than to an abstract prototype.

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(5002)

Integrating Absolute Pitch and Absolute Identification:

Long-Term Learning of Sine Tones. BABETTE P. RAE, *The University of Newcastle*, ROGER DEAN, *University of Western Sydney*, ANDREW HEATHCOTE and SCOTT D. BROWN, *University of Newcastle*—Absolute pitch (also called “perfect pitch”) is the ability to identify musical notes sounded on their own. Absolute pitch is rare: about 1 in 10,000 in the general population, and up to 1 in 15 in highly accomplished musicians. While it was long thought that absolute pitch was an innate ability more recent research has suggested that learning of absolute pitch is possible. This parallels research in the related classical paradigm of absolute identification. Miller’s seminal work in 1956 described a severe limit in absolute identification (7+-2), but recent research has shown that this limit can sometimes be broken by extended practise. We examined whether absolute pitch might be similarly learned by practise. Four dedicated non-musicians completed a long-term learning experiment (tens of thousands of trials), with computer-generated musical notes. We tracked their performance throughout practise using tests of both absolute pitch, and relative pitch (long considered a confound in such studies).

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(5003)

The Purpose of Emotion and Timbre: Linking Music and Speech.

CASADY D. BOWMAN and TAKASHI YAMAUCHI, *Texas A&M University*—Timbre provides a key link between emotion in music and speech, but can it explain emotion in other types of sound? This study demonstrates that the ability to perceive emotion in infants’ vocalizations is linked to the ability to perceive timbres of musical instruments. This ability, however, does not cross into other sound domains. In three experiments, 360 sound stimuli were created by rearranging spectral frequencies of 10 musical instruments: flute, clarinet, alto-saxophone, trumpet, French horn, tuba, guitar, piano, violin, and bell (Experiment 1), as well as cooing, babbling, crying, and laughing (Experiment 2), and utilizing the International Affective Digitized Sounds (IADS) (Experiment 3). Participants listened to each sound and rated the emotional quality. Results suggest that five acoustic components of timbre (e.g., roll off, mel-frequency cepstral coefficient, attack time and attack slope) accounted for nearly 50% of the variation of the emotion ratings for the instrumental and prelinguistic vocalizations; however there was minimal overlap that explained emotion in the IADS. These results implicate the likelihood that the same mental processes are applied for the perception of musical instruments and speech sounds.

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(5004)

Vocalizing While Watching Conducting-Like Gestures: Kinematic Features of Conducting Drive Acoustic Features of Speech.

AYSU ERDEMIR, EMELYNE BINGHAM, SARA BECK and JOHN RIESER, *Vanderbilt University*—This study shows that adults can follow a conductor’s gestures, so the acoustic features of their utterances map onto the spatio-kinematic features of the gestures. In one condition, people were asked, without any explanation, to say the syllable /da/ while viewing each of four video-clips of conducting gestures. In other conditions, people were asked to vary their spoken /da/s in a way to match the gestures. In the judgment task, expert judges listened to the spoken /da/s while guessing which of the four gestures were observed, with results yielding significant hit rates. Second, psychoacoustic analysis on the sound data revealed significant associations of the motion characteristics, namely time, energy, and space with overall duration, amplitude and pitch levels of the utterances, respectively. Third, kinematic analysis of the gestures showed associations of velocity with amplitude. However, the strength of associations varied as a function of the strength of instruction, emphasizing the importance of instruction. The results demonstrate strong cross-modal links connecting vision to the auditory-motor system. We are exploring learning and development of this link by testing professional musicians, children and infants.

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(5005)

Music Performance and Learning in a Severely Amnesic Patient With Bilateral Medial Temporal Lobe Damage. JUSSI VALTONEN, *University of Helsinki*, EMMA GREGORY, JOEL RAMIREZ, MICHAEL MCCLOSKEY and BARBARA LANDAU, *Johns Hopkins University* (Sponsored by Elisabet Service)—Playing a musical instrument via sight-reading requires extraction of abstract information from visual patterns and motor execution of temporally structured sequences. We studied learning of novel musical pieces in a newly identified amnesic, LSJ, who was a skilled amateur musician prior to contracting viral encephalitis. LSJ has extensive damage to medial temporal lobe structures, including virtually complete destruction of the hippocampus bilaterally. Three novel viola pieces were composed, controlling for length, key, time signature, note pitch and duration, hand position and string crossings. LSJ practiced playing two of the pieces from sheet music. Relative to the unpracticed piece, clear evidence of learning was observed in LSJ's performance both in note-by-note analyses, and in professional musicians' judgments, both immediately after training and after a 14-day delay. While learning has been previously observed in amnesics in simple motor tasks, our results demonstrate that non-hippocampal structures can support learning for music performance.
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• EVENT COGNITION •

(5006)

Neural Markers For Attentional Tuning During Suspenseful Film Viewing. MATTHEW A. BEZDEK, *Georgia Institute of Technology*, RICHARD J. GERRIG and WILLIAM G. WENZEL, *Stony Brook University*, JAEMIN SHIN, *Georgia State University*; *Georgia Tech Center for Advanced Brain Imaging*, KATHLEEN PIROG REVILL, *Emory University*, ASHA KUMAR and ERIC H. SCHUMACHER, *Georgia Institute of Technology*—People often report being transported to narrative worlds, in a way that makes them feel detached from the real external world. In fact, behavioral evidence suggests that attention to extra-narrative stimuli during “hot spots” (i.e., time points when potential negative outcomes are most salient) is suppressed during natural viewing of suspenseful film scenes (Bezdek, 2012). The current study investigates the brain mechanisms for this effect. We measured brain activity while participants passively viewed centrally presented suspenseful film excerpts while an irrelevant checkerboard pattern flashed in the periphery. Peripheral visual processing areas along the calcarine sulcus (identified with a separate visual localizer task) demonstrated decreased activity at suspenseful hot spots compared to non-suspenseful “cold” spots. Whole-brain analyses revealed additional brain regions (e.g., right lateral prefrontal cortex) were affected by narrative changes in suspense. These results provide evidence of narrative-induced attentional tuning effects using complex realistic stimuli.
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(5007)

Changes in Situation Models Modulate Gaze Behavior, Memory and Prediction Performance in Motion Pictures. MARKUS HUFF, TINO G. K. MEITZ and FRANK PAPANMEIER, *University of Tübingen*—Humans understand film by representing its contents in situation models. These describe situations using five dimensions: time, space, protagonist, causality, and intentionality. Changes in these dimensions cause discontinuities and are perceived as boundaries between two meaningful units at which the situation model has to be updated. It has been shown that situations at event boundaries are remembered more precisely and predictions about the future become less reliable. We hypothesized that these effects are dependent on the number of changes in the situation model. In three experiments, we measured participants' memory, prediction performance, and eye movements for breakpoints that contained a change in no, one, or two dimensions. Results showed a linear relationship: the more dimensions changed, the higher was the recognition performance and gaze coherence. Similarly, participants' predictions became less reliable. We conclude that updating of situation models at event boundaries occurs incrementally.
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(5008)

Single and Multiple Object Tracking in Event Comprehension. SARAH H. SOLOMON, *University of Pennsylvania*, NICHOLAS C. HINDY, *Princeton University*, GERRY T.M. ALTMANN, *University of York*, SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Event comprehension often requires tracking multiple objects across time while also recognizing alternative states of individual objects. How do we keep representations separate for distinct, yet similar, objects, and bound for altered states of the same object? Left posterior ventrolateral prefrontal cortex (pVLPFC) is implicated in resolving conflict between semantic alternatives, and is hypothesized to be involved in tracking alternative representations of a single object as it changes in state during a described event (Hindy et al., 2012). We used fMRI to measure left pVLPFC recruitment when subjects read about events involving multiple distinct objects (e.g., one whole apple and another sliced apple), or involving multiple states of the same object (e.g., the same apple whole and sliced). We observed an interaction in pVLPFC activation across conditions, suggesting different processes for discriminating between distinct objects and categorizing the bound states of a single object.
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(5009)

Smile Intensity and Hemifacial Asymmetry for Perceived Trustworthiness. MATIA OKUBO, KENTA ISHIKAWA and AKIHIRO KOBAYASHI, *Senshu University*—Our cognitive mechanisms are specially designed to detect cheaters in social exchanges. However, such cheater detection can be thwarted by a posed smile, which cheaters display with greater emotional intensity than cooperators. In addition, the left-hemiface of cheaters looked more trustworthy than their right-hemiface when they expressed a posed smile. The present



study investigated relationship between smile intensity and hemifacial asymmetry for trustworthiness using smiling faces of cheaters and cooperators ($N = 48$). Independent observers rated the emotional intensity of the smiling faces and performed trustworthiness judgment on left-left and right-right face composites. For cheaters, the emotional intensity positively associated with the left-hemifacial advantage for trustworthiness while this association was not observed for cooperators. These results suggest that cheaters used the left-hemiface, which is connected to the emotional side of the brain (i.e., the right hemisphere), more effectively than the right hemiface to conceal their anti-social attitude.

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(5010)

Post-Traumatic Stress Disorder Symptom Severity Predicts Event Processing and Prediction Performance. MICHELLE L. EISENBERG, JEFFREY M. ZACKS and JASON LI, *Washington University in St. Louis*—The ability to segment ongoing activity into meaningful events is important for event understanding and memory. Event Segmentation Theory proposes that people constantly make predictions about what is going to happen next and that people experience boundaries between events at times of transient prediction failure (Zacks et al., 2007, *Psychological Bulletin*, v. 133, p. 273-293). Disruptions to prediction error monitoring may lead to impaired event comprehension in some clinical conditions. Post-Traumatic Stress Disorder (PTSD) is associated with event cognition impairments including intrusive recollections and memory difficulty. To investigate the relationship between prediction, event comprehension, and PTSD, 214 participants completed event segmentation and event prediction tasks and questionnaires assessing PTSD severity. Replicating previous results, persons with greater PTSD severity segmented events less well. They also performed less well on the event prediction task. These findings suggest that difficulty with event prediction and comprehension may affect PTSD patients' ability to interpret the activity occurring around them. This deficit could contribute to symptoms such as intrusive recollections and increased arousal.

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• ACTION •

(5011)

Increases in Task Difficulty Whiten the Spatial Structure of Motor Output. ANDREW B. SLIFKIN, JEFFREY R. EDER and PATRICK BYRNE, *Cleveland State University*—We recently demonstrated that the time-series structure of movement amplitude (MA) values shifted from pink to white noise when movement amplitude requirements (A) increased and target width (W) was constant (Slifkin and Eder, 2012, *Exp Brain Res*). That result was attributed to an increased reliance on closed-loop visual feedback processes induced by increases in A. Here, we sought to determine if variations of both A and W would predict MA structure. In particular, the combined influence of A and W was captured by the index of

difficulty [$ID = \log_2(2A/W)$]. Participants produced cyclical aiming movements under two ID levels (2 and 5 bits) and there was a small- and large-scale version of each ID: The A and W values of the large-scale version were twice those used for the small-scale version. Given that increases in ID are known to induce increased reliance on the available visual feedback, we predicted an ID-induced shift in time-series structure from pink to white noise. Indeed, that is what we found. Further, there were no changes in MA structure when scale level changed within each ID level. Thus, MA time-series structure is best captured by the combined influence of A and W, and not A alone.

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(5012)

Trajectory Deviations in Individual and Joint Simon Tasks. SANDRA PACIONE, MATTHEW RAY and JIAN OU, *University of Toronto*, HEATHER F. NEYEDLI, *University of Oxford*, TIMOTHY N. WELSH, *University of Toronto*—The present study tested the response co-representation account of the joint Simon effect (JSE) by examining the trajectories of aiming movements in individual two-choice, joint go-nogo, and individual go-nogo tasks. Differences in trajectory curvature on compatible and incompatible trials were examined because they mark the simultaneous presence of competing response codes. That is, in individual two-choice tasks, movements deviate more towards the non-target location on incompatible than on compatible trials suggesting the presence of a non-target response code activated by the irrelevant stimulus information. Thus, if co-representation of the co-actor's response leads to the JSE, then larger deviations on incompatible than on compatible trials will be observed in the two-choice and joint Simon tasks, but not in the individual go-nogo task. Although significant trajectory deviations were only observed in the two-choice task, there was a significant positive correlation between the magnitudes of the deviations on joint Simon and two-choice tasks. There were no significant correlations between deviation magnitudes in the individual go-nogo task and the other tasks. These results support the co-representation account of the JSE.

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(5013)

Symmetries in Action: On the Interactive Nature of Planning Constraints for Bimanual Object Manipulation. JOHN M. HUHN, *The Pennsylvania State University*, KIMBERLY A. SCHIMPF and ROBRECHT PRD VAN DER WEL, *Rutgers, The State University of New Jersey*—An important functional question for understanding how people perform physical actions is to understand how they manipulate objects with their two hands. Previous research suggests that people prefer to move their hands symmetrically. For bimanual object manipulation, such symmetry may take on several forms, however. Actions may be symmetrical when objects are grasped (initial symmetry), when they are placed on their target locations (goal symmetry), and/or relative to the objects being moved (object symmetry). We studied how these forms of symmetry influenced grasp selection when participants moved two plungers from two start locations to

two target locations. We varied the heights of these locations across conditions. The grasp locations participants adopted indicated a preference for object symmetry. This preference was even stronger when initial symmetry coincided with object symmetry. These results provide a tractable illustration of how multiple planning constraints may interact to give rise to both regularity and flexibility in motor behavior.

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(5014)

Movement Amplitude, Precision, and Hand Dominance: Revisiting Fitts' Law. JONATHAN VAUGHAN, ELIN L. LANTZ, MAHIMA KARKI, SUMMER B. BOTTINI, CARRIE G. CABUSH, ALEXANDER T. CATES and SARAH E. MANDEL, *Hamilton College*—Fitts' Law describes how movement time (MT) is affected by amplitude (A) and target width (W): $MT = a + b \log_2(2A/W)$. In recent observations by ourselves and others using circular targets, Fitts' Law overpredicted the effect of W, which differs from Fitts's observations (using rectangular targets) that W and A had equivalent effects on MT. We explore possible reasons for this discrepancy such as type of target used, the type of movement employed, and the performing hand (dominant or non-dominant). MTs to repetitively touch circular targets with a tool were measured by recording limb kinematics using a Nest of Birds system. When W was varied, participants touched easier targets using a smaller, more difficult "effective" width, whereas when A was varied, effective width was more nearly constant. As a consequence, the effective manipulation of difficulty for W was attenuated, leading to the overprediction. Slower movement times for the non-dominant hand were again observed. In addition, participants adjusted accuracy (responding less precisely, insofar as possible) with the non-dominant hand, demonstrating a new aspect of the accommodation of movement execution to hand dominance.

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(5015)

Breaking the Rules: Cognitive Conflict During Deliberate Rule Violations. ROLAND PFISTER and ROBERT WIRTH, *University of Würzburg*, KATHARINA A. SCHWARZ, *University Medical Center, Hamburg-Eppendorf*, WILFRIED KUNDE, *University of Würzburg*—Not all rules can be obeyed at all times, and violating a rule has various consequences beyond its obvious ethical and legal implications. It is unknown, however, whether the simple fact of violating a rule (i.e., committing an error by intention) leaves a fingerprint on the acting agent, even in the absence of any negative outcomes. A line of behavioural experiments targets this question using reaction time and trajectory data. Converging results indicate that cognitive conflict does indeed arise during rule violations in such restricted settings. In turn, anticipating this conflict might bias decisions whether to violate a rule or not in the first place.

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• AUTOBIOGRAPHICAL MEMORY •

(5016)

Effects of Cue Modality on Autobiographical Remembering in Blind, Blindfolded, and Sighted Individuals. DILAY Z. KARADÖLLER, MERVE MUTAFOGLU and ALI I. TEKCAN, *Bogazici University*—Although visual imagery is a crucial component of autobiographical remembering, very few studies addressed the effects of congenital blindness on autobiographical memory. Existing studies report that the blind may be slower to produce autobiographical memories compared to the sighted (Goddard & Pring, 2001) and that they report stronger imagery in non-visual domains, indicating presence of compensatory mechanisms (Ogden & Barker, 2001). The present study examined the effects of cue modality on retrieval and phenomenology of autobiographical memories in blind, blindfolded and sighted individuals. Participants were given verbal, auditory, and tactile cues and reported an autobiographical event in response to each cue. In addition, they filled out the Autobiographical Memory Questionnaire (Rubin et al., 2003) measuring recollective experience as well as different types of imagery for each memory. The results are discussed in terms of compensatory mechanisms and Basic Systems Approach to autobiographical memory (Rubin, 2005).

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(5017)

Estimating the Wane of Childhood Amnesia. KRISTI S. MULTHAUP and SAVANNAH ERWIN, *Davidson College*—Recent studies estimated the wane of childhood amnesia by asking participants to classify their childhood memories as remember or know memories; the transition from predominantly know memories (childhood amnesia) to predominantly remember memories was estimated with the mean of the median know memory age and the median remember memory age (e.g., Bruce, Dolan, & Phillips-Grant, 2000; Multhaup, Johnson, & Tetrick, 2005). These studies consistently found 4.7 yrs as the transition estimate. Whereas these studies asked participants about events that typically occur between ages 0-8 yrs or 0-10 yrs, two new studies asked participants about events that typically occur between ages 0-18 yrs. The transition estimate across the new studies was roughly 5.5 yrs. By contrast, a third study used the cue-word method (cued recall) for memories that occurred between ages 0-16 yrs and found a transition estimate of 7.2 yrs. Together these studies suggest that critical cognitive changes occur around age 5 (e.g., frontal lobe development), resulting in the wane of childhood amnesia, and that cued recall measures lead to an inflated age estimate for the transition from childhood amnesia to the development of autobiographical memories.

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(5018)

Reminiscence Bump for Most Important, Happiest, and Saddest Personal and Public Memories. ALI I. TEKCAN, AYSECAN BODUROGLU, AYSU MUTLUTÜRK and ASLI AKTAN ERCIYES, *Bogazici University*—Comparison of life-span retrieval distributions for personal and public



memories represent a testing ground for existing theories of the reminiscence bump, adults' tendency to remember disproportionately more memories from their youth. Although it has been shown that the emotional valence of the events may play a role in the emergence of the bump for personal events (Berntsen & Rubin, 2003), this effect has not been tested for public events. In the present study we tested the effects of emotional valence on life-span distributions of personal and public events comparatively. We asked a nationally representative Turkish sample (N = 608) for the most important, happiest, and saddest personal and public memories. A clear bump emerged for important and happiest but not for saddest personal events. For public events, the typical bump was limited to important events. The results are discussed in terms of existing theories of the bump.

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(5019)

Ambient Odor Affects What and How We Remember. BERIVAN ECE-USTA, SEZIN ONER, EZGI AYTURK, GUN SEMIN and SAMI GULGOZ, *Koç University*—Odor effect on autobiographical memory has been studied extensively in studies where the presentation of odor is open to associations with verbal and visual cues. To eliminate such associations, the effect of implicit ambient odor on autobiographical remembering was explored. A total of 88 (42 male) adults (M=19.66, SD=1.77) produced autobiographical memories to ten neutral cue-words and rated their qualities (e. g., importance, emotional valence and intensity). They were randomly assigned to three different conditions (pleasant, unpleasant, or no odor). Participants in pleasant odor condition produced more important memories while they remembered more negative events in unpleasant odor condition. Furthermore, emotionally less intense memories were recalled in unpleasant odor condition. Finally, more recent events were retrieved in unpleasant odor condition. Overall results indicated the critical role of odor in the retrieval context and the differential impact of particular odor types independent of the participants' awareness of these odors.

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(5020)

Remembering Success or Failure Memories and Self-Efficacy: The Role of Memory Perspective. EZGI AYTURK and SAMI GULGOZ, *Koç University*—The manipulation of perspective influences the qualities of autobiographical memory during recall. In this study, perspective was manipulated to observe whether it moderates the effect of remembering failure- or success- related autobiographical memories on perceived self-efficacy. Forty-three undergraduate students were asked to remember either a success or a failure memory. Half of each group was instructed to visualize their memory from the first person-actor perspective, and the other half was to take the third person-observer perspective. Participants' perceived self-efficacy was assessed before and after the experimental manipulation by self-report and implicit measures. Results revealed that third person perspective increased and first person perspective decreased perceived self-efficacy in the

failure memory condition. On the contrary, third person perspective decreased, and first person perspective increased subjects' self-efficacy in the success memory condition. The results show the influence of remembering particular memories from different perspectives influence the judgments about self.

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(5021)

How Nostalgia Influences Moral Judgment? JUN KAWAGUCHI, *Nagoya University*, KOU MURAYAMA, *University of California, Los Angeles*; *Japan Society for the Promotion of Science*, HIROKO NAKAMURA, *Nagoya University*—Nostalgia, a sentimental longing for the past, is an affective process that can accompany autobiographical memories. Researchers have found that nostalgia has a social function; for example, it bolsters social bonds and increases charitable intentions. In this study, we examined whether nostalgia influences another kind of social decision, in particular, moral judgment (personal moral dilemma). Eighty participants wrote an essay on a nostalgic event (nostalgia condition) or on an ordinary event (control condition). Then participants answered nine moral judgment problems (e.g., footbridge dilemma) to assess a tendency to deontological or utilitarian judgment. The results showed that participants remembering nostalgia event made more deontological judgments than remembering ordinary event. These results suggest that the sense of nostalgia influences moral judgment in a way that increases deontological judgments, disapproving of sacrificing one person for the greater good of others.

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(5022)

Culturally-Promoted Memory for Categorically Processed Information: An East-West Cross-Culture Study. LIXIA YANG, *Ryerson University*, WENFENG CHEN, *Chinese Academy of Sciences*, ANDY H. NG, *York University*, XIAOLAN FU, *Chinese Academy of Sciences*—Literature suggests that categorization, as an information processing and organization strategy, was more often used by Westerners than by East Asians, particularly for older adults (e.g., Gutches et al., 2006). The current study examines East-West cultural differences in memory for categorically processed items and sources in a reality monitoring task. In this experiment, forty-eight Canadians of European descent (24 young and 24 older) and 46 Chinese (24 young and 22 older) viewed a series of words, each followed either by a corresponding image (i.e., SEEN) or a blank square within which they imagined an image for the word (i.e., IMAGINED). At test, they decided whether the test words were old-SEEN, old-IMAGINED, or new. In general, Canadians outperformed Chinese in memory for categorically processed information, an effect more pronounced for older adults. Extensive exercise of culturally preferred categorization strategy differentially benefits Canadians and reduces their age group differences in memory.

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(5023)

Autobiographical Memory and Narcissism: Phenomenology and Narrative Analysis. A. MICHELLE WRIGHT and LARA L. JONES, *Wayne State University*—Do those higher in narcissism, as opposed to self-esteem, have more phenomenologically detailed positive-agentic (self-focused) autobiographical memories? The present study compared narratives and phenomenological ratings using the Autobiographical Memory Questionnaire (AMQ) for four memory types: 1. positive agentic (“Think of a time when you were clever”), 2. negative agentic (stupid), 3. positive communal (cooperative), and 4. negative communal (rude). Patterns of relationships between each AMQ subscale and narcissism differed across the four memory types from those for self-esteem. Results supported the agency model of narcissism, which characterizes narcissists as having a positive and agentic self view rather than a communal (other-focused) one. For instance, narcissism was correlated with vividness and rehearsal for the “clever” memory but not for the “cooperative” memory. In contrast, self-esteem was correlated with vividness for the “cooperative” memory. Additional LIWC and narrative analyses further support narcissists’ unique positive-agentic tendencies in autobiographical memories.

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(5024)

Qualitative Characteristics of Memory for Events: Relationships Between Spatial Information and Sense of Reliving. SAMANTHA A. DEFFLER, SHARDA UMANATH and DAVID C. RUBIN, *Duke University*—Tulving distinguishes “episodic” or event-related memories from knowledge based on a number of characteristics (Tulving, 1972; 1983; 1984); here, we are specifically interested in the sense of reliving that often accompanies the remembering of an event. We suggest that in order to have this sense of reliving, one must retrieve the spatial layout of the memory. In fact, spatial layout may be the fundamental characteristic that makes a memory “episodic.” To test this theory, we queried participants on characteristics of their memories using the Crovitz-Schiffman word-cuing paradigm. Ratings of reliving while remembering were highly correlated with mentally “seeing” the event and knowing the event’s spatial layout. The effect is likely mediated by the type of event reported, with specific events showing the greatest effect and factual information showing little to no correlation. These data support the idea that spatial layout is a key component of event memories and that it is closely linked to reliving.

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(5025)

The Effect of Concussion on Episodic Autobiographical Memory Recall. NICOLE C. BARRY, *Brock University*, JENNIFER L. TOMES, *Mount Allison University*—The purpose of the current study was to investigate the effects of concussion on long-term episodic autobiographical memory. A preliminary sample of previously concussed (N=45) and non-concussed (N=33) participants completed a survey that included a self-reported concussion history, two proxy measures of intelligence, the short-term memory

component of the Sport Concussion Assessment Tool, a measure of episodic autobiographical memory, and a depression inventory. As was predicted, non-concussed control participants provided significantly more detail than previously concussed individuals when recalling episodic memories across all life periods. The two groups did not differ significantly in terms of ratings of the vividness and completeness of memories, nor how easily memories came to mind, however the pattern of findings was in the predicted direction. These data suggest that there are long-term negative effects of resolved concussion(s) on episodic autobiographical recall. Limitations of the current findings, implications and suggestions for future research are discussed.

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• EXPLICIT MEMORY IV •

(5026)

Fill-in And Protrusion Effects in Serial Order Memory. ADAM F. OSTH and SIMON DENNIS, *The Ohio State University*—In his seminal dissertation, Henson (1996) identified a number of constraints on theories of serial order memory. Two constraints, the fill-in constraint, in which an item that is erroneously recalled early is likely to be followed by its predecessor rather than its successor (recall of ACB is more likely than ACD), and the protrusion constraint, in which prior list intrusions are likely to be recalled in the same output position as their previous serial position, were considered evidence against chaining theories. We present results from experiments which investigate the extent to which these effects are dependent on experimental methodology by comparing serial recall with an open set, a closed set, and a reconstruction task. The fill-in effect persisted across all methodologies, although it was larger in the closed set and reconstruction tasks and the protrusion effect was robustly observed even in the open set conditions. Implications for models of serial recall are discussed.

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(5027)

Familiar (But Not Recollected) Pseudowords Are Forgotten Faster Than Words. JASON D. OZUBKO, *Rotman Research Institute*, PAUL SELI, *University of Waterloo*—Pseudowords (e.g., HENSION) are often less memorable than words. It has been suggested that whereas highly orthographically similar words can easily be differentiated based on unique semantics (e.g., HORSE vs. HOUSE), pseudowords cannot (e.g., GRAWK vs. GLAWK). It is therefore more difficult to form unique representations for pseudowords than for words. We hypothesized that, if pseudoword representations (compared to word representations) are less semantically rich, then they may be particularly vulnerable to decay, as they should be less integrated within existing knowledge networks. To test this hypothesis we examined the decay of words and pseudowords in a continuous-recognition paradigm using remember/know and confidence measures. Consistent with our hypothesis, results indicate that pseudowords do indeed decay faster than words. Interestingly, however, although fewer



pseudowords than words were recollected, pseudowords that were recollected decayed at the same rate as words that were recollected. Pseudowords therefore decayed faster than words because familiarity decayed faster for pseudowords than for words. These findings provide new insight into the role of semantic integration for recollection and familiarity.

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(5028)

Enhancement of Recognition Memory by Point Value is Associated With Increased Recollection. MICHAEL S. COHEN, JESSE A. RISSMAN, ELIZA R. HARBERT, ALAN D. CASTEL and BARBARA J. KNOWLTON, *University of California, Los Angeles*—People often need to be selective to remember important information. When words are associated with arbitrarily assigned point values, learners generally show better memory for more valuable items (e.g., Castel et al., 2002). Memory, particularly recognition, can be divided into two processes: recollection and familiarity. We presented young adults with 5 lists of 24 words (12 low-value, 12 high-value) in an fMRI scanner, with a free recall test after each list. As expected, free recall was better for high-value words. About 45 minutes later, a recognition memory test was given. We computed estimates of recollection and familiarity for high-value and low-value items using ROC curves (Yonelinas, 1999). Estimates of recollection were higher for high-value than low-value items, while value did not seem to affect familiarity. Even when recalled items from earlier free recall tests were excluded, this pattern persisted. Thus, it seems that people tend to encode high-value items in a way that enhances recollection. Individuals showing greater enhancement of recollection by value also show greater modulation of encoding-related activity in left ventrolateral prefrontal cortex by value, suggesting strategic use of deep semantic encoding. Email: Michael S. Cohen, mcohen1@ucla.edu

(5029)

An Illusory Signature of Threshold Recollection in a Pattern Separation Task. KATHERINE M. INGRAM and JOHN T. WIXTED, *University of California, San Diego*—Some computational models hold that “pattern separation” (the ability to appreciate that a test stimulus differs from a very similar stimulus presented earlier) is a hippocampus-dependent threshold recollection process. There are two basic indicators of threshold recollection: 1) it only occurs for items that are recognized as being old with a high degree of confidence, and 2) it produces a curvilinear z-ROC. We found both of these trends in data from an Old-versus-Similar pattern separation task involving items with a very high degree of perceptual overlap. An alternative explanation for results like these is that: 1) the Old and Similar items were so similar that the small difference between them would not be detected at the time of retrieval unless a very clear memory representation had been formed at the time of encoding, and 2) target items recognized as old with low confidence (or target items that were not recognized as old) yield chance performance on the Old/Similar task, and their inclusion in the z-ROC analysis (not threshold recollection) is what causes

the z-ROC to be curvilinear. In three experiments using confidence ratings along with Old/New/Similar judgments, we report evidence for this latter interpretation.

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(5030)

Seeing the Truth: Saccade Execution Increases Correct “True” Responses on T/F History Tests. KEITH B. LYLE and RYAN P. HACKLAENDER, *University of Louisville*—Making a series of saccadic eye movements immediately before the retrieval phase of a memory test has been found to enhance test performance. Here, for the first time, we examined the effect of saccade execution on retrieval of educationally relevant material. Subjects read an encyclopedia-like entry on a historical figure and then took a true/false test. Immediately before the test, subjects either executed saccades or fixated on a stationary stimulus. Compared to stationary fixation, saccade execution increased correct “true” responses, especially in the later stages of the test. However, saccade execution actually disrupted performance on the first few questions. This complex pattern sheds light on how saccade execution affects memory retrieval and specifically informs how students might enhance their test performance in classroom settings.

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(5031)

That’s Not What You Said the First Time: The Relationship Between Consistency and Accuracy of Recall. SARAH E. STANLEY and AARON S. BENJAMIN, *University of Illinois at Urbana-Champaign*—Over multiple response opportunities recall may be inconsistent. For example, an eyewitness may report information at trial that wasn’t reported during initial questioning—a phenomenon called reminiscence. Such inconsistencies are often considered by lawyers to be inaccurate and are sometimes interpreted as evidence of the general unreliability of the rememberer. We examined the output-bound accuracy of inconsistent memories, and found that reminisced memories were less accurate than memories reported consistently. However, reminisced memories were just as accurate as memories that were reported initially but not later, indicating that it is the inconsistency of recall, and not the later addition to the recall output, that predicts lower accuracy. Finally, rememberers who exhibited more inconsistent recall were less accurate overall, indicating the common legal assumption may be correct – inconsistent witnesses are less reliable overall.

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(5032)

Is Variety the Spice of Memory? Evaluating the Encoding Variability Hypothesis. MARK J. HUFF and GLEN E. BODNER, *University of Calgary*—We examined whether encoding variability leads to improved recall when the type of processing is varied across study trials. In the variable-processing group, items were studied once using an item-specific processing task (e.g., mental imagery or pleasantness ratings) and once using a relational processing task (e.g., category sorting or narrative construction). This group was compared to a variable-task group whose separate study tasks

recruited the same type of processing each time, and to a repeated-encoding group who performed the same study task twice. Recall was greater in the variable-processing group than the variable-task or repeated-encoding groups, but only when studied list items were weakly related rather than strongly related. Our findings suggest that when studying an unrelated list of items, varying the type of processing recruited by study tasks across trials (i.e., item-specific and relational) may be critical to producing an encoding-variability advantage.

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(5033)

The Recall of Sounds Versus Words as a Function of Stimulus Presentation Rate. ROBERT J. CRUTCHER, *University of Dayton*—Environmental sounds are recalled better than spoken verbal labels of sounds (e.g. the sound of someone laughing vs. the spoken word “laughing”). This auditory picture superiority effect (Crutcher & Beer, 2011), like the classic picture superiority effect (Pavio & Csapo, 1973), has been found under varied stimulus processing conditions (e.g. incidental vs. intentional encoding). However, under certain conditions, the visual picture superiority effect has been eliminated or reversed. For example, with serial recall and recognition memory tasks, words are sometimes remembered as well or better than pictures, particularly at faster presentation rates. Paivio & Csapo (1971) found that pictures were recalled better than words at slow presentation rates but not at fast presentation rates. The current study investigated the effect of presentation rate on the auditory superiority effect and found that regardless of stimulus presentation rate (4, 6, or 8 seconds) environmental sounds were recalled better than verbal labels.

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(5034)

The Effects of Divided Attention on Encoding Processes under Incidental and Intentional Learning Instructions: Underlying Mechanisms? MOSHE NAVEH-BENJAMIN, *University of Missouri*, JONATHAN GUEZ, *Achva College*, MATTHEW BRUBAKER and YOKO HARA, *University of Missouri*, IRIS LEWANSCHUSS, *Ben-Gurion University*—Divided attention (DA) at encoding has been shown to significantly disrupt later memory for the studied information. However, what type of processing gets disrupted during DA remains unresolved. In this study, we assessed the degree to which strategic effortful processes are affected under DA by comparing the effects of DA at encoding under intentional and pure incidental learning instructions. In three experiments, participants studied list of items or item pairs under either full or divided attention. Results of the 3 experiments converged to show that the effects of DA at encoding reduce memory performance to the same degree under incidental and intentional learning. Secondary task performance indicated enhanced attention to the initial appearance of the words under both types of learning instructions. Results are interpreted to imply that other processes, rather than only strategic effortful ones, might be affected by DA at encoding.

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(5035)

Voluntary Forgetting and the Power of Selective Cues to Forget. CARLOS J. GÓMEZ-ARIZA, *University of Jaén*, CARMEN AGUIRRE, *University of Granada*, PILAR ANDRES, *University of Balearic Islands*, GIULIANA MAZZONI, *University of Hull*, M. TERESA BAJO, *University of Granada*—While some studies have shown that providing a cue to selectively ignore one subset of previously learned facts may cause specific forgetting of this information, little is known about the mechanisms underlying this memory impairment. In two experiments we aimed to better understand the nature of this selective directed forgetting (SDF) effect. Participants studied a List 1 consisting of 18 sentences about either two or three different characters and a List 2 consisting of sentences about an additional character. In Experiment 1, after presenting List 1 for study a cue to forget a given number of characters (1 out of 2 vs. 1 out of 3 vs. 2 out of 3) was provided before List 2 study. In Experiment 2, participants’ attentional resources during List 2 learning were reduced having them perform a concurrent updating task. Our results join other findings to show that SDF is a robust phenomenon and suggest boundary conditions for the effect to be observed.

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(5036)

Anger Impairs Episodic Recall. RUTH E. PROPPER, TAYLOR BARR and ANTHONY MOLLOY, *Montclair State University*, TAD T. BRUNYÉ, *Tufts University*; *U.S. Army*—The Hemispheric Encoding/Retrieval Asymmetry (HERA) model of episodic memory suggests that recall is enhanced by left hemisphere encoding/right hemisphere retrieval of information. Mood induction via music can be used to induce differential hemispheric activity, with happiness versus anxiety being associated with left versus right hemispheric activity, respectively. Anger may also be a left hemisphere emotion. 100 right-handed participants (score above ‘0’ on Edinburgh Handedness Inventory) studied and recalled list words immediately following mood induction in a between-subjects, 3 (pre-study: happy, angry, fearful) x 3 (pre-recall: happy, angry, fearful) factorial design. The ANOVA examining corrected scores (hits minus false alarms) was not significant ($p > .1$); planned comparisons between each pre-study/pre-recall group revealed that the anger-anger group recalled significantly fewer words compared to the fear-fear, happy-fear, anger-happy, anger-fear, and fear-anger groups ($p < .05$ for all comparisons). Results do not support the HERA model, but suggest that anger at both encoding and retrieval impairs memory.

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(5037)

The Production Effect is Both a Benefit and a Cost. NOAH D. FORRIN, BRIANNA GROOT and COLIN M. MACLEOD, *University of Waterloo*—Reading aloud boosts memory for words compared to silent reading. This production effect is typically more robust in a within-subject (i.e., mixed-list) design than in a between-subjects (i.e., pure list) design. The larger within-subject effect does not necessarily reflect benefits to reading aloud in a mixed study list: There may in



fact be costs to reading silently, or both benefits and costs. To assess these alternatives, we used a blocked design in which participants studied three lists: pure aloud, pure silent, and mixed. A recognition test immediately followed each list. Our results showed that production leads to both benefits and costs in a mixed-list. We explain these findings in terms of a distinctiveness account, while acknowledging the potential impact of lazy reading.

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(5038)

Information Retention in Graphical and Story-Based Passwords. STEFFEN WERNER and CONNOR C. HOOVER, *University of Idaho*—Users have a difficult time remembering secure passwords that conform to the requirements of modern information technologies. The so-called password problem describes the inverse relation between memorability and strength of passwords. It presents a unique opportunity for cognitive researchers to find the optimal design of cognitive authentication mechanisms that allows users to safely log into a system while keeping memory load and forgetting to a minimum. In a series of studies we have investigated memory for graphical passwords and short stories of 1,000 words or less (flash fiction) that are designed as a combination of randomly selected elements. To assess the information retained we developed an adaptive recognition paradigm, which modifies recognition demands by stepping down the size of the distracter set (up to 10 bits of information, 1024 items) to estimate the capacity of recognition memory. This approach might be able to provide strong passwords without the problems of traditional alphanumeric passwords.

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(5039)

The Effects of Cue and Target Strength in Cued Recall. JACK H. WILSON, WILLIAM R. AUE, and AMY H. CRISS, *Syracuse University* (Sponsored by Mike Kalish)—Aue, Criss, & Fischetti (2012) found that repeating the individual items of a studied pair lead to more correct responses and more incorrect responses in a later cued recall task. In a series of experiments, we orthogonally manipulate the strength of the cue and target via repetition. Overall, we find that strengthening the target item consistently leads to more correct answers. The findings are interpreted within the framework of memory models, with an emphasis on the REM model. The role of item, context, and associative information in cued recall is discussed.

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(5040)

Exploring Memory for Order in the Production Effect. TANYA R. JONKER, MERRICK LEVENE and COLIN M. MACLEOD, *University of Waterloo* (Sponsored by Mike Masson)—Recently, McDaniel and Bugg (2008) proposed an item-order account to explain a number of encoding phenomena, such as the generation effect. The account proposes better relational processing of commonly processed items compared to unusually-processed items in pure lists (e.g., read vs. generated words). This is exemplified by tests of memory for the order in which items were studied: Typically,

order memory is superior following common processing in pure lists compared to unusual processing. In a series of experiments, we explored the production effect (saying words aloud vs. reading silently) in the context of the item-order account. We found that the studied order was better remembered when items were read silently (i.e., common) than when they were read aloud (i.e., unusual) in pure lists. There was no such difference in mixed lists, which contained both aloud and silent items. Furthermore, we explore why unusual and common processing might produce different results for memory for relational information.

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• FALSE MEMORY •

(5041)

Field Dependence Increases False Memories by Reducing Monitoring. SASHA N. CERVANTES and DAVID A. GALLO, *The University of Chicago*—Few studies have investigated how individual differences in information processing style, such as field dependence, affect false memories. Field dependent individuals are less likely to separate perceived components from their surrounding context. Research indicates that field dependence increases susceptibility to false memories, but the underlying mechanisms for this effect are unknown. We used a modified DRM task to disentangle the effects of field dependence on false memory activation and monitoring processes. Participants recalled associated lists under standard or inclusion instructions, and also were given a recognition test with warnings to avoid errors. Consistent with prior work, field dependent people were more prone to the DRM illusion than field independent people. Critically, these differences were found on the warning test that emphasized retrieval monitoring, but not on an inclusion test that emphasized activation. These results suggest that field dependence increases false memory propensity not by increasing activation, but by reducing monitoring.

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(5042)

The Effect of Anger on Memory for False Information. MICHAEL J. GREENSTEIN and NANCY FRANKLIN, *Stony Brook University*—Anger increases reliance on heuristic processes and lowers recognition thresholds. These effects are evolutionarily advantageous but may also increase errors. We tested for this using a classic misinformation paradigm. After exposure to critical information, participants were either made angry or kept in a neutral state. Following initial learning, all participants were misinformed about some critical details. Angry participants were more likely than neutral participants to attribute both schematic and schema-irrelevant false details to initial learning. This suggests that anger lowers acceptance thresholds for a broad range of items. Therefore, someone who is angry may be particularly vulnerable to memory manipulations.

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(5043)

Visual and Verbal Cognitive Loads Influence Hemispheric True (but Not False) Memories. MICHAEL J. TAT and TAMIKO AZUMA, *Arizona State University*—Studies investigating hemispheric asymmetries in false memories have shown that the left hemisphere (LH) is less susceptible to memory errors than the right hemisphere (RH). It has been suggested that the LH uses top-down mechanisms to reduce false memory errors (Federmeier, 2007). In the current study, cognitive load manipulations were used to disrupt top-down mechanisms that may influence hemispheric memory. Participants studied lists of related words while simultaneously completing a verbal or visual task. Using divided visual field presentation, memory was probed for old, new, and critical lure words. Results revealed no hemispheric differences in memory errors to lures. Interestingly, LH memory for old words was detrimentally influenced by both verbal and visual tasks, but RH memory was only influenced by the visual task. This finding suggests that top-down mechanisms influencing LH encoding are less specialized for specific types of information, while top-down mechanisms influencing RH encoding are more visuo-spatially oriented.
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(5044)

Hypnotic Susceptibility But Not Suggestion Influences False Memory in Suggestible Individuals. MICHELLE N. DASSE and CHARLES A. WEAVER, *Baylor University* (Sponsored by William L. Kelemen)—Susceptibility to suggestion is a measurable trait that influences the development of false memories. In Experiment 1, participants heard a positive or negative suggestion regarding hypnosis, then listened to eight DRM lists in hypnotic state. Hypnosis alone did not produce differences in memory, nor did the suggestions about its effectiveness. However, participants of high susceptibility to suggestion (as measured by the Creative Imagination Scale) were significantly more accurate in both recall and recognition than participants of low susceptibility. In Experiment 2, suggestions were delivered in the form of performance feedback. Participants heard a positive or negative suggestion about their performance prior to either encoding or retrieval of eight DRM lists. Overall, participants did not differ in accurate or false memory between the suggestion conditions. However, when susceptibility was included, those with high hypnotic susceptibility recalled and recognized fewer critical lures if they received a negative suggestion about their performance. These results highlight the importance of individual differences to susceptibility of suggestion in the creation of false memories.
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(5045)

Stereotype Threat Moderates the Likelihood of Memory Contagion. JESSICA J. ANDREWS, SCOTT R. HINZE and DAVID N. RAPP, *Northwestern University*—Information that individuals produce during collaborative activities is available for other group members to encode and use on subsequent tasks. Such memory contagion can be beneficial when the produced information is correct, but problematic when it is

not. We investigated whether stereotype threat influences the contagion of incorrect productions. Participant-confederate pairs completed a collaborative memory task. In Experiment 1, half of the participants were informed students from their university perform poorly on similar tasks relative to students at another university, acting as a stereotype-threat prime. These participants recalled more confederate-generated and self-generated incorrect information than did unprimed participants. In Experiment 2, stereotype-primed participants learned about the cause of poor performance for students at their university (i.e., an inability to resist erroneous information). This resulted in substantial reductions in their recall of incorrect information as compared to unprimed participants' recalls. Performance beliefs can influence the use of other people's problematic contributions.
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(5046)

Ageist Stereotype Threat at Encoding but Not Retrieval Affects False Recollection. JESSICA T. WONG and DAVID A. GALLO, *The University of Chicago* (Sponsored by Benton Pierce)—Ageist stereotype threat impairs memory, but because most studies have manipulated threat before encoding, it is unclear whether threat primarily affects encoding or retrieval processes. We induced threat by having older adults read a scientific passage about age-related neurocognitive decline. One group received threat prior to an incidental encoding task, another group received threat after encoding but before a recollection test, and a control group read a non-threatening passage. At encoding, participants made different semantic judgments on words. At test, participants needed to recollect whether each word had been associated with one of the judgments, regardless of the other judgment (i.e., a criterial recollection task). We found that threat at encoding increased recollection confusions compared to the control condition, but threat at retrieval did not. These results extend stereotype threat effects to errors on a recollection task, and they suggest that threat primarily affects encoding processes.
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(5047)

Explanatory Coherence and False Recollection of Suggested Events. ERIC RINDAL, *Kent State University*, QUIN CHROBAK, *University of Wisconsin-Oshkosh*, MARIA S. ZARAGOZA, *Kent State University*—People are highly motivated to achieve a coherent understanding of the world around them, and to this end, they seek causal explanations of the events they experience (e.g., Weiner, 1985). Recent evidence suggests that the search for explanatory coherence also plays a role in the testimonial errors that result from suggestive forensic interviews. For example, Chrobak & Zaragoza (2012) showed that witnesses were more likely to incorporate false suggestions into their freely provided testimony when they provided a causal explanation for a witnessed outcome. What is unclear from past research is whether false suggestions that serve an explanatory function are especially likely to develop into false recollections, or whether they are simply more likely to be believed. Using measures of phenomenal



experience, the present study supports the conclusion that explanatory coherence plays a role in the development of false recollections.

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(5048)

Illusory Recollection is Influenced by Activation Processes During Study. KARIN M. BUTLER, *University of New Mexico*, BRYAN A. FRANKS, *Louisiana State University*, JAMES BISHOP and BRENDAN LIBERMAN, *University of New Mexico*—Illusory recollection is the attribution of experiential details to falsely remembered events. We examined the processes that influence illusory recollection when participants study lists of associated words in the DRM paradigm. Each list was divided into three subsets based on the association to the theme (BAS: High, Medium, and Low). The presentation location and order of the High and Medium subsets was manipulated. In a previous study, we found that both the associative strength from studied words to themes and the order that words were studied affected the illusory recollection. In this study, we tested whether a decision strategy of attributing themes to the items studied first on the lists may account for the previous findings. We kept the High and Low BAS subsets of items the same and varied the associative strength of the moderately associated subset. The difference between the studied lists did not influence whether attributions were made to themes, but did influence the characteristics of the attributions. These findings suggest that processing at encoding influences the source attributions made to falsely remembered words and are consistent with an activation-monitoring explanation of illusory recollection.

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(5049)

The Contribution of Thematic Extraction to the Persistence of False Memories. PAULA CARNEIRO and LEONEL GARCIA-MARQUES, *Universidade de Lisboa*, ANGEL FERNANDEZ, *Universidad de Salamanca*—The finding that DRM false memories are very durable is hardly explained by an account based solely on associative activation. In order to analyze the role of associative activation and thematic extraction in the false-persistence effect, two experiments were conducted using DRM lists with two different types of critical items: one, associative, corresponding to the word most strongly primed by its associates; and another, thematic, which best describes the theme of the list. In both experiments half the participants were assigned to an immediate condition and the other half to a delay condition (tested one week after). Results using a standard yes/no recognition response (exp 1) and a four alternative forced choice response (exp 2) showed that false memories driven by associative activation fade more rapidly and false memories driven by thematic extraction tended to be more stable, suggesting that thematic extraction plays a more critical role in the false-persistence effect.

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(5050)

Effects of Study and Test Repetitions on False Memory for Category Items. KURT A. DESOTO and HENRY L. ROEDIGER, *Washington University in St. Louis*—Roediger and DeSoto (2013) and others have shown that when subjects study items from semantic categories (e.g., 'birds'), they are later likely to falsely recognize high output dominance category members of the studied categories that were never presented (e.g., 'eagle'). In a recent experiment, we presented 60 subjects with additional study or study/test repetitions over to-be-learned category items to investigate how these manipulations would affect the probability of false alarms to high output dominance items. Although an additional study repetition reduced the false alarm rate overall, only the combination of repeated study and an intermediate test (with feedback) improved subjects' metacognitive monitoring, as shown through measures of calibration and resolution. The inference is that an intermediate test repetition evokes a qualitative change in responding on a final test.

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(5051)

The Effects of Social Media on False Memory. NICHOLAS GRIFFIN, MITCHELL UITVLUGT, SUSAN RAVIZZA and KIMBERLY FENN, *Michigan State University*—Social media websites, like Facebook and Twitter, are informational sources that are gaining popularity. Posts on these sites do not require verification and may therefore conflict with actual events. Because false information can contribute to memory distortion, social media inaccuracies may contribute to false memory. Here, we investigated the effects of social media on false memory. Participants first viewed a series of images that depicted a story and completed a math task to reduce information rehearsal. Later, they viewed scrolling text about the story that contained false information. Some participants viewed the recap of the images in a Twitter feed and a control group saw the recap in a feed that did not resemble social media. Participants were then given a memory test. All groups showed similar levels of correct memory, but false memory was significantly lower when the false information was presented in a social media format. Participants who viewed the Twitter feed reported lower trust of the information than the control group. This suggests that individuals approach social media with heightened skepticism that may help them to reduce false memory.

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(5052)

Do Photographs Create False Memories? ALEXIS JONES and DEBORAH K. EAKIN, *Mississippi State University*—Photographs are used to convey information in news headlines, billboards, and many other types of media. Unfortunately, research has shown that photographs can facilitate production of false memories; however, other research has not found this effect. We examined whether studying photographs plus text or text alone produced more false memories, or whether the effect was due to repetition of information. We presented both true and false headlines about popular culture—chosen based on pre-tested high, medium, or low knowledge—either with or

without photographs, and with or without repetition of the headline or the photograph. Photographs did not produce more false memories than the headlines alone; repetition also had no effect on production of false memories. However, high prior knowledge produced more false memories than low or medium knowledge, suggesting that the false memories may be due to familiarity with the headline's subject matter.

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(5053)

The Influence of Level of Processing on Spanish-English Bilingual False Memory. MICHAEL P. TOGLIA, HANNA I. GIRALDO and JORGE FEBLES, *University of North Florida*—We investigated the role of level of processing on memory for DRM lists with Spanish-English bilingual participants in within-language (English-English, Spanish-Spanish) and cross-language conditions (English-Spanish, Spanish-English). Higher levels of recall were observed for semantic encoding in all conditions, however at the cost of higher thematically related intrusions, thus demonstrating the “more is less” pattern (Toglia, Neuschatz, & Goodwin, 1999). Cross-language conditions resulted in higher semantically relevant intrusions and lower recall compared to within-language conditions, a “less is less” effect. Overall, non-semantic processing led to fewer false memories, producing accuracy scores that exceeded those in semantic-processing conditions. Greater levels of accuracy also were observed in the within-language conditions. This experiment further highlights the effects of deep processing on associative memory in relevant linguistic conditions as the Spanish-English bilingual population continues to increase and already represents more than half of all bilinguals in the United States. Implications for forensic interviewing of witnesses are discussed.

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(5054)

The Effect of Task Manipulation on False Memory During Immediate Serial Recall. GABRIELLE RITCHIE, JESSICA TOLLEMACHE, RACHAEL A. WYNNE, SOPHIE PARHAM and GEORGINA A. TOLAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*—This project manipulated presentation rate, articulatory suppression, modality, and retention interval during an immediate serial recall task to investigate false memory in a short-term paradigm. Thirty-six participants were presented with six-word lists based on the Deese-Roediger-McDermott (DRM) false memory task (Roediger & McDermott, 1995). Half of the trials contained hybrid lists of semantic associates. Items in serial position one, two and three were semantically related to a critical lure. Items in serial position four, five and six were semantically related to a different critical lure. The remaining trials contained all unrelated items. The false memory effect was observed under short-term memory conditions. This effect was more prevalent in conditions that interfered with episodic recall when compared to conditions that were less likely to interfere with episodic recall. Findings are discussed in relation to current understanding of working memory and false memory effects.

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(5055)

Interaction Between Learning Duration and Learning Frequency on DRM False Memory: Evidence From Comparing Under Equal Exposure Amounts. KENTA NOZOE, *Gakushuin University* (Sponsored by Nobuo Ohta)—DRM false memory creation is influenced by the interaction between duration and the frequency of list item exposure. Namely, when the frequency of learning increases, false memory also increases with brief presentation of items, but decreases with longer duration. Then, based on multiplying duration by frequency, false memory rate seems to show an inverted U-shaped function, but it's unclear because previous studies didn't consider the whole exposure amounts among conditions. This study investigated the interaction between learning duration and learning frequency under equalizing the whole exposure amounts. Effect of time-limited recognition was also examined. Results showed that false recognition rate was higher when items were presented five times for 400ms each than when presented once for 2000ms. Time-limited context didn't affect false recognition. Learning frequency might have priority to duration at a time under equal exposure amounts. Relation between false memory production and amounts of item exposure will be discussed.

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(5056)

False Memories for Pictures: Effects of Warnings and Directed Forgetting Instructions. KAITLIN ENSOR and KERRI A. GOODWIN, *Towson University*—Weinstein and Shanks (2010) successfully induced false memories for pictures by having participants imagine words that they later viewed as pictures. The present study replicated and extended the results by altering test instructions and introducing directed forgetting. In Experiments 1 and 2, test instructions warning participants about imagined words were compared to standard test instructions. In Experiment 1, the Weinstein and Shanks results were replicated, but no effect of test instruction was found. However, when a source-monitoring recognition test was given to participants, there was no false memory effect. In Experiments 3 and 4, directed forgetting was introduced to the methodology. Although no directed forgetting effects were found, false memories for pictures were found under certain scenarios, even using the source-monitoring recognition test. Implications of these findings are discussed within the context of the effects of cognitive load on false memories.

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(5057)

Mechanisms of Continued Influence. PATRICK RICH and MARIA ZARAGOZA, *Kent State University*—Recent research from our laboratory has shown that, in the context of the continued influence effect (Johnson & Seifert, 1994), implied misinformation is more difficult to correct than explicit misinformation. The goal of the current study was to investigate two potential reasons why implied misinformation is especially resistant to correction. The first stems from the additional elaboration necessary to generate connections between the implied cause and the outcome. This elaboration, which does not occur with explicit misinformation where



these connections are directly provided, may result in the misinformation becoming more resistant to correction in the implied case. A second possibility is that, relative to explicitly provided misinformation, people are less aware of the influence of implied misinformation, and hence are less likely to detect a discrepancy when they encounter a correction. The results of the current study suggest that multiple mechanisms may be responsible for the continued influence of implied misinformation.

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(5058)

Retrieval Enhances Certainty: Using Verbal Hesitation to Understand Retrieval Enhanced Suggestibility Effects. MEEYEON LEE, CAROLINE CHEN and LEAMARIE GORDON, *Tufts University*, THORA TENBRINK, *Bangor University*, AYANNA K. THOMAS, *Tufts University*—Linguistic markers in verbal reports have been widely used to explore cognitive processes (Ericsson & Simon, 1984, 1993). In the misinformation paradigm, researchers have demonstrated qualitative differences in verbal report associated with perceived and suggestive details (Schooler, Gerhard, & Loftus, 1986). The goal of the present research was to examine the changes in linguistic markers in a repeated retrieval misinformation study (e.g., Chan, Thomas & Bulevich, 2009). A pre-misinformation testing group was compared to a post-misinformation testing group that provided verbal reports only after the narrative. We found that immediate retrieval improved memory for the original event, but also increased the likelihood of producing misleading details in post-misinformation retrieval. Additionally, participants in the pre-misinformation retrieval group were less likely to include hesitation markers in association with produced misleading details. These results suggest that immediate retrieval affects not only memory but the telling of a witnessed event after misinformation.

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(5059)

Deriving “Dog” From Wolf and Fox, or Leash and Bark? False Memory in Categorical and Associative Word Lists. JENNIFER H. COANE, *Colby College*, DAWN M. MCBRIDE, *Illinois State University*, MIIA-LIISA TERMONEN, *Colby College*, J. COOPER CUTTING, *Illinois State University*—Studying lists of categorically and associatively related words, such as garage, truck, and drive, results in false memory for critical lures (i.e., car). Does one type of relation or the other increase the accessibility of critical lures? In prior studies (e.g., Knott et al., 2012), associatively related lists included both associates (e.g., drive, garage) and categorically related items (e.g., truck). Thus, one cannot isolate the effects of association from those of feature overlap or semantic similarity, a critical question for understanding the nature of the underlying processes. In the present study, participants studied carefully matched lists of categorically or associatively related items. Immediate free recall and final recognition tests were administered. Categorically related list items were recalled and recognized more than associatively related list items. Importantly, critical lures from categorical lists were

also falsely recognized more than those from associative lists, suggesting that, when associative strength is matched, shared features or similarity contribute to false memory above and beyond associative strength.

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(5060)

Distinctiveness Reduces Memory Errors, But Does It Reduce False Recollection? PATRICK O. DOLAN, *Drew University*, STEPHEN J. GRAY and DAVID A. GALLO, *The University of Chicago*—It is well established that errors on “false memory tasks” are reduced when participants are tested for distinctive information (e.g., pictures compared to words). These effects have been attributed to a retrieval monitoring process, whereby participants make fewer errors when they expect more distinctive recollections. Importantly, most of this research has used traditional recognition or source memory tasks, so these distinctiveness effects may be due to differences in familiarity-based guesses or inferences, as opposed to differences in high-confidence false recollection. In the current research we used a criterial recollection task to more directly investigate distinctiveness effects on false recollection errors, while experimentally manipulating familiarity. Consistent with a false recollection account, we found that testing recollection for more distinctive information reduced high-confidence recollection errors, and these effects were dissociated from familiarity. These results provide strong evidence that expectations about recollection quality can affect the subjective experience of false recollection.

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(5061)

Individual Differences in Personality Traits Predict False Memories. MATTHEW J. GILLESPIE and TROY A. SMITH, *The Ohio State University*, WILLIAM A. CUNNINGHAM, *University of Toronto*, PER B. SEDERBERG, *The Ohio State University*—Although who we are as individuals undoubtedly influences how we perceive and construe the world around us, this fact has traditionally been ignored in cognitive psychology. However, the field has recently begun to recognize the importance of accounting for individual differences in cognition instead of simply treating them as measurement error. Here, we report two major findings linking Big Five personality dimensions to individuals’ probability of making critical item intrusions, or false memories, in the Deese-Roediger-McDermott paradigm: a) High openness to experience alone predicts increased tendencies for false memories, and b) high neuroticism predicts increased false memory in individuals who are high in openness to experience but reduced false memory in low-openness individuals. Additionally, neither openness to experience nor neuroticism influenced veridical memory. This work is a critical demonstration of ‘Big Five’ personality traits alone reliably predicting outcomes in a basic cognitive task with individuals from the normal population.

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(5062)

The Effect of Task Difficulty and Hybrid Lists on Short-Term False Memories. RACHAEL A. WYNNE and GEORGINA A. TOLAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*—The project sought to examine the effect of manipulating task difficulty for false memory effects on short-term recall when semantic and phonological hybrid lists are employed. Task presentation rate, articulatory suppression, modality and retention interval was manipulated. Thirty-six participants completed a modified Deese-Roediger-McDermott false memory task where the six-item lists were semantic and phonological associates of a non-represented critical lure (Roediger & McDermott, 1995). Semantic associates were presented in serial positions one, three, and five, in decreasing order of associative strength. Phonological associates derived through Sommers and Lewis' (1999) principles of phoneme substitution appeared in serial positions two, four, and six. False memory effects were greater in related trials compared to unrelated word lists. Increased false memory effects occurred when task modifications interfered with episodic recall compared to control, non-interference tasks. Findings are discussed in relation to current models of false memory effects.

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• WORKING MEMORY IV •

(5063)

A Motor Similarity Effect in Object Memory. FRÉDÉRIC DOWNING-DOUCET and KATHERINE GUÉRARD, *Université de Moncton*—In line with theories of embodied cognition (e.g., see Versace et al., 2009), several studies suggest that the motor system used to interact with objects in our environment is involved in object recognition (e.g., Helbig et al., 2006). However, the role of the motor system in object memory is more controversial. The objective of the present study was to investigate the role of the motor system in object memory by manipulating the similarity between the actions associated to series of objects to retain in memory. The present study showed that lists of objects associated to dissimilar actions were better recalled than lists of objects associated to similar actions, and that this effect was abolished under motor suppression. The motor similarity effect provides evidence for the role of motor affordances in object memory.

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(5064)

Knowledge Biases Recall Over the Short Term: Familiar Objects and Faces. MARIE POIRIER, SAIYARA TASNIM, DANIEL HEUSSEN and JAMES HAMPTON, *City University London*—The present study extends the findings of Hemmer and Steyvers (2009) 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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(5065)

The Role of Verbal Working Memory in Picture Story Inference Processing. KARYN HIGGS, *Northern Illinois University*, ADAM M. LARSON and LESTER C. LOSCHKY, *Kansas State University*, JOSEPH P. MAGLIANO, *Northern Illinois University*—Visual narratives, such as graphic novels or movies, cannot depict all of the information that comprises those sequences. Viewers presumably generate inferences for missing content, just as with text-based narratives. The current study investigated whether verbal working memory systems support inferences when viewing a visual narrative. Participants viewed picture stories containing event sequences that included four critical target episodes, each consisting of a beginning state, an inferable action, and an end state. Versions of the stories were created in which the action was either present or absent. Experiment 1 showed an inference effect, such that viewing times were longer for the end state picture when the inferable action was absent. Experiments 2 and 3 showed that verbal load attenuated this inference effect, whereas articulatory suppression did not. These results suggest that linguistic working memory processes support inferencing while viewing picture stories, but these inferences do not require subvocal articulation.

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(5066)

What is the Speed Limit? Picture Superiority and Updating Sequential Memory. EUMJI KANG and CARRICK C. WILLIAMS, *Mississippi State University*—Drivers are not required to remember road signs seen while driving for a later long-term memory test; they need to remember the most recently encountered road signs presented in a sequence (What is the current speed limit?). In the current experiment, we investigated the interaction of picture superiority and memory updating to determine if earlier presented pictures led to stronger proactive interference effects. In a serial presentation stream, participants had to keep track of the most recent member of several categories, including road signs, that could be presented in either picture or word form. Proactive interference was stronger when the penultimate item was a picture regardless of the current stimuli type. In addition, the least amount of proactive interference was found when the penultimate item was a word and the ultimate item was a picture. These findings support the notion that picture superiority makes it difficult to recognize when specific picture information was learned leading to difficulty with memory for sequential events.

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(5067)

Influence of Long-Term Memory on the Two Tiers of Working Memory. MARGARET O'CONNELL, NITHYA RAMAKRISHNAN and CHANDRAMALLIKA BASAK, *University of Texas at Dallas*—Hierarchical models of working memory posit a core limited-capacity focus of attention where information is easily accessible and has near-perfect accuracy. Other information units are in an activated state of long-term memory (outer store), requiring focus-switching when they are needed for subsequent processing, and are susceptible to effects of interference (Verhaeghen & Basak, 2005). In this study, we assess the influence of long-term memory (LTM) on the two tiers of working memory. We hypothesize that items in the outer store will be influenced by LTM; the degree of influence may be related to how far the item was processed. In Experiment 1, variable length word lists (5,7,9,11 or 13 lower-case words) of either high or low frequency words were presented at 500 ms/word. Each list was followed by a visual mask, and then by an upper-case, different colored probe word. The participants judged whether the probe matched one of the last 5 words in the list, or not. In Experiment 2, the word lists constituted of words from 3 different categories. The probe was match, non-match, or semantically similar non-match word. Results show that items outside, not inside, the focus were affected by the frequency manipulation. Email: Chandramallika Basak, cbasak@utdallas.edu

(5068)

Choking under Pressure: Regulatory Focus and Working Memory Capacity. AKIHIRO KOBAYASHI and MATIA OKUBO, *Senshu University*—Choking under pressure refers to performance decrements under pressure circumstances. Pressure disrupts cognitive performance more in the gain structure than in the loss structure. People with high working memory capacity (WMC) suffer from pressure more severely than those with low-WMC while performing cognitive tasks. The present study investigated the relationship between regulatory focus (gain or loss) and WMC (high or low) under pressure circumstances (high or low). Participants with high-WMC ($n = 35$) suffered from pressure more severely in the gain condition than in the loss condition while performing a category-learning task. On the other hand, the opposite pattern was observed for participants with low-WMC ($n = 34$). These results suggest that the effect of pressure was moderated not only by regulatory focus but also by WMC and an interaction between them. Email: Akihiro Kobayashi, factor.impact@gmail.com

(5069)

Impact of Training Procedures Working Memory Training and Transfer Effects. CLAUDIA C. VON BASTIAN and ANNE ESCHEN, *University of Zurich*—This study tested the hypothesis that working memory (WM) training is most effective if it is adaptive (i.e., task difficulty is adjusted automatically to individual performance). Evidence for this assumption stems from studies comparing adaptive training to a condition where tasks are practiced on the easiest level of difficulty only (cf. Klingberg, 2010), thereby confounding adaptivity and exposure to varying task difficulty. For a more

direct test, we therefore randomly assigned 132 participants to one of three training procedures (adaptive, randomized, or self-chosen task difficulty) or an active control group. In comparison to the control, all three experimental groups showed increased performance in the trained tasks, which transferred to non-trained, structurally different WM tasks. However, there was no transfer on reasoning in any of the groups. Neither training nor transfer effects were modulated by training procedure, indicating that the role of adaptivity might have been overestimated in previous training research. Email: Claudia von Bastian, c.vonbastian@psychologie.uzh.ch

(5070)

Short-Term Memory for Auditory Scenes is Not Lost Over Time. MELISSA K. GREGG and JOEL S. SNYDER, *University of Nevada, Las Vegas*—We used a change detection paradigm with spectro-temporally static and dynamic sounds to show that memories for auditory scenes are remarkably enduring. On each trial, two scenes were presented consecutively that had the same sounds or one sound that differed. There were 2, 4, or 6 sounds within each scene, and the silent interval between scenes was 0, 350, 750, or 2000 msec. Change detection performance was worse as scene size increased, but did not deteriorate as the interval between scenes increased for dynamic sounds. Performance for static sounds was better at the 0 msec interval than at longer intervals, but it did not differ between the longer intervals. The simple stimuli likely afforded good performance at the 0 msec interval because of automatic frequency-shift detection. The results suggest that although auditory memory capacity is limited, once sounds enter memory they are not lost. Email: Melissa Gregg, Melissa.Gregg@unlv.edu

(5071)

Investigating the Mechanism for the Emotional-Semantic Effect in Short-Term Memory. MABEL C. LAU and WINSTON D. GOH, *National University of Singapore*—Emotional-semantic knowledge facilitates immediate serial recall performance. This emotional-semantic effect may arise because emotional words constitute unique semantic categories in long-term memory, but the precise mechanism underlying how long-term knowledge facilitates the recall of emotional words remains unclear. The present series of experiments test two competing accounts that differ in the locus of the effect – whether long-term knowledge facilitates recall at the point of retrieval through the reconstruction of decayed traces (redintegration account), or whether it is activated at the point of encoding to prevent decay through trace maintenance (language-based account). Emotional words were better recalled as compared to neutral words in immediate serial recall, however, when a serial order reconstruction task was employed, the emotional-semantic effect was suppressed. Overall, these findings provided evidence for the redintegration account as the mechanism underlying the emotional-semantic effect. Email: Winston Goh, psygo@nus.edu.sg

(5072)

Gaze Direction Affects Visuo-Spatial Working Memory.

CHRISTOPHE CARLEI and DIRK KERZEL, *University of Geneva*—Asymmetries in the recall of visuo-spatial stimuli were investigated between the left, right, upper, and lower visual field. We carried out five experiments on 146 individuals aged from 18 to 35 years. To probe visuo-spatial working memory, participants memorized a stimulus matrix. We varied the position of the matrix on a large projection screen and observed that memory performance was better when the matrix was shown in the top left corner of the screen. The effect persisted when observers only made a saccade to this position during the retention interval while the matrix appeared centrally. Further, we distinguished between recall strategies that relied on visual or non-visual (counting) cues and found that the effect of gaze position only occurred with visual recall strategies. Our results suggest that unilateral gaze increases activation of specific areas of the contralateral cerebral hemisphere, leading to improved performance after activation of the right hemisphere.

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(5073)

Perceptual Bias in Size Judgment and its Relation to Attentional Control.

CHRISTOPHER A. SANCHEZ, *Oregon State University*—Prior knowledge has been shown to bias perceptual judgments in a top-down fashion. For example, being told a circle is a 'golfball' causes individuals to underestimate the size of the circle at recall, consistent with their representation of 'golfball'. However, do differences in the ability to retrieve such information from secondary memory, and also manage information in primary memory influence the likelihood of this occurrence? Individuals higher in working memory capacity (WMC) both more accurately retrieve information from secondary memory, and manage interference between items in primary memory. Across 2 studies, participants who varied in WMC provided perceptual size judgments for items at risk for this bias. Surprisingly, higher WMC individuals were significantly more susceptible to the influence of prior knowledge than lower WMC individuals. Further, the lack of bias in the lower WMC group appears to be connected to differences in the contents of primary memory, as when low WMC participants were not required to retrieve information from secondary memory, but hold biasing information in primary memory, they also exhibited the bias in perceptual judgment.

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(5074)

Connecting Working and Long-Term Memory: A Model-Based Analysis of Encoding and Retrieval Processes.

BEATRICE G. KUHLMANN, *Heinrich-Heine-Universität Düsseldorf*, MATT E. MEIER, *University of North Carolina at Greensboro*, NINA R. ARNOLD, *Heinrich-Heine-Universität Düsseldorf*—Better recall performance of individuals high in working-memory capacity (WMC) has been primarily attributed to their superior self-cued retrieval from long-term memory (Unsworth & Engle, 2007). However, there

is further evidence relating high WMC to better (strategic) encoding (Unsworth & Spillers, 2010). The present study used multinomial modeling combined with a novel individual-data estimation procedure (beta-MPT) to disentangle WMC-related influences on encoding and retrieval processes in a recall paradigm. Participants studied and recalled a 20-word list on which some words formed semantic clusters. Under standard instructions ($n = 93$), WMC was positively correlated with cluster retrieval but not cluster encoding. However, when participants were instructed to look for semantically related pairs during encoding ($n = 81$), WMC no longer correlated with cluster retrieval but positively with cluster encoding. Thus, the present study provides direct evidence for WMC-related differences in both long-term memory encoding and retrieval, depending on the memory-task instructions.

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(5075)

The Effects Working Memory and Emotional Arousal on Reading Comprehension.

AMANDA M. CLEVINGER and HEATHER M. KLEIDER, *Georgia State University*—Cognitive load impacts processing of written information and how accurately it is remembered (Coltheart, 1993). Emotional cognitive load specifically degrades performance on complex cognitive tasks by reducing working memory capacity (WMC) (Kleider, Parrott & King, 2010). As reading comprehension is a demanding cognitive task, we hypothesized that internal emotion/arousal would negatively impact word processing which would be detrimental in a high stakes testing situation (e.g., SAT). Moreover, people high in trait anxiety, low in WMC or both would be especially impacted. To test this, subjects read SAT passages while cognitive load was varied (no load, neutral load, arousing load) and answered comprehension questions. WMC and Trait anxiety were measured separately. Results suggest individuals with high vs. low WMC comprehend more information overall; however, lose their performance edge under cognitive load, while low WMC persons maintain performance rates. Further effects of emotional load and trait anxiety on performance are also discussed.

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(5076)

Saccade Latency Reveals Episodic Representation of Object Color.

ROBERT D. GORDON, *North Dakota State University*—While previous studies suggest that identity, but not color, plays a role in episodic object representation, such studies have typically used tasks in which only identity is relevant. In the present study, participants viewed a preview display containing one or two letters, then viewed a target display containing a single letter, in either the same or a different location. Participants executed an immediate saccade to fixate the target; saccade latency served as the dependent variable. In each of two experiments, saccade latencies were longer to fixate a target appearing in its previewed location, consistent with a bias that favors new objects. The results of Experiment 2 further demonstrate, however, that changing target color eliminates these latency differences. The results suggest that



color and identity are part of episodic representation even when not task relevant, and that examining biases in saccade execution may be a useful approach to studying episodic representation.

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(5077)

Cognitive Load Modulates the Effect of Emotional Content in Adaptive Working Memory Performance. FRANCISCO J. ROMÁN, JUAN BOTELLA, MARÍA J. GARCÍA-RUBIO, JESÚS PRIVADO, SARA LÓPEZ-MARTÍN, KENIA MARTÍNEZ, LUIS CARRETIÉ and ROBERTO COLOM, *Universidad Autonoma de Madrid*—Here the effect of emotional information on performance differences in an adaptive working memory training program were analyzed. 51 university students completed four cognitive training sessions. Human faces depicting negative (disgust), neutral, and positive emotions were the stimuli comprised by the n-back adaptive program. Participants improved their performance across the training sessions. These improvements were identical for the three emotional conditions. However, the analysis of reaction times (RTs) showed significant differences among emotions: faster RTs were observed for the negative emotions. Interestingly, this latter difference vanished in the last training session at which participants achieved the highest level of difficulty in the primary task. This main finding supports the view that emotional modulation of performance occurs for low and intermediate levels of cognitive load only. The dynamic change across the training sessions is consistent with a general-purpose limited set of cognitive resources theoretical perspective: participants ignore emotional content at increased cognitive challenges.

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• HUMAN LEARNING AND INSTRUCTION III •

(5078)

The Influence of Individual Difference and Task Variables on Cognitive Performance. SARA L. GREEN and TRAVIS L. SEYMOUR, *University of California, Santa Cruz*—Performance is a product of an individual's abilities, aptitudes, preferences and strategies, as well as the limitations and demands of the task at hand. Schumacher and colleagues (2001) demonstrated dramatic effects of on human performance achieved by simple variations in strategy and task instructions. Although speculated upon, there is no accounting for preexisting individual differences that may have contribute to differential performance. Rather than constraining potential performance influences to within-session variants, we analyzed several individual differences and task-specific factors to determine independent contributions to varying performance. Several components, including task and goal conditions, prior experience, and self-efficacy can be used to predict improved performance. We extend existing theory and present a model for using these variables to predict performance. Our results

also have applied implications for optimizing performance of research participants in laboratory studies, as well as tailoring classroom instruction to increase learning outcomes.

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(5079)

Computerized Hints Can Optimize Recall: Difficulty and Duration. MATTHEW J. HAYS, *University of Southern California*, JASON R. FINLEY, *Washington University in St. Louis*—Successful retrieval attempts are more beneficial for long-term retention than are presentations (e.g., Roediger & Karpicke, 2006). More difficult successful retrievals are more beneficial for long-term retention than are easier retrievals (e.g., Modigliani, 1976). Unsuccessful retrieval attempts provide no benefit for long-term retention (e.g., Landauer & Bjork, 1978). Feedback can make unsuccessful retrieval attempts advantageous (e.g., Hays, Kornell, & Bjork, 2013), but success would be preferable to presentation-based feedback. Thus, the optimal learning event is a retrieval attempt that is both maximally difficult but also successful (i.e., feedback does not need to be provided). We used a computer to provide hints dynamically, which ensured that both these conditions were met. The result is long-term retention superior to that yielded by non-dynamic feedback and assistance algorithms (Hays, Finley, Bjork, Benjamin, & Walker, 2012). The present studies explore and report the effects of item difficulty and retention interval on this overall finding.

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(5080)

Retrieval Practice: Transfer to Deductive Inferences? RANDY TRAN and HAL PASHLER, *University of California, San Diego*—Retrieval practice has been shown to enhance later recall of information reviewed through testing, whereas final-test measures involving making inferences from the learned information have produced mixed results. In the present study, participants studied a set of related premises, and then reviewed these premises either by rereading or by taking fill-in-blanks tests. As expected, the testing condition produced better final-test recall of the premises (whether immediate or delayed by 48 hours). However, performance on multiple-choice inference questions showed no enhancement from retrieval practice. We speculate about whether other forms of retrieval practice might produce benefits on such measures.

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(5081)

Relative Benefits of Immediate vs. Delayed Testing for Predicting Knowledge Retention. LINDSAY S. ANDERSON, ALICE F. HEALY, MATT JONES and ERICA V. ROZBRUCH, *University of Colorado*—Previous research on the effects of temporal spacing on learning has shown that spaced practice yields better performance than massed practice. We propose that spacing might also benefit teaching, in that increasing the spacing between study and test can improve the reliability of student assessment. The present experiment utilized a laboratory fact-learning task and a version of the list-before-last paradigm to compare three conditions that varied in the

time relative to study--immediately or after a delay--at which test questions were asked. In the Immediate conditions, test questions covered material from the immediately preceding study topic. In the Delayed condition, test questions covered material from one topic earlier. A subsequent posttest assessed retention of all studied topics. Results showed that although initial test performance was lower for the Delayed condition than for the Immediate conditions, initial test performance was a better predictor of posttest performance in the Delayed condition than it was in the Immediate conditions. These findings suggest that introducing a delay between study and test enables better prediction of students' knowledge retention. Email: Alice Healy, alice.healy@colorado.edu

(5082)

Individual Differences in Locus of Control and the Effectiveness of Structured Retrieval Activities. LAUREL P. POSTON, MEGAN A. SMITH and *JEFFREY D. KARPICKE, *Purdue University* (Sponsored by David B. Pisoni)—Little work has investigated the relationship between individual differences and the effectiveness of retrieval-based tasks. We examined the relationship between students' locus of control and the level of structure afforded by a retrieval practice activity, where locus of control refers to whether students attribute the outcome of events to internal or external factors. Participants studied educational texts and then practiced retrieval by completing either a structured map in which concepts were provided with blank linking phrases in place, or an unstructured map in which concepts were provided but linking phrases were not in place. Learning was assessed on an immediate free recall test. Practicing retrieval enhanced learning relative to a study-only control condition. The structured activity led to superior recall for the externals relative to the unstructured activity. Externals performed similarly in both the unstructured and study-only conditions. These results suggest that one's locus of control influences the effectiveness of structured or unstructured retrieval activities. Email: Megan Smith, smith598@purdue.edu

(5083)

The Role of Preference Versus Familiarity in Incidental and Intentional Learning. VERONICA X. YAN, KOU MURAYAMA and ALAN D. CASTEL, *University of California, Los Angeles*—When we are presented with large amounts of information, what guides our focus and retrieval? As people widely vary regarding what is important to them, we examined this question in a context where subjective value—namely, liking—could be measured in a memory task. Participants studied a list of 16 ice cream flavors, rating how much they liked each flavor (and post-test, how familiar they were with each flavor). Learning was incidental in Experiment 1 and intentional in Experiment 2. Participants were then asked to recall as many flavors as they could remember. Multilevel modeling analyses examined the relationship between liking and recall performance. The results revealed that when encoding had been incidental, preference significantly predicted recall. This effect was independent of familiarity. When encoding was intentional, however, the effect of liking

was eliminated. Together, these results suggest that preference can guide retrieval, but not in the presence of intentional encoding processes.

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(5084)

Self-Explanation Prompts Plus Metacomprehension Monitoring Improve Memory for Text. AIMEE A. CALLENDER, BAVANI PANEERSELVAM and BROOKE WIDDER, *Auburn University*—Self-explanation can improve comprehension but often requires extensive training. Low ability readers produce more paraphrases and fewer metacomprehension statements than high ability readers when self-explaining. We investigated whether self-explanation prompts (SEPs) improve memory when minimal training was provided and whether prompting metacomprehension statements improve memory more than SEPs alone. Participants were assigned to a SEP group, a SEP plus metacomprehension (Plus) group, and a read only control group and were tested immediately or 1 week later (recall, multiple choice and problem solving). The SEP and Plus groups performed significantly better than the control on the MC questions. The Plus group performed better than the control group on the problem solving questions and better than the control and SEP groups on the recall task. High ability readers made more inferences, elaborations, and predictions than low ability readers. The Plus condition significantly increased the number of metacomprehension statements for all readers.

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(5085)

Delaying Feedback Promotes Long-Term Retention and Transfer of Knowledge. ANDREW C. BUTLER, *Duke University*, BERENICE VERDIN and RICARDO VON BORRIES, *University of Texas at El Paso*, ELIZABETH J. MARSH, *Duke University*—Feedback is critical to learning because it facilitates the correction of misconceptions and the maintenance of accurate knowledge. In both theories of learning and educational practice, it is often assumed that immediate feedback is best. However, a growing body of research is challenging this long-held assumption by demonstrating that delaying feedback can improve learning. Nevertheless, some researchers and educators have questioned the generalizability of the benefits of delayed feedback, claiming that the finding only occurs in a highly controlled laboratory setting. We will present findings from the classroom and the laboratory that show delayed feedback produces superior long-term retention and transfer of knowledge relative to immediate feedback. Despite benefiting from delayed feedback, students reported that they learned best with immediate feedback, indicating a metacognitive disconnect between actual and perceived effectiveness. We will discuss the implications of these findings for theory and educational practice.

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(5086)

The Misleading Effects of Fluency on Learning. MIKO M. WILFORD and SHANA K. CARPENTER, *Iowa State University*, NATE KORNEILL, *Williams College*, KELLIE M. MULLANEY, *Iowa State University*—Assessing what one has learned is often affected by the ease or fluency with which information was presented. The current research investigated the effect of lecturer fluency on participants' metacognitive perceptions and regulation. Participants were shown one of two videotaped lectures of an instructor explaining a scientific concept. The videos were identical with respect to content, length, and the instructor. The only difference was that the instructor presented the information in a fluent (e.g., stood upright, maintained eye contact) or disfluent (e.g., used notes, spoke haltingly) manner. Results showed that fluency had a significant impact on a constellation of variables including participants' judgments of learning, instructor effectiveness, instructor knowledge, etc. Fluency did not, however, affect actual learning or the amount of time spent restudying the lecture content. These results show that what appears easy to learn in the present can often be difficult to recall in the future. Email: Miko Wilford, mwilford@iastate.edu

(5087)

On the Relationships Between Social Structures and Acquired Knowledge in Societies. TOSHIHIKO MATSUKA, *Chiba University*, HIDEHITO HONDA, *National Institute of Informatics*—Many existing studies on human learning in Cognitive Science pay almost exclusive attention to how individual learns. Unlike those studies, we examined influence of social structures on knowledge acquired by societies using computer simulations. We compared four types of social networks, namely regular, random, small world, and scale-free networks. When individual differences and the principle of homophily (i.e., people who have similar beliefs tend to have close relationships with each other) exist in societies, the societies would acquire pareto-optimal knowledge. We also investigated influences of highly connected individuals on knowledge acquired by societies. The results inarguably indicate that highly connected individuals play important roles in social learning, setting the standards for what type of knowledge to be acquired by societies. Email: Toshihiko Matsuka, matsukat@muscat.l.chiba-u.ac.jp

(5088)

Self-generated Analogies Promote Spontaneous Transfer. KENNETH J. KURTZ and GARRETT HONKE, *Binghamton University, SUNY*—Transfer of knowledge is a foundational topic in psychology -- how do people generalize what they know beyond the specific content and context of their past experience? A specific challenge to researchers comes from wide-ranging evidence that spontaneous transfer of a principle is surprisingly uncommon: people generally fail to transfer a known principle unless there is a contextual hint or surface similarity. In the present study we attempt to promote spontaneous transfer through self-generation of an analogy to a source case at study. Prior results show the positive effect of comparing two provided analogous sources, however the impact is limited. As a first test of the power of self-generation

of an analogy, we compared this study task with a control group who summarized the provided source case. Participants who generated an analogy were significantly more likely to transfer the target principle to successfully solve a novel test problem.

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(5090)

Numerical Abilities of School-Age Children With Developmental Coordination Disorder (DCD): A Behavioral and Eye-Tracking Study. ALICE GOMEZ, MANUELA PIAZZA, ANTOINETTE JOBERT, GHISLAINE DEHAENE, STANISLAS DEHAENE and CAROLINE HURON, *University Paris-Sud*—Mathematical impairments of children with Developmental Coordination Disorder are scarcely studied and their underlying cognitive mechanisms are unknown. We hypothesized that mathematical impairments stem from numerical magnitude or number-to-space mapping impairments. Twenty 7-to-10 year-old DCD children were compared to twenty controls on the numberline task. Children judged the numerical value of a hatch mark on a 0 to 100 numberline and eye-movements were recorded. Children with DCD mapped number to space linearly, but their estimates were less accurate. Moreover, children with DCD showed abnormal patterns of eye movements that were correlated with their motor coordination scores. Implications in terms of number magnitudes representations will be discussed.

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(5091)

Number Acuity of Children With Developmental Coordination Disorder (DCD). ALICE GOMEZ, MANUELA PIAZZA, ANTOINETTE JOBERT, GHISLAINE DEHAENE, STANISLAS DEHAENE and CAROLINE HURON, *University Paris-Sud*—Developmental coordination disorder (DCD) is a learning disability that affects motor coordination but also numerical skills. It is acknowledged that numeracy depends on the 'number sense', a core ability to grasp numerical quantities. Despite the report of mathematical difficulties in children with developmental coordination disorder, no studies have directly assessed their number sense. Forty 7-to-10 year-old children (half control, half DCD) were tested on a dot comparison task, a psychophysical task allowing measurement of the Weber fraction for the numerosity of sets of dots ("the number acuity"), and on a digit comparison task. In children with DCD, numerical acuity was severely impaired with 7-10-years-old children with DCD scoring at the same level than 4-years-old controls. In contrast, children with DCD were as accurate as controls when they compared symbolic digits. These results argue for a defective perception of concrete sets of object associated with a spared semantic representation of numerical quantity, in children with DCD.

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(5092)

The Impact of Academic Delivery Method on Student Performance and Attrition Rates. YANA DURMYSHEVA, *Borough of Manhattan Community College, CUNY*, DMITRY

BURSHTEYN, *Siena College*, ROMMEL ROBERTSON, *Queensborough Community College, CUNY*—Studies comparing student performance in traditional (face-to-face) vs. hybrid (partially online) course sections have produced mixed results. Some demonstrated no difference in student performance (e.g. Kakish et al., 2012), while other studies revealed better performance in hybrid sections (e.g. McFarlin, 2008). The goal of this investigation was to compare student performance and attrition rates in traditional vs. hybrid sections of a college course in General Psychology. Final grades were collected in four sections of the course using traditional delivery (N=120) and compared to the final grades in four sections with hybrid delivery (N=90) taught by the same instructor. The results demonstrated no statistical difference in student performance between traditional and hybrid sections of the course ($t(169) = .536, p = .593$), while significantly higher attrition rates were observed in the hybrid sections, ($\chi^2(1, N = 210) = 9.96, p < .002$).

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(5093)

What's in a Name? Engineering Memorable Names With the Tools of Information Theory. MELODY DYE, *Indiana University*, MICHAEL RAMSCAR, *University of Tübingen*—Human languages can be seen as socially evolved systems that are structured to optimize information flow in communication. One means of quantifying the rate of information transfer is through entropy, a measure of the amount of uncertainty a message contains at any given point (e.g., how predictable a word is in context). It appears that communication proceeds most smoothly when entropy is relatively stable: Peaks in entropy are associated with errors and delays in production on the part of the speaker, and difficulties in comprehension on the part of the listener. In previous work, we have examined how these constraints have shaped the evolution of naming practices historically, and how, over the last several hundred years, social legislation and rapid population growth have severely disrupted naming practices in the West, making Western names harder to process and remember. In our current work, we are now testing these models empirically. The results of three studies, including a name generation task, name recognition test, and an artificial name learning experiment, provide converging evidence in support of information theoretic constraints on name memory. We discuss the social and cognitive import of these findings.

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• SELECTIVE ATTENTION III •

(5094)

Effects of Valence and Arousal on Stroop Task Performance. VIKTORIA TIDIKIS, *Northern Arizona University*, IVAN K. ASH, *Old Dominion University*—This study examined the effects of emotions on attentional selectivity using Stroop task. The authors predicted that the effects of emotions on attention would be dependent on valence of emotions and

their activation level that is there would be a valence by arousal interaction. Overall, participants in a negative mood condition took longer to respond than participants in a positive mood condition. Three-way valence-by-arousal-by-congruency interaction was observed, with participants in positive mood high arousal and negative mood low arousal conditions showing greater Stroop effect, thus demonstrating poorer selective attention compared to that in other conditions. In consequence, positive mood high in arousal and negative mood low in arousal made goal maintenance and competition resolution more difficult. Stroop task was also hypothesized to be a parallel measure of attentional breadth to that traditionally used in research; however, this hypothesis was not confirmed.

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(5095)

Atemporal Focus in Mind-Wandering Paradigms. JONATHAN D. JACKSON, *Brandeis University*, YANA WEINSTEIN, *University of Massachusetts - Lowell*—Recent research has examined how often we mind-wander about the past versus the future. However, mind-wandering may also be atemporal. It is unclear what proportion of mind-wandering is atemporal, and also how an atemporal response option would affect the prospective bias often reported during low-demand tasks. The present study examined self-reported (Experiment 1) and probe-caught (Experiment 2) mind-wandering using the Sustained Attention to Response Task (SART) in younger (18-30) and older (50+) adults. Across self- and probe-reports, the atemporal response option was used at least as frequently as past or future. Older adults, although reporting far fewer mind-wandering events, showed a very similar temporal pattern to younger adults. Most importantly, inclusion of the atemporal report option affected performance on the SART and selectively eliminated the prospective bias in self-reported mind-wandering, but not in probe-caught mind-wandering. These results suggest the importance of including the atemporal dimension in studies of temporally-focused mind-wandering.

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(5096)

Can Simple Numerical Magnitude Judgments be Influenced by Cross-Modal Selective Attention? MAGALI E. KREUTZFELDT, DENISE N. STEPHAN, WALTER STURM, KLAUS WILLMES and IRING KOCH, *RWTH Aachen University* (Sponsored by Cristina Massen)—Previous studies have shown that cross-modal selective attention plays an important role in executive control. In the current study, cross-modal selective attention was investigated using a numerical magnitude judgment task. In contrast to previous studies, this allowed us to examine the nature of numerical magnitude representations proposed as a central and amodal process. To study cross-modal selective attention, stimuli were presented bimodally (auditory and visual number words). A cue indicated the imperative modality, which varied randomly. Participants were asked for a magnitude judgment of the number (1 to 9 without 5 in relation to the standard 5) presented in the relevant modality. Results indicate a



numerical distance effect (i.e., larger distances to the standard number cause better performance). The observed difference in congruency across input-modalities can be interpreted as cross-modal interference (i.e., visual dominance). Implications of the findings are discussed in relation to amodal number representations and modality-specific attention accounts.

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(5097)

The Building Blocks of Numerical Ability—Numerosity is Important but Not Sufficient. SHARON NAPARSTEK, TALI LEIBOVICH and AVISHAI HENIK, *Ben-Gurion University of the Negev*—It has been suggested that the ability of subjects to enumerate or to compare arrays is one of the building blocks of numerical cognition and that humans are born with the ability to process numerosities. Accordingly, we show that numerosity is processed automatically. Namely, it modulates performance even when irrelevant to the task at hand. However, a dot array contains, in addition to numerosity, continuous properties such as the total surface area of the dots, their density, etc. These properties are highly correlated with numerosity and therefore might influence subjects' performance. Accordingly, we show that visual-spatial properties of dot arrays affect performance and might be difficult to ignore. Attempts to control these confounding factors may lead to contradicting results and may not eliminate the confound. We suggest that studying continuous properties, instead of just trying to control them, may contribute to unraveling the building blocks of numerical abilities.

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(5098)

Is the Auditory Deviation Effect a General or Domain-Specific Form of Auditory Distraction? FRANCOIS VACHON, KATHERINE LABONTE, JEAN-DENIS LATULIPPE-THERIAULT and ALEXANDRE MAROIS, *Universite Laval*—The occurrence of an unexpected, infrequent sound in an otherwise homogeneous auditory background tends to disrupt the ongoing cognitive task. This 'deviation effect' is typically explained in terms of attentional capture whereby the deviant sound draws attention away from the focal activity, regardless of the nature of this activity. Yet, Lange (2005) showed that an unexpected tone change hampered the visual recall of verbal but not spatial material, suggesting that the deviation effect is rather domain specific. Since the verbal and spatial memory tasks used in Lange's study were not perfectly equivalent, the present study aimed at testing the domain-specific account of the deviation effect by equating the procedure for the verbal and the spatial conditions. Experiment 1 established that verbal deviants—a letter embedded in the repetition of another letter—can hinder both visual verbal and spatial serial recall. Experiment 2 revealed the same pattern of results with spatial deviants—a sound presented contralaterally to the other sounds. Such findings demonstrate that the deviation effect reflects a general form of auditory distraction.

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(5099)

Reverse Cross-Modal Stroop: An Unexpected Pattern of Results. DANIELLE A. LUTFI-PROCTOR and EMILY M. ELLIOTT, *Louisiana State University*—The classic Stroop task, during which one names the ink color of color words, has long been used as a measure of selective attention (MacLeod, 1991). Since its initial creation, many variations of the task have been developed. One of these is cross-modal Stroop, which uses visual colored targets and auditory distractor color words. However, whether the same mechanisms and processes are used while completing the two tasks has yet to be determined. We examined response times and accuracy levels for repeating auditory color words and visual colored items with and without accompanying distractors. Although an asymmetry was found for cross-modal Stroop, it was not the same asymmetry found in classic Stroop. This finding suggests that the same processes and mechanisms may not be involved when participants name colors in cross-modal Stroop and the classic Stroop task.

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(5100)

No Temporal Dissipation of Attention Settings in Auditory Task Switching. IRING KOCH and VERA LAWOW, *RWTH Aachen University*—Using a cued task-switching variant of dichotic listening, we varied the response-cue interval (RCI) to examine temporal dissipation effects. In each trial, participants used a visual cue to select a female or a male voice (simultaneously presented) as target for a numerical judgment. Experiment 1A (N = 20) used two different cues for each gender and showed only small cue-repetition benefits (same cue vs. alternate cue) but large switch costs (alternate cue vs. task switch). A replication without immediate repetitions (Experiment 1B, N = 30) showed very similar switch costs, suggesting that cue repetitions play a negligible role for the size of auditory attention switch costs. Importantly, both experiments showed only slightly better overall performance with short RCI but no effect at all on switch costs. Because statistical power for this null-effect was reasonable (N = 50), this finding suggests that auditory attention settings do not dissipate quickly over time.

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(5101)

The Role of Response Demands in Auditory Task Switching. VERA LAWOW and IRING KOCH, *RWTH Aachen University*—Using a cued task-switching variant of dichotic listening, we examined intentional attention switching by varying the cue-stimulus interval to assess both switch costs and preparation effects. In each trial, a cue indicated which of two number words, spoken by a female and a male speaker, had to be attended. In Experiment 1, participants either repeated the relevant number word (shadowing) or judged it as being smaller or larger than five (numerical categorization) by direct vocal responses (i.e., "smaller" vs. "larger"). We found reduced switch costs and increased preparation benefits for shadowing compared to numerical categorization. In Experiment 2, vocal responses to numerical categorizations were either direct or abstract ("left" vs. "right"). Performance was overall better for

direct compared to abstract responses, but the specific result pattern did not differ across response demands. We discuss results regarding the difficulty of response selection.

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(5102)

Auditory Distractor Influence Varies With Category Novelty. DONALD J. TELLINGHUISEN, LAUREN J. BENDER and DAVID LEE, *Calvin College*—Irrelevant auditory distractors influence visual searches when distractors map on to the response required for targets. Recently, we demonstrated larger distractor effects when distractors (the word “number” or “letter”) and targets fit preexisting categories (targets were N or X for one category response; 4 or 7 for another), than new categories (targets were 4 or N for one category response; 7 or X for another). In addition, these effects occurred when the target search perceptual load was high, but not when it was low. In this study, we explored the effects of an irrelevant distractor when the target was a known letter (X) or a novel, letter-like symbol that we named a “zad”. Target incompatible distractors (“X” or “zad” spoken) influenced processing when the target was a known letter presented in high perceptual loads. This suggests that auditory distractor influence may be greatest for known rather than novel categories.

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(5103)

Selective Attention Modulates the Effect of Contingencies on Processing Redundant Targets. CHENG-TA YANG and TING-YUN CHANG, *National Cheng Kung University*—Contingencies can be implicitly learned to affect the decision strategies of processing redundant featural information of an object. However, it is unknown whether processing redundant information from different spatial locations is also affected by implicit learning for contingencies as visual primitives across space are assumed to be parallelly processed. We used a double-dot paradigm by manipulating the target probability and attentional instructions. Results from Experiments 1 and 2 showed that all the three participants adopted parallel self-terminating processing regardless of the relative target probability. When participants were instructed to attend to the location with higher target probability in Experiment 3, two participants altered their decision strategies to serial self-terminating processing but one still adopted parallel self-terminating processing. In all the experiments, the process capacity was generally limited. Taken together, individual differences were observed: relative target probability only affected two participants’ decision strategies especially when spatial attention was manipulated. We conclude that selective attention is necessary for implicit learning for contingencies.

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(5104)

Reversing the Route-Familiarity Effect by Recording the Driver’s EEG: A Driving Simulator Study. MATTHEW R. YANKO and THOMAS M. SPALEK, *Simon Fraser University*—We have shown that as drivers become more familiar with a route, they respond less promptly to emergencies (e.g., a vehicle braking). This Route-Familiarity

effect was attributed to increased mind wandering along familiar routes (Yanko & Spalek, 2013). We speculate that the stress of someone monitoring/evaluating you would likely reduce the incidence of mind-wandering. Therefore, in the present work we measured driving performance while either doing the driving task normally or while we concurrently recorded EEG activity using an electrode cap. Consistent with our past findings, when drivers were not monitored with EEG, the typical Route-Familiarity effect was observed, whereby familiar drivers were slower to respond to emergencies than were unfamiliar drivers. On the other hand, when drivers were additionally monitored with EEG, the route-familiarity effect was reversed. These results are consistent with the hypothesis that the route-familiarity effect is due to increases in the incidence of mind-wandering.

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(5105)

Failure to Yield to Oncoming Motorcycles at Intersections: The Role of Motorcycle Lane Position. BERTRAND SAGER and MATTHEW R. YANKO, *Simon Fraser University*, DANIEL M. BERNSTEIN, FARHAD N. DASTUR and DAVID J. FROC, *Kwantlen Polytechnic University*, THOMAS M. SPALEK, *Simon Fraser University*—A driver turning left and failing to notice an oncoming motorcyclist until it is too late is the most-often cited cause of motorcycle collisions. Previous research has focused on static physical properties of the motorcycle (size, shape, colour) to explain its inconspicuousness. Using a high-fidelity driving simulator, we examined a different characteristic, namely the motorcycle’s trajectory of approach. Our results show that drivers are more likely to turn in front of an oncoming motorcycle when it travels in the left portion of its lane than when it travels in the right portion of its lane. Perceptual and cognitive factors – such as responsiveness to motion cues and time-to-arrival judgment – may underlie car-drivers’ failure to respond appropriately to oncoming motorcycles. Based on these results, we recommend that motorcyclists approach intersections from a right-side-of-the-lane position.

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(5106)

Relative Contributions of Vision and Proprioception to Attention During Tool Use. GEORGE D. PARK, *Claremont Graduate University*, CATHERINE L. REED, *Claremont McKenna College*—When holding a tool, despite attentional prioritization for space near the hands, bias transfers to the tool’s end/functional part. However, the visual/proprioceptive input requirements to the tool/hand are unknown. We compared target detection (50/50, go/no-go) performance while participants held a tool (stick with shallow cup at end) over a flat monitor in 3 conditions: 1) open-tool: tool’s end visible, 2) hidden-tool: tool’s end visually obscured, and 3) no-tool: non-extending, short stick in hand. In Exp-1, without tool practice, faster RTs were found at tool-end location for both open- and hidden-tool conditions, with no RT differences for no-tool condition. Exp-2 dissociated tool-end attention to farthest visual stimulus or end of tool for open- and hidden-tool conditions. Results suggest visual attention is



drawn toward the tool's end even when visually obscured. RTs not facilitated by visible hand proximity. Tool proprioception provides enough information for directing tool-end attention while tool vision is unnecessary.

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(5107)

Direction is Superior to Distance in the Symbolic Control of Spatial Attention. BRADLEY S. GIBSON and PEDRO SZTYBEL, *University of Notre Dame*—A spatial symbol can guide attention to a specific location only when both the direction and distance parameters of a reference frame are fully specified. Interestingly, very few spatial symbols convey information about both direction and distance, and the symbolic cues that have been used in previous spatial cuing studies only convey information about direction, but not distance. These observations led us to propose that symbolic information about direction may dominate symbolic information about distance for the control of spatial attention. Consistent with this direction superiority hypothesis, the results showed that observers were better able to use symbolic information about direction to guide their attention in space than symbolic information about distance, when both types of information were conveyed by a single cue. Further experiments showed that direction superiority was characteristic of voluntary control, but not involuntary control, and was not an artifact of differences in semantic familiarity.

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(5108)

Can Mental Imagery of Natural Environments Restore Directed Attention? GEETA SHIVDE, JOHN ANDRACCHIO, TYLER SCHARADIN, ERIN MORRISSEY and V. K. KUMAR, *West Chester University*—The effects of directed attention fatigue can be reduced by interacting with stimuli (e.g., viewing pictures, taking walks) from natural environments, but not from urban environments (Berman, Jonides, and Kaplan, 2008). The current study investigates whether this same attention restoration effect can occur through engaging in mental imagery of natural environments. 169 participants first engaged in a backwards digit span (BWD) task to induce directed attention fatigue. Participants' directed and involuntary attention function was assessed with the Attention Network Test (ANT). They then listened to guided imagery instructions for 15 minutes that involved detailed descriptions of either a walk in a forest, a walk in a city, or basic relaxation instructions. After imagery or relaxation, participants again completed the ANT. Although there was no reliable interaction of type of imagery on ANT performance in the overall sample, additional analyses showed that participants that were more engaged in the imagery tasks did show the expected effect of a benefit for their ANT executive function scores in the natural imagery condition.

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(5109)

Feature-Based Attention is Selectively Modulated by Spatial Attention. TAOXI YANG, XIAOPENG SONG, *Peking*

University, ERNST PÖPPEL, & YAN BAO, Peking University and University of Munich—Attention can be shifted to a spatial location either by a centrally presented symbolic cue like an arrow or by a sudden onset of a peripheral cue. The present study aims to investigate whether spatial attention initiated by these two types of cues interacts with feature-based attention. Following an initial feature cue which indicated the likely feature of the target, either a non-informative central cue or peripheral cue was presented before the onset of a target. Subjects were asked to make a choice response to the target feature. The results showed a significant interaction between spatial attention and feature-based attention, but only when spatial attention was initiated by the central cue which possibly involves both endogenous and exogenous attention. The results suggest that feature-based attention possibly share some neural processes with endogenously generated spatial attention, while exogenous spatial attention might have rather independent neural mechanism.

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(5110)

Working Memory vs. Selection History in Attentional Guidance. IGOR DOLGOV and JEREMY D. SCHWARK, *New Mexico State University*, JOSHUA D. SANDRY, *Kessler Foundation Research Center*, CHRISTOPHER B. VOLKMAN, *New Mexico State University*—Recent theories have proposed that selection history is a separate, dissociable source of information that influences attention. The current study sought to investigate the simultaneous involvement of selection history and working-memory on attention during visual search. Experiments 1 and 2 used target feature probability to manipulate selection history and found significant effects of both working-memory and selection history, although working-memory dominated selection history when they cued different locations. Experiment 3 eliminated the contribution of voluntary refreshing of working-memory and replicated the main effects, although selection history became dominant. Using the same methodology, but with reduced probability cue validity, both effects were present in Experiment 4 and did not significantly differ in their contribution to attention. Effects of selection history and working-memory never interacted. These results suggest that selection history and working-memory are separate influences on attention and have little impact on each other, which has implications for models of attention.

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(5111)

Attentive Tracking in the Perception of Animacy: A Computational Model of "Chasing" vs. "Stalking". TAO GAO, CHRIS L. BAKER and JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology*—Perception can involve seemingly higher-level social properties such as animacy (e.g. chasing and fleeing). Based on rigorous psychophysical data, we constructed a computational model of perceived chasing, which demonstrates how the perception of animacy is deeply rooted in other aspects of vision, including attention and working memory. This model integrates a Bayesian ideal observer model with cognitive constraints,

assuming that (a) only a limited number of agents can be tracked simultaneously; and (b) only a limited period of motion trajectories can be stored in working memory. These two straightforward constraints nevertheless produce an intriguing chasing vs. stalking distinction, which matches human performance quantitatively across a variety of tasks. In contrast, a model with unlimited capacity is only sensitive to the actual efficiency of chasing, without the ‘chasing’ vs. ‘stalking’ distinction at all. These results demonstrate how perceived chasing is determined by both the domain-specific assumptions implemented in an ideal observer model and domain-general constraints from limited cognitive capacities. They provide a new perspective in understanding how attention and working memory enable rich social percepts.

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(5112)

Separating Stimulus, Goal and Response Switching During a Fast-Paced Sustained Attention Task. BEN J. DYSON and ADAM HARLEY, *Ryerson University*—Previous research into sustained attention has shown the importance of goal and stimulus switching, but response switching has so far been ignored as a factor. The current study investigated the combined contributions of goal, stimulus, and response switching on performance recovery during sustained attention. 60 participants performed a fast-paced task involving a primary, a break, and a return phase, wherein the break phase involved all possible combinations of goal, stimulus and response repetition and switch across separate blocks. In accordance with the recommendations of the literature, reaction time, commission errors and omissions errors were all considered. Participants experienced increases in both commission and omission errors for goal switching and response switching. A unique and short-lived effect in omission error was found for response switching, particularly when combined with stimulus repetition. The data are discussed in light of the measurement of vigilance decrement and whether breaks help or hinder sustained attention.

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• CONSCIOUSNESS •

(5113)

The Effect of Mindfulness Meditation on Time Perception. ROBIN S.S. KRAMER, *University of Kent*, WEGER W. ULRICH, *Universität Witten/Herdecke*, DINKAR SHARMA, *University of Kent*—Research has increasingly focussed on the benefits of meditation in everyday life and performance. Mindfulness in particular improves attention, working memory capacity, and reading comprehension. Given its emphasis on moment-to-moment awareness, we hypothesised that mindfulness meditation would alter time perception. Using a within-subjects design, participants carried out a temporal bisection task, where several probe durations are compared to “short” and “long” standards. Following this, participants either listened to an audiobook or a meditation

that focussed on the movement of breath in the body. Finally, participants completed the temporal bisection task for a second time. The control group showed no change after the listening task. However, meditation led to a relative overestimation of durations. Within an internal clock framework, a change in attentional resources can produce longer perceived durations. This meditative effect has wider implications for the use of mindfulness as an everyday practice and a basis for clinical treatment.

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(5114)

The Phenomenology of Controlling a Moving Object With Another Person. JOHN A. DEWEY and GÜNTHER K. KNOBLICH, *Central European University*, THOMAS H. CARR, *Michigan State University*—The sense of agency (SoA) is the perception of willfully initiating and controlling an action. When acting individually, SoA depends on congruence between the predicted and actually perceived sensory consequences (action effects). However, little is known about SoA for action effects that are jointly determined by more than one actor. In two experiments, we studied how individuals’ experience of controlling a moving object was influenced by sharing control with a second person. Participants used joysticks to manipulate an object in pursuit of a moving target either with or without a co-actor. Participants’ SoA was strongly influenced by the correlation between their own joystick movements and the moving object, but also influenced (reduced) by the mere presence of a co-actor with a non-working joystick. In a second experiment, when the co-actor’s joystick was active and enhanced acquisition of the target, participants’ SoA increased. SoA during joint action is influenced by low-level visuomotor correlations, but also by the presence of competing causal influences, and by the success of joint action goals.

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(5115)

Unconscious Processing of Pictures Revealed by Mouse Movement Trajectories. KUNCHEN XIAO and TAKASHI YAMAUCHI, *Texas A&M University*—Unconscious priming effects are often taken as the evidence for the idea that complex information can be processed unconsciously. However, it has been argued that the results based on reaction time measures can be contaminated by participants’ intentional control. To mitigate these problems, a priming framework was combined with a mouse movement method that measured trajectories of a cursor in a trial to reveal priming. Participants were instructed to judge, by clicking a button on the screen with a computer mouse, if two numbers (targets) were the same or not after briefly presented pictures (primes), while the mouse trajectory was recorded in each trial to assess priming effects. The movement data revealed larger deviation (measured by the area under a cursor trajectory) to an unselected choice in trials where the information about the priming pictures and numbers (targets) was conflicting, and an awareness test showed that such priming effect was still significant at a subliminal level. Taken together, results suggest that the



mouse movement method can complement the reaction time method to study unconscious priming and complex priming is likely to occur on a subliminal level.

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(5116)

Failure to Replicate Exclusion Failure in a Novel, Forced-Choice Exclusion Task. GARY D. FISK, *Georgia Southwestern State University*, STEVEN J. HAASE, *Shippensburg University*—Exclusion tasks typically test for unconscious perception by priming participants with masked words, followed by instructions to complete prime word stems with words that were not displayed. Persaud & McLeod (2008) introduced a novel exclusion task that required participants to choose the non-displayed alternative of briefly presented (5 or 10 ms) masked target letters (either b or h). We attempted to replicate their results. Experiments 1 (original mask), 2 (simplified mask), and 3 (pattern mask) did not produce evidence supporting unconscious perception for 8 ms or 17 ms targets. A fourth experiment with target durations ranging from 0 to 100 ms produced evidence of conscious perception at the long target durations. However, there was no evidence for unconscious perception at shorter durations as would be expected if the exclusion failure → unconscious perception hypothesis is correct. We conclude that forced-choice exclusion tasks do not provide requisite evidence for unconscious perception.

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(5117)

Unconsciously Processed Symbolic Cues and the Allocation of Spatial Attention. ERIC TAYLOR, DAVOOD GOZLI and JAY PRATT, *University of Toronto*—Symbolic cues, such as arrows, automatically direct spatial attention. In this project, we asked whether awareness of arrow cues would modulate this effect. We used object substitution masking to conceal uninformative arrows that preceded a target at a congruent or incongruent location. A four-dot mask offset either simultaneously with the arrow (unmasked condition) or 200 ms later (masked condition). As expected, a response time facilitation effect was found in the unmasked condition, with faster responses to targets at locations congruent with the arrow. Unexpectedly, this pattern reversed for the masked condition, as responses were faster at locations incongruent with the arrows. These findings indicate that the effect of arrow cues depends on conscious awareness, and that arrow cues below awareness can produce negative compatibility effects.

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• LETTER AND WORD PROCESSING III •

(5118)

Relational Integration and Association Strength in Integrative Priming. LARA L. JONES, *Wayne State University*—Word recognition is facilitated for targets that

can be easily integrated with a prime to form a sensible phrase (steam --> boat) and for targets sharing a strong association with the prime (ship --> boat). Such integrative priming has been found in a variety of lexical priming paradigms and in the absence of an association between prime and target across SOAs ranging from 100 to 2500 ms (e.g., Estes & Jones, 2009; Jones & Golonka, 2012). In the current study, the independent and combined effects of relational integration and association strength were investigated in a LDT at a short 50 ms SOA (Experiment 1) and across three long SOAs (500, 1500, 2500; Experiment 2). Results showed priming that differed in magnitude and/or underlying mechanism for integrative pairs that are strongly associated with their targets (sail --> boat) from those having only a strong association or only an integrative relation.

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(5119)

You Can't Drink A Word: Lexical And Individual Emotionality Affect Subjective Familiarity Judgments. CHRIS F. WESTBURY, *University of Alberta*—For almost thirty years, subjective familiarity has been used in psycholinguistics as an explanatory variable, allegedly able to explain many phenomena that have no other obvious explanation (Gernsbacher, 1984). I tested the hypothesis is that the subjective familiarity of words is reflecting personal familiarity with or importance of the referents of words. Using an empirically-grounded model of affective force derived from Wundt (1896) and based in a co-occurrence model of semantics (that involves no human judgment), I show that the affective force of a word can account for the same variance in a large set of human subjective familiarity judgments as other human subjective familiarity judgments, can predict whether people will rate new words of the same objective frequency as more or less familiar, and can predict lexical access as well as human subjective familiarity judgments do. Individuals who have highly affective reactivity rate words as significantly more familiar than individuals who have low affective reactivity.

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(5120)

The Role of Orthographic Consistency in Korean Monosyllabic Words. SAY YOUNG KIM, *Nanyang Technological University*, DONALD J. BOLGER, *University of Maryland*—Although Korean is known for its transparent writing system, consistent letter-to-sound mapping, particular consonant sounds in the coda position are orthographically inconsistency (i.e., same sound, different spelling). We tested the effect of the orthographic inconsistency on the recognition of Korean monosyllabic words using a masked priming lexical decision task (prime duration = 50ms). Korean participants were given CVC structured monosyllabic words as targets preceded by one of five different prime types: consistent body (O+ P+ in CV), consistent rime (O+ P+ in VC), inconsistent rime (O- P+ in VC), identical (O+ P+ in CVC), and non-match (O- P- in CVC). The main effect of prime type was significant, showing that identical primes elicited the largest facilitation priming effect. Both consistent bodies and rimes induced facilitation, but inconsistent rimes elicited a large

inhibition effect as compared to non-match trials. This is the first empirical evidence of an orthographic (in)consistency effect in Korean.

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(5121)

Skipped Words are Processed Differently Than Fixated Words During Reading. MICHAEL A. ESKENAZI and JOCELYN R. FOLK, *Kent State University*—The purpose of this study was to investigate whether words are processed differently when they are fixated during silent reading than when they are skipped. A serial processing model of eye movement control (e.g., EZ Reader) predicts full identification of skipped words (Reichle, Rayner & Pollatsek, 2003), while a parallel processing model (e.g., SWIFT) predicts occasional “best guesses” for skipped words (Engbert, Nuthmann, Richter, & Kliegl, 2005). Participants read 34 sentences with target words embedded in them while their eye movements were recorded. All target words were three letters, low frequency, unpredictable, and familiar nouns. After the reading session, participants completed a repetition priming lexical decision task with the target words from the reading session included as the repetition prime targets. When participants skipped a word during the reading session their reaction times on the lexical decision task were significantly longer than when they fixated the word. This result provides evidence that skipped words are sometimes not processed to the same degree as fixated words during reading, as the parallel processing model predicts.

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(5122)

Eye Movements and Misidentification of Words During Reading. JULIE GREGG and ALBRECHT W. INHOFF, *Binghamton University, SUNY*—Not all words are correctly identified during reading, and not all misperceptions are subsequently detected. The study examined the effects of target word properties and of contextual congruency on word identification during sentence reading. Targets were high or low frequency words with a lower- or higher-frequency orthographic neighbor, respectively. There were three posttarget context conditions: congruent, meaning only the target was plausible in the sentence; incongruent, meaning only the target’s neighbor was plausible in the sentence; or neutral, meaning both were plausible within the sentence. Analyses of eye movements showed longer first pass viewing durations for low- than high-frequency targets. Second pass reading revealed a significant interaction of target frequency with post-target context, as low frequent targets with incongruent subsequent sentence context were less frequently re-read than high frequency targets. This finding suggests that a low frequency target was relatively often mistaken for a higher frequency neighbor, and that its lexical selection may have occurred during posttarget reading.

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(5123)

Phonological Activation of Word Meanings in Adult and Child Readers: Evidence From Eye Tracking. DEBRA JARED and KATRINA O’DONNELL, *University of Western Ontario*, STEPHEN AGAUAS and JANE ASHBY, *Central Michigan University*—The role of phonology in silent reading was investigated in two experiments in which participants read sentences while their eye movements were monitored. The sentences contained either a homophone that was used correctly, or an error word that was the homophone mate or a spelling control word. In Experiment 1 participants were skilled adult readers and error words were high frequency words. First fixation and gaze durations were significantly shorter on homophone error words than on spelling control words, although only when the correct homophone was also a high frequency word. These results provide evidence that phonology contributes to the activation of word meanings in silent reading even for very common words. Developmentally, beginning readers are thought to use an effortful phonological recoding strategy that is gradually replaced by automatic activation of phonology (e.g., Grainger et al., 2012). Experiment 2 examined whether the activation of phonological representations from print has become efficient enough by Grade 5 to contribute to the activation of word meanings when students read silently.

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(5124)

The Effect of Semantic Neighbors on Word Identification: Evidence From Eye Movements. BADRIYA H. AL FARSI, SARAH RULE and SIMON P. LIVERSEDGE, *University of Southampton* (Sponsored by Nick Donnelly)—Isolated visual word recognition research has shown that a word’s semantic neighbors (i.e. the number of words that tend to co-occur with a particular word in a similar semantic context, NSN, e.g. Lund & Burgess, 1996) influence the speed of word identification. Words with high NSN are responded to faster than words with low NSN. We carried out two eye movement experiments to examine the effect of NSN in normal reading (Experiment 1, corpus based text passages, Experiment 2 a single sentence target word manipulation). Increased NSN resulted in reduced first pass reading time measures in both experiments, demonstrating that consistent NSN effects do occur in normal reading. We discuss our findings in terms of Stolz and Besner’s (1996) embellishment to the interactive-activation framework.

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(5125)

The Effect of High- and Low-Frequency Previews and Sentential Fit on Word Skipping During Reading. BERNHARD ANGELE, *University of California, San Diego*, ABBY LAISHLEY, *Bournemouth University*, KEITH RAYNER, *University of California, San Diego*, SIMON LIVERSEDGE, *University of Southampton*—In a previous gaze-contingent boundary experiment, Angele and Rayner (2012) found that readers are likely to skip a word that appears to be the definite article the even when syntactic constraints do not allow for articles to occur in that position. In the present study, we



investigated whether the frequency of the preview of a three-letter target word influences a reader's decision to fixate or skip that word. We found that the preview frequency rather than the felicitousness (syntactic fit) of the preview affected how often the upcoming word was skipped. These results indicate that visual information about the upcoming word trumps information from the sentence context when it comes to making a skipping decision. Skipping parafoveal instances of the therefore may simply be an extreme case of skipping high-frequency words.

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(5126)

Constraints on Semantic Preview Benefit. ELIZABETH R. SCHOTTER, *University of California, San Diego* (Sponsored by Keith Rayner)—While orthographic and phonological preview benefits in reading are uncontroversial, researchers have debated the existence of semantic preview benefit, with positive evidence in Chinese and German but no support in English. Two experiments, using the gaze-contingent boundary paradigm, show that semantic preview benefit can be observed in English when the preview and target are synonyms (e.g., curlers-rollers) but not when they are semantically related (e.g., curlers-styling). Furthermore, the degree to which the meaning of the sentence changes when the target replaces the preview was positively related to reading time. The results will be discussed in relation to (1) previous failures to find semantic preview benefit in English and (2) the fact that semantic preview benefit is observed in other languages even for non-synonymous words. Similarity between what is accessed parafoveally and what is processed foveally is an important influence on preview benefit, as are attentional demands and depth of orthography.

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(5127)

Phonological Processing During Silent Reading in Developing Readers With Permanent Childhood Hearing Impairment and With Dyslexia. JONATHAN H. DICKINS, HAZEL I. BLYTHE and SIMON P. LIVERSEDGE, *University of Southampton*—Developing readers with dyslexia, and those with Permanent Childhood Hearing Impairment (PCHI) have phonological processing deficits, as well as marked literacy deficits. Eye movement research has shown that skilled adult readers process phonological information in lexical identification during silent sentence reading (Rayner, Pollatsek, & Binder, 1998). Such effects have yet to be examined in developing readers. Three participant groups were recruited: Typically developing readers; developing readers with dyslexia; and developing readers with PCHI. Eye movements were recorded as they read sentences containing three types of target words: Correct words (e.g., church); pseudohomophones (e.g., cherch); and orthographic controls (e.g., charch). Visual similarity of the pseudohomophone-correct target pairs was also manipulated. The data showed differential patterns of sensitivity to our manipulations between the three participant groups, and are discussed in the

context of theoretical standpoints on phonological processing in reading (e.g., Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Seidenberg & McClelland, 1989).

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(5128)

Is There a Transposed Letter Effect Across Words? MICHAEL G. CUTTER, DENIS DRIEGHE and SIMON P. LIVERSEDGE, *University of Southampton*—Using the boundary paradigm during reading (Rayner, 1975), Johnson (2007) found that transposing the third and fifth letter of a parafoveal word (e.g. “flewor” as a preview of “flower”) leads to a greater preview benefit than substituting the same two letters (e.g. “flawur”). We investigated whether the same effect was observed when we transposed the final and initial letter of adjacent parafoveal words (e.g. “sip tea” in “He liked to slowly sip tea ...”). Participants received an identity preview (e.g. “sip tea”), or a preview in which the third and fifth characters were transposed (e.g. “sit pea”) or in which they were substituted (e.g. “six sea”). Significant identity preview benefit occurred, but there were no differences between the transposition and substitution conditions. The absence of a transposition effect across words is taken as evidence against parallel processing of orthographic information from multiple words.

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(5129)

Masked Homophone Priming Effects for Japanese Kanji Words. YUU KUSUNOSE, MARIKO NAKAYAMA and YASUSHI HINO, *Waseda University*—Using lexical decision tasks with briefly presented primes (85 ms and 150 ms prime durations), Chen, Yamauchi, Tamaoka and Vaid (2007) failed to report a significant homophone priming effect for Japanese kanji word targets when the primes were presented in kanji, although a significant effect was observed when the primes were transcribed into hiragana. Although their results indicate that automatic phonological activation does not arise when reading kanji words, there are some previous studies indicating the possibility of automatic phonological activation for kanji words (e.g., Hino, Kusunose, Lupker & Jared, 2013). In order to re-examine whether automatic phonological activation arises when reading kanji words, therefore, we attempted to examine whether a priming effect arises for homophonic kanji word pairs using lexical decision tasks with masked primes. Significant homophone priming effects were observed with a new set of homophone pairs as well as those used by Chen et al. These results clearly indicated that automatic phonological activation arises even when reading kanji words.

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(5130)

Effects of Character Structure and Stroke Type on Chinese Character Processing. PEIYUN ZHOU and KIEL CHRISTIANSON, *University of Illinois at Urbana-Champaign*—Studies of visual Chinese character recognition have largely treated all character types the same. Yet classes of overall character structure exist, and may influence recognition processes. Two masked-prime lexical decision tasks investigated whether stroke type and character structure

influence Chinese character recognition. 400 characters with five different structures were targets, including single, top-bottom, left-right, enclosures, and half-enclosure. Four priming conditions were manipulated: identical character, irrelevant character, first stroke removed and last stroke removed. 25 types of Chinese strokes were removed at the first or last stroke position. LME modeling showed that priming condition, stroke type, stroke number, character structure, character frequency, and font size were significant predictors of response time (RT). Left-right, top-bottom and single structures had longer RTs than characters with enclosure and half-enclosure structures. Recognition was significantly delayed when the stroke 'heng shu gou' was removed at the first stroke position (e.g., 习). The results suggest that readers used a direct visual route from orthography to meaning in Chinese character recognition.

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(5131)

Semantic Richness, Orthographic Neighborhood Size, and Stimulus Quality Effects on Visual Word Recognition.

JASON F. REIMER, VANESSA CARLOS and ADRIANA L. VERDUZCO, *California State University, San Bernardino*—Semantic richness effects demonstrate that words with relatively richer semantic representations (e.g., balloon) are recognized more quickly and accurately than words with less rich semantic representations (e.g., muzzle). According to interactive activation (IA) accounts of semantic richness effects, words with greater semantic richness are recognized more quickly because they produce greater feedback activation from semantics to orthography than do less semantically rich words. The present study was designed to more extensively examine IA accounts of semantic richness effects, and how such effects are modulated by orthographic neighborhood size and stimulus quality. This was done by varying the semantic richness, orthographic neighborhood size, and stimulus quality of words within the lexical decision task. A three-way interaction was found such that semantic richness modulated the effect of orthographic neighborhood size when words were intact, but not when they were degraded. This pattern of results demonstrates how the convergence of top-down and bottom-up activation constrains the dynamics of visual word recognition. The results will be discussed within the context of current models of visual word recognition.

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(5132)

The Reversed Goldilocks Effect: Premask Duration Modulates Priming in the Masked-Priming Same-Different Task.

JASON GELLER, *Iowa State University*, MARY L. STILL, *San Jose State University*, ALISON L. MORRIS, *Iowa State University*—In the standard masked-priming same-different task, a related prime (e.g., fiath-FAITH) produces facilitation when the reference -- presented above a premask -- and target are the same. At first blush, the mechanisms underlying the task appear straightforward, as simulated by the Bayesian Reader model. In two experiments, we employed a modified version of the task: Participants were presented with a reference (1000 ms), followed by a premask (1000 ms or 500

ms or 250 ms) and then the prime (48 ms) and the target. The premask variation and use of reversed-anagram primes (e.g., hsiF-FISH) allowed us to manipulate inter-item competition. Premask duration modulated priming effects: For the long and short premask durations, priming was found in both word and nonword blocks, but for the medium premask duration, priming effects were unreliable. We propose a new model, which simulates the observed results as a function of competition, attention, and lexicality.

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(5133)

Effects of Degradation, Frequency, and Priming: Do Trial History and Data Transformations Matter?

MELVIN J. YAP, *National University of Singapore*, ANDREW J. ASCHENBRENNER and DAVID A. BALOTA, *Washington University in St. Louis*—The additive and interactive effects of stimulus quality, word frequency, and semantic relatedness have provided challenging constraints for models of lexical processing. Adding to the complexity of these findings, Masson and Kliegl (2013), using linear mixed-effects (LME) modeling, demonstrated that these joint effects are modulated by recent trial history (i.e., the stimulus quality and lexicality of the previous target). However, recent evidence (Balota, Aschenbrenner, & Yap, in press) suggests that effects from LME analyses may be qualified by how the raw RT data are transformed. In the present study, we use LME analyses to further explore the influence of trial history and data transformations on theoretically important joint effects in primed lexical decision, when high forward associative strength primes and a long SOA are used (cf. Masson & Kliegl). RT distributional analyses, which provide a finer-grained characterization of effects are also presented. Implications for the word recognition architecture are discussed.

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(5134)

Reading in Russian: A Language With Context-Dependent Mappings Between Orthography and Phonology.

ANASTASIA ULICHEVA and BRENDAN S. WEEKES, *The University of Hong Kong*—Russian is an Indo-European language that uses Cyrillic alphabet to represent the sounds of language. The system of correspondences between orthography and phonology in Russian is distinct from languages studied to date. On one hand, the pronunciations of letters are unpredictable e.g. may have alternative pronunciations; on the other hand, the mappings between orthography and phonology are regular since all alternations may be described in terms of regular rules e.g. final devoicing. Therefore, the translation from orthography to phonology are fully context-dependent. The aim of the present study was to investigate what effect this unique feature of Russian has on skilled reading of monosyllabic words. Russian metrics for type and token predictability were estimated based on the sample of 50 000 words. The results of mixed modeling show that words containing potentially unpredictable sounds elicit longer naming times. The results are discussed in terms of existing models of word reading.

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(5135)

Lexical Decision vs. Semantic Categorization: A RT Distribution Analysis of Semantic Priming and Relatedness Proportion Effects. BIANCA DE WIT and SACHIKO KINOSHITA, *Macquarie University*—The magnitude of the semantic priming effect has been found to increase as the proportion of related trials in an experiment increases. This relatedness proportion effect is generally only found at long SOAs and therefore mostly explained in terms of strategic, controlled processing. This study investigated the relatedness proportion effect (25% vs. 75% of semantically congruent prime-target pairs) at a short SOA (240 ms), which is widely assumed to preclude strategic use of the prime, in both a lexical decision and semantic categorization task. Surprisingly, relatedness proportion effects were found in both tasks. RT distribution analysis revealed different patterns for the two tasks in the high relatedness proportion condition, indicating that the relatedness proportion effect is driven by different underlying mechanisms in lexical decision and semantic categorization.

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(5136)

Word Identification in English and Chinese Texts by Speakers Varying in Fluency. LIANG TAO, *Ohio University*, ALICE F. HEALY, *University of Colorado-Boulder*—Native Chinese speakers and native English speakers in advanced Chinese language courses parsed Chinese and English texts into words. Three Chinese passages and their English translations were presented in strings of alphabet letters (English and Chinese pinyin, an alphabetic phonetic system) or in Chinese characters. All texts had equal spaces between characters or letters, as with regular Chinese texts, which contain no inter-word spaces. Word identification was much easier in English than in Chinese texts, evidenced by errors and reading times. In parsing Chinese texts into words, native Chinese speakers typically made errors by selecting units larger than words, whereas native English speakers were equally likely to select units larger or smaller than words. The results indicate that Chinese reading does not depend on successfully parsing strings of characters into words, even when Chinese is written in alphabetic characters. Consequently the processing units seem to be larger for native Chinese speakers than for native English speakers. Words may not always be the basic processing units in reading.

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(5137)

Using Topic Models to Extrapolate Subjective Ratings for Psycholinguistic Variables. PAWEŁ MANDERA, EMMANUEL KEULEERS and MARC BRYSSBAERT, *Ghent University*—Subjective ratings of word characteristics, such as concreteness, imageability, or age-of-acquisition are indispensable for psycholinguistic research. As a consequence, many experiments are restricted to using only those stimuli for which norms exist. We investigated whether a small number of ratings could be used to automatically extrapolate to non-rated words by using topical information extracted from text corpora using Latent Dirichlet Allocation. As test cases we used

existing English age-of-acquisition and concreteness norms on 30,000 words. A random forest model (robust to overfitting) was fit to 25% of the ratings and then used to predict the remaining 75%. Compared to a model based on only word frequency, model predictions increased from 35% to 51% for age-of-acquisition and from 5% to 44% for concreteness. These results have immediate practical implications for experimental research, particularly in languages or domains where little or no subjective ratings have been collected.

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(5138)

On the Alphabetic Nature of Brahmi-Derived Writing System: Evidence From Devanagari/Hindi. ANURAG RIMZHIM, *University of Connecticut*; *Haskins Laboratories*, CAROL A. FOWLER, *University of Connecticut*, LEONARD KATZ, *University of Connecticut*; *Haskins Laboratories*—Research on reading in different writing systems suggests that a consistent (i.e., shallower) orthography promotes using smaller grain-size(s) of orthographic units compared to a less consistent, deeper orthography. The orthographies for the indigenous languages of South and Southeast Asia that are derivative of the ancient Brāhmī writing system are considered alphasyllabaries or abugidas having both syllabic and alphabetic characteristics. We provide empirical evidence that one of those orthographies is functionally alphabetic. In a lexical decision task, we tested the relevance of various orthographic and phonological units of length in the Brāhmī-derived Devanāgarī, the (shallow) orthography of Hindi. Length in letters, but not in “akshars,” units of approximately syllable size, predicted latencies. We propose that the letter is the most relevant psycholinguistic unit for skilled reading in Devanagari. Our results are consistent with the orthographic depth hypothesis (Katz & Frost, 1992) and the psycholinguistic grain-size theory (Ziegler & Goswami, 2005).

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(5139)

Letter Position Coding in Visual Word Recognition: On The Role of Confusability. SERJE ROBIDOUX, SASKIA KOHNEN and YVETTE KEZILAS, *Macquarie University* (Sponsored by Max Coltheart)—Skilled readers easily identify letters and put them in order when reading. This system, while efficient, is also flexible: it is not difficult to identify psychology and psychology as misspellings of psychology. However, this flexibility is necessarily limited: readers must be able to identify pirates as its own word, and not as a misspelling of parties (or vice versa). Though seemingly effortless to skilled readers, identifying and ordering letters is not trivial. Letter position dyslexia is characterized by a deficit in putting letters in the correct order (Kohnen et al., 2012), and letter-by-letter dyslexia is characterized by a deficit in accurately identifying letters within letter strings, particularly if those letters are easily confused for other letters in the alphabet (Fiset et al., 2005). In the present study, we examine the role that letter-pair confusability (e.g., how likely a reader is to confuse an O for a Q) plays in position coding for both skilled readers and letter position dyslexic readers.

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• BILINGUALISM III •

(5140)

The Effect of Semantic Overlap and Logical Relatedness on Argument Evaluation. M. ANNE BRITT, *Northern Illinois University*, SRIKANTH DANDOTKAR, *Eastern Illinois University*, JOSEPH P. MAGLIANO, *Northern Illinois University* (Sponsored by Murray Singer)—Many readers have difficulty evaluating informal arguments based on logical structure alone. We examined whether students' argument-evaluation difficulty is due to an over-reliance on superficial word overlap, poor memory for the claim, or ignoring logical structure in favor of consistency with their own beliefs. In two experiments, we independently manipulated logical relatedness and semantic overlap across claims and their supporting reasons in short arguments. Participants evaluated the arguments for structural quality or agreement and then, after a delay, recalled the arguments. We found that semantic overlap affected quality evaluations for arguments with high logical relatedness but not those with low logical relatedness. Furthermore, less-skilled reasoners' argument quality evaluations were related more to their difficulty in precisely recalling the argument claims and whether the argument was consistent with their prior beliefs than to simple semantic overlap.

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(5141)

Automatic American Sign Language (ASL) Activation During Reading in ASL-English Deaf Bilinguals. NATHALIE N. BÉLANGER, *University of California, San Diego*, JILL P. MORFORD, *University of New Mexico*, KEITH RAYNER, *University of California, San Diego*—Bilinguals activate words in both languages when reading either in their L1 or in their L2. This has been shown across languages sharing scripts (English-French), across scripts (English-Chinese), but also across modalities (spoken vs. signed languages). In other words, when confronted with English print, ASL-English bilinguals activate ASL, even if there is no formal relationship between these languages. The present experiment embedded pairs of unrelated English words for which translation equivalents in ASL were related (signs that share several structural parameters in ASL) or unrelated (no overlap at all between the two sign equivalents) within sentences (RELATED: The cats will be sick (prime) if they touch (target) the plant's leaves; UNRELATED: The cats will be safe (prime) if they touch (target) the plant's leaves.) Eye movement measures on the target words suggest that while reading English sentences ASL is activated extremely early (in first fixation durations) in deaf ASL-English bilinguals.

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(5142)

Does the Bililingual Mind Read the Words as a Whole? YU-CHENG LIN and ANA I. SCHWARTZ, *University of Texas at El Paso*—Monolingual research demonstrates that lexical access is flexible in terms of letter-position; Transposed-letter (TL) nonwords (judge) prime recognition of their base words (judge) stronger than orthographic controls (jutpe). In

two experiments we examined whether TL priming would be observed across languages and whether the magnitude of priming would vary according to cross-language form overlap. Spanish-English bilinguals performed a lexical decision on either noncognate targets, cognate targets with high orthographic overlap (actor/actor: +O) or cognates with lower orthographic overlap (fruit/fruta: -O). In Experiment 1 there was significant TL priming in response latency across all cognate and noncognate conditions. Priming in accuracy was only observed for +O cognates. In Experiment 2 the TL primes were followed by targets that were semantic associates of the TL base word (e.g., actor: MOVIE). In that experiment there was only a facilitative effect for +O cognate in both latency and error rates.

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(5143)

Are Japanese-English Phonological Priming Effects Lexical or Prelexical? ERIKO ANDO and KAZUNAGA MATSUKI, *University of Western Ontario*, HEATHER SHERIDAN, *University of Toronto*, DEBRA JARED, *University of Western Ontario*—Masked Katakana primes have been shown to facilitate lexical decisions to similar-sounding English target words in Japanese-English bilinguals (Nakayama et al., 2011). We investigated whether the locus of this effect was lexical or prelexical by examining whether the phonological priming effect occurred earlier than the effect of word frequency. Both ERP waveforms and lexical decision response distributions were analyzed. In right anterior electrodes, a phonological priming effect was significant at 200-250 ms but the frequency effect was not significant until 250-300 ms. However, in left posterior electrodes, the frequency effect was again significant at 250-300 ms but the phonological priming effect was not significant until 500-600 ms. Likewise, in the lexical decision data, the divergence point for responses to high vs low frequency words was earlier than the divergence point for targets preceded by phonologically similar vs dissimilar primes. The early phonological priming effect in the ERP data may reflect prelexical feed-forward activation of phonology, whereas the later phonological priming effect may be a consequence of feedback activation from phonological to lexical orthographic representations.

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(5144)

Lexical Entrenchment and Cross-Language Competition Interact During Bilingual Reading: The Joint Effects of Word Frequency and Non-Target-Language Neighborhood Density. VERONICA WHITFORD and DEBRA TITONE, *McGill University*—Eye movement measures of bilingual reading show different patterns of first- (L1) and second-language (L2) word frequency effects (FEs) within and across bilinguals (e.g., Gollan et al., 2011; Whitford & Titone, 2012). Such effects are important as they provide clues about how bilinguals organize and access L1 and L2 words in memory. However, whether they arise from reduced lexical entrenchment, cross-language competition, or both is an open question. We thus investigated whether current L2 exposure, which reflects lexical entrenchment, and non-target-language



neighborhood density, which reflects competition, modulate L1 and L2 FEs in 86 French-English bilinguals during L1 and L2 paragraph reading. Replicating our prior work, gaze duration data showed larger L2 vs. L1 FEs, and larger L1 FEs in bilinguals with increased L2 exposure, consistent with a lexical entrenchment account. However, irrespective of L2 exposure, increased L1 neighborhood density during L2 reading facilitated gaze durations for low-frequency L2 words, consistent with a competition account. Thus, both lexical entrenchment and cross-language competition drive bilingual FEs, and are very likely two sides of the same theoretical coin. Email: Debra Titone, debra.titone@mcgill.ca

(5145)

Spanish-English Bilingual Word Norms With New Examination of Comprehensive Cognate Measures. JENNIFER M. MARTIN, JEANETTE ALTARRIBA and MATTHEW J. PAGANO, *University at Albany, SUNY* (Sponsored by Dana M. Basnight-Brown)—Normative values on six word attributes (valence, arousal, familiarity, concreteness, context availability, and imageability) were obtained for 192 English words and 192 Spanish translations. Spanish-English bilinguals, principally speakers of Dominican and Puerto Rican dialects of Spanish, normed abstract, concrete, emotion, and emotion laden words on these six attributes. All words were piloted on native Spanish speakers, and include no cognates as determined by three different calculations informed by the fields of linguistics and psychology. Correlational analyses are conducted between these measures of cognates and a thorough discussion of the merits of various measures of cognateness offers critical guidance for all those working with two or more languages. This set of norms also provides an invaluable resource for researchers using Spanish-English bilinguals as participants, particularly in the greater New York area where these dialects are commonly spoken, as no previous set of norms has focused on this group.

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(5146)

Lexical Selection and Language Co-Activation in Bimodal Bilinguals. MARCEL R. GIEZEN and KAREN EMMOREY, *San Diego State University*—We used the picture-word interference paradigm to investigate cross-language activation for languages with distinct phonological systems: American Sign Language (ASL) and spoken English. Highly proficient ASL-English bilinguals (N=20) named pictures in ASL while English distracter words were simultaneously presented over headphones. Relative to unrelated distracters, they were faster to sign the name (e.g. CHAIR) when they heard the English translation equivalent (chair), slower when they heard a semantically related English word (bed), and faster when they heard a word with a phonologically related translation (train, which is a minimal pair with CHAIR in ASL). The finding that spoken words activated the phonology of their manual sign translations indicates that language co-activation can occur via lexical-semantic representations alone. Furthermore, the finding that bimodal bilinguals exhibited semantic

interference effects suggests that lexical selection occurs by competition between lexical nodes and not in a phonological output buffer.

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(5147)

Is First-language Syntax Susceptible to Second-Language Influence Without Time Pressure? AMY LEBKUECHER and BARBARA C. MALT, *Lehigh University*, PING LI, *The Pennsylvania State University*—Bilinguals may show an influence of their second language (L2) syntax in their first language (L1) use. It has been argued that L2 syntactic influence on L1 occurs only under time pressure and so represents a performance effect but not a shift in underlying grammatical representation. To evaluate the nature of the L2 influence, we had Korean-English bilinguals make grammaticality judgments for Korean and English word strings. Word order matched either canonical English or Korean sentence order, and subject nouns either obeyed a Korean animacy constraint or violated it in a way that is acceptable in English. Bilinguals rated the sentences first with and then without time pressure. Bilinguals respected word order conventions in both languages but did not observe subject animacy constraints in Korean. The same pattern was found for both speeded and deliberative judgments. These results argue for a shift in L1 grammatical representation.

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(5148)

Barking Perro, Barking Horse: Detecting Language Switches Versus Semantic Errors. IVA IVANOVA and TAMAR H. GOLLAN, *University of California, San Diego*—Speakers sometimes produce within-language errors (chair instead of table) but bilinguals almost never mistakenly switch languages (mesa instead of table; Poulisse, 1999). This seems to challenge the notion of selection by competition in speech production because translation equivalents overlap in meaning exactly and should be strong competitors. One reason language intrusions are rare might be because they are monitored out of overt speech more easily than within-language semantic errors. To test this hypothesis, Spanish-English bilinguals read aloud 16 paragraphs written mostly in English, and pressed a button whenever they detected Spanish words or within-language semantic errors. Preliminary data revealed that semantic errors were indeed detected more slowly than translation equivalent language-switches, and also more slowly than unrelated control words in both languages. Additional analyses revealed that readers slow down when approaching controls more than semantic errors or translations, and thus implied sensitivity in monitoring processes to both meaning and form.

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(5149)

Second Language Verb Agreement in First Language Chinese. HENRIETTA LEMPET, MICHAL CHWALEK and TAMARA ZIMONJIC, *University of Toronto*—Do post-puberty second language learners acquire linguistic features, which are not instantiated in their first language (L1)? We used

preamble completion to examine L2 verb number agreement and plurality in L1 speakers of Chinese, a language which does not observe either agreement or grammatical plurality. Completions of Singular-Plural (SP) preambles (The sky in the photos...cloudy) and SDMP (Double Marked Plural) preambles (The sky in both photos) indicated comparably frequent attraction errors in 36 early learners (AoA, 0-11) and 35 late learners (AoA, 12-19); attraction was greater for SDMP than SP. Conversely, PS (The apples on the branch... green) elicited more errors than DMPS (Three apples on the branch); both types elicited comparably more errors from late than early learners. The results for singular head preambles suggest that even late L1 Chinese learners have access to the procedures than underlie agreement, but have difficulty processing plurality on-line.

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(5150)

Facilitated Integration of Homonym Subordinate Meanings into Sentence Context for Bilingual Readers.

JUSTIN G. LAURO and ANA I. SCHWARTZ, *University of Texas at El Paso*—We present eye-movement data demonstrating that bilinguals' integration of subordinate meanings of homonyms into a sentence context is facilitated by cross-language activation when the target meaning is a cognate. Highly proficient Spanish-English bilinguals read all-English sentences containing either a polarized homonym (dominant meaning probability > .75) or balanced homonym (no meaning > .60). Half of the homonyms were cognates (e.g., arms/armas; pole/polo) and half were noncognates (e.g., foot, gross). When the sentences required selection of the subordinate meaning of a polarized homonym, Total Reading Times were greatly reduced for cognate meanings relative to noncognates, but only when the sentence provided early bias towards that meaning. For balanced homonyms, there was a general facilitative effect of cognate status of the target meaning, irrespective of sentential bias. The emerging pattern is that interfering effects from competing, cognate meanings emerge early (Gaze duration) while facilitative effects of cognate, subordinate meanings arise late.

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(5151)

Bilingual Lexical Interactions: Inevitable or Malleable?

RACHEL JOBE and BARBARA C. MALT, *Lehigh University*, PING LI, *The Pennsylvania State University*, EEF AMEEL, *University of Leuven*, ANETA PAVLENKO, *Temple University*—Words conventionally treated as translation equivalents often show subtle differences in usage patterns in the two languages. Language learners typically initially import their first-language (L1) patterns to the second (L2), and errors can persist for years even under immersion. Conversely, when L2 patterns are better approximated, L1 patterns may shift away from native-like. To examine whether initial L2 errors are an inevitable consequence of entrenched L1 knowledge or due, in part, to sub-optimal input, we trained English speakers on Russian naming patterns for drinking vessels under several conditions designed to optimize learning. To examine whether acquisition of the L2 pattern can be accomplished

without shifting L1 patterns, we measured English naming for the same objects before and after training. Participants in all conditions successfully acquired Russian patterns. However, they became less consistent in L1 naming of trained items compared to controls, hinting that even brief L2 exposure may influence L1.

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(5152)

The Relation Between Executive Function Skills and Verbal Fluency in Monolinguals: Can We Simulate the Bilingual Advantage?

KIREN S. KHAN, JASON W. GULLIFER and JUDITH F. KROLL, *The Pennsylvania State University* (Sponsored by Paola E. Dussias)—Prior research has shown that while bilingual adults may be disadvantaged on verbal fluency in terms of overall number of items produced, they in fact outperform their monolingual peers in certain production contexts (i.e., letter fluency relative to category fluency), and when matched on vocabulary resources (Luo et al., 2010). In the present study, we attempt to further examine this issue of how task and resource demands influence verbal fluency performance. We asked whether individual differences in executive control (as indexed by the Simon, Flanker and non-linguistic switching tasks) would modulate the rate of production on letter fluency in native English-speaking monolingual adults and effectively simulate the observed bilingual advantage. The results for the monolinguals failed to simulate the bilingual advantage in verbal fluency but suggest that other factors (such as language experience) may play a role in how task demands interact with production performance.

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(5153)

Language Experience Questionnaire: Status & Skills Identification (LEQ-SSI).

PAULA L. CASTONGUAY and JEAN E. ANDRUSKI, *Wayne State University* (Sponsored by Patricia Siple)—The purpose of this study was to develop a reliable and valid instrument to measure language status, dominance, and ability in adults who are bilingual or second language learners. The construct validity and the internal consistency of the Language Experience Questionnaire: Status and Skills Identification (LEQ-SSI) questionnaire were determined by using factor analysis and Cronbach's alpha correlation coefficient, respectively. Factor analyses revealed consistent factors suggesting that the LEQ-SSI was internally valid. Cronbach's alpha values revealed moderate to high correlation between the items and the questionnaire, indicating that the LEQ-SSI is a reliable instrument. The final questionnaire consists of 80 items. The LEQ-SSI is a valid and reliable instrument for assessing language experience and proficiency of bilingual and second language learners in adult population.

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(5154)

Reading "Libro" but Remembering "Book": Bilingual Language and Memory Processing in a Cross-Language Levels-of-Processing Task.

ILEANA RATIU and TAMIKO AZUMA, *Arizona State University*—This experiment



investigated the encoding of lexical, semantic, and language specific information in Spanish-English bilinguals using a cross-language levels-of-processing task. Seventy-nine bilingual speakers encoded words via Deep tasks (e.g., Is this word a noun?) and Shallow tasks (e.g., Does this word begin and end with a vowel?) across Spanish, English, and Mixed Language conditions. Later, they received a surprise recognition task. Analyses were conducted on correct responses and cross-language false recognition errors (i.e., translation errors). Overall, participants better remembered words that were presented in a Deep task compared to a Shallow task, and there was no difference in hit rates across language conditions. However, false alarm rates for Deep and Shallow words differed across the Spanish, English, and Mixed language conditions. The findings suggest that encoding of specific language information may be dependent on the task and an individual's language proficiency.

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(5155)

Do Handedness and Language Dominance Work Hand-in-Hand? CLARA D. MARTIN, ESTIBALIZ BLANCO and JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain and Language*—Language switch cost is asymmetrical in unbalanced bilinguals: switching to the dominant language is harder than switching to the weaker language. Here, we tested the hypothesis that the asymmetrical switch cost originates at the motor level, by comparing switch cost patterns observed for language and handedness dominance. We recruited bilingual participants with a clear dominance for one hand and one language. They performed a language switching task (naming digits in the dominant or weak language, depending on a cue) and a manual switching task (pressing buttons with the right or left hand). Subjects were slower in switching to their dominant language as well as to their dominant hand. The two switch costs were asymmetrical and highly similar, suggesting a similar underlying originating principle. The results suggest that the origin of the asymmetrical language switch cost is in the motor command during articulation, and is not specifically related to lexical access.

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• CONCEPTS AND CATEGORIES III •

(5156)

Label Enhancement Effect in Categorization and Perception. ÉTIENNE DUMESNIL, *Université de Montréal*, DENIS COUSINEAU, *Université d'Ottawa*—Previous research has shown that as stimuli reach our senses they are recognized in terms of categories, which are in turn associated with responses we feed back into the world. However, the nature of the labels associated with those categories has been scarcely addressed. In the experiments presented here, subjects learned to classify stimuli within two distinct categories. In one condition, categories were associated with fixed labels, while in the other they were associated with varying labels. Results showed that category learning was better when the

labels were fixed. Moreover, a same-different task was run before and after both of these conditions. It was found that fixed labels appeared as an added dimension to the perceptual space of the stimuli, which might explain, at least in part, the phenomenon known as “categorical perception”.

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(5157)

The Influence of Category Characteristics on Abstraction in Category Representations. GERT STORMS, LOES STUKKEN and WOLF VANPAEMEL, *University of Leuven*—A decade ago, Smith and Minda (2001) investigated the conditions under which subjects are likely to represent a category with a prototype or with an exemplar representation, shifting the focus from a permanent and unitary representation that underlies categorization to identifying the conditions under which one representation is more likely than another. Recently, several models suggested that representations intermediate between exemplar and prototype models make up viable category representations. The goal of the present study was to reinvestigate the conditions that influence the level of abstraction in a person's category representation using one of these models: the varying abstraction model. This allowed us to get a more fine-grained estimation of the level of abstraction in a category representation, and thus a clearer view of the relationship between a category's features and the abstraction in its representation. Results of experiments in which category size and category complexity were manipulated are discussed.

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(5158)

An Event-Related Potential (ERP)-Based Concealed Attitude Test. DAVID R. HERRING, *University of Florida*, GABRIELA TERRAZAS, *University of Texas at El Paso*, LINSIA N. JABEEN, *Trinity University*, CIARA K. KIDDER, SYLVIA HERNANDEZ, BIANCA BALDERRAMA, ANA RODRIGUEZ and STEPHEN L. CRITES, *University of Texas at El Paso*—The concealed attitude test (CAT) is an oddball paradigm in which low frequency evaluative stimuli (e.g., negatives) appear among high frequency evaluative stimuli (e.g., positives). Previous studies have demonstrated that the late positive potential (LPP) of the event-related potential (ERP) is larger to stimuli incongruent (e.g., negatives) relative to congruent (e.g., positives) with a preceding context (e.g., positives) when participants misreport their attitudes. In the current study, participants were randomly assigned to mentally count or make key presses to oddballs. Unlike previous CATs, participants concealed their attitudes by not responding half the time to oddballs. LPPs were larger to pictures incongruent compared to congruent with the context even when participants concealed their attitudes, but there were no effects involving task type (counting vs. key pressing). Taken together, these data suggest that the concealment type (i.e., no response vs. misreporting) during the CAT critically influences the LPP during concealment.

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(5159)

Effects of Superficial Variation and Prior Knowledge on Learning Abstract Concepts. DAVID W. BRAITHWAITE and ROBERT L. GOLDSTONE, *Indiana University*—Learning abstract concepts through concrete examples may promote learning at the cost of reducing transfer. Comparing multiple examples, however, has shown the potential to promote transfer without sacrificing learning. The benefits of comparison imply the importance of understanding how to select the examples to be compared and how this selection should depend on learner characteristics. Three experiments investigated the effects of superficial variation across examples and learners' prior knowledge on learning and transfer of a mathematical concept. Better outcomes resulted from high variation when prior knowledge was high, but from low variation when prior knowledge was low. The results suggest that high variation helps to extract deep structure and de-emphasize superficial details, while low variation reinforces comprehension of structure without de-emphasizing such details. The optimal position in this trade-off depends on prior knowledge, with more knowledgeable learners coping with, and benefiting from, more variability than less knowledgeable learners.

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(5160)

Learning Categories of Snakes on a Need-to-Know Basis: Influences of Intentionality and Intrinsic Value on Multi-Level Inductive Learning. SHARON M. NOH, VERONICA X. YAN, MICHAEL VENDETTI, ALAN D. CASTEL and ROBERT A. BJORK, *University of California, Los Angeles* (Sponsored by Sean H.K. Kang)—Inductive learning—learning categories and concepts from examples—can happen at different levels. Snakes, for instance, can be categorized by genus (a lower-order category, LOC), or as venomous/non-venomous (a higher-order category, HOC). We explored the effects of intention to learn and intrinsic value (e.g., venomous/non-venomous vs. tropical/non-tropical) on inductive learning of multiple category levels. In two experiments, participants studied images of snakes and were instructed to attend either to the LOC or the HOC. Intrinsic value was manipulated either in the HOC (Exp 1) or the LOC (Exp 2). On the final tests, participants were asked to identify both category levels, regardless of initial instruction. People were able to induce category levels both intentionally and incidentally, though they were more successful at inducing LOCs when learning was intentional than when incidental. Intrinsic value, however, also affected learning: High-value levels distracted from intentional learning of the other level. This finding suggests that highly valued intrinsic properties (e.g. venom-ness) may override intentional encoding strategies.

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(5161)

Model-Based fMRI Reveals Influence of Attention on Neural Representations of Categories. MICHAEL L. MACK and ALISON R. PRESTON, *University of Texas at Austin*, BRADLEY C. LOVE, *University College London*—Selective

attention is ubiquitous in theories of category learning. Formal models posit explicit mechanisms of attention and category representations tuned to diagnostic information. Despite this theoretical emphasis, the impact of attention on neural representations of category knowledge remains unknown. Here, we explored this issue using formal modeling combined with fMRI pattern similarity methods. Participants performed a classic category learning task. An exemplar model of categorization was fit to behavior to derive similarity predictions for the task stimuli. Using fMRI searchlight, these model-based similarities were compared to the similarities of neural representations during category decisions. We found correspondence between model and neural similarity in a network of brain regions including lateral occipital, parietal, and lateral prefrontal cortex. In contrast, similarity predictions from a model variant with no selective attention showed corresponding neural similarity restricted to early visual areas. These results suggest patterns of selective attention are embodied in the neural representations of category members, and provide neural evidence for the attention mechanisms formalized by category learning theories.

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(5162)

Information Sampling in Children's Relational Thinking: Effects of Comparison and Labeling. PAULO F. CARVALHO, CATARINA VALES, CAITLIN M. FAUSEY and LINDA B. SMITH, *Indiana University*—Children show less targeted scanning of visual information than adults (e.g., Mackworth, 1970) and this is often reflected in their poorer ability to visually compare differences and similarities in visual arrays (e.g., Vurpillot, 1968). Interestingly, when trying to learn a new relational property (e.g., sameness), children benefit from the presentation of two examples of the relation compared to only one (e.g., Christie & Gentner, 2010), as well as from the addition of a label (e.g., Christie & Gentner, 2007). In the present work we investigated how adding (1) a second example and (2) a label to the presentation of one or two examples in a relational match-to-sample task changes preschooler's visual sampling. The results indicate that adding a second sample significantly increases the proportion of time spent fixating each of the objects during study. Additionally, adding a label reduced the number of saccades between the options and the initial samples. Overall, these results indicate increased sustained attention when two examples are presented and when a label is added.

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(5163)

Expected Contrast Drives the Modification Effect. THOMAS L. SPALDING and CHRISTINA L. GAGNÉ, *University of Alberta*—Recent research (e.g., Gagné & Spalding, 2011) has shown that the judged likelihood of properties true of modified nouns (baby ducks have webbed feet) is reduced relative to unmodified nouns (ducks have webbed feet), whereas the judged likelihood of properties false of a modified noun (purple candles have teeth) is increased relative to unmodified nouns (candles have teeth). Two experiments investigate the role of expected contrast—



participants' expectation that a modified noun should be both similar and different with respect to the unmodified noun. We presented nouns and modified nouns that either matched or mismatched on a blank predicate (ducks have sesamoid bones; baby ducks have/do not have sesamoid bones) prior to the standard property judgment task. The results indicate that the modification effect is sensitive to the manipulation of expected contrast. In particular, seeing a property mismatch (increasing the expected contrast) tends to increase the magnitude of the modification effect, while seeing a property match (decreasing the expected contrast) tends to decrease the magnitude of the modification effect, but primarily for the type of property (true or false) used in the match/mismatch manipulation.

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(5164)

The Organization of Concrete and Abstract Concepts: Categorical vs. Associative Relationships. JINGYI GENG and TATIANA SCHNUR, *Rice University*—In three word-translation experiments, we examined the different representational frameworks theory (Crutch & Warrington, 2005, 2010) that concrete words are organized primarily by category whereas abstract words are organized by association. In our experiments, Chinese-English bilingual speakers were presented with an auditory Chinese word and four written English words simultaneously and asked to select the English word that corresponded to the auditory word. For both abstract and concrete words, higher error rates and longer response times were observed when the four English words were categorically or associatively related compared to the unrelated conditions and the magnitude of the categorical effect was bigger than the associative effect. These results challenge the different representational frameworks theory and suggest that although category and association are important for organizing abstract and concrete concepts, category plays a greater role for both.

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(5165)

Eye-Tracking as a Measure of Category-Based Induction. STEPHANIE Y. CHEN, *New York University*, BRIAN H. ROSS, *University of Illinois*, GREGORY L. MURPHY, *New York University*—Category information is used to predict unknown properties of category members. Previous research has found that when categorization is uncertain, predictions often do not reflect integration of information across possible categories as normative principles and Bayesian models suggest. Rather, people often base predictions on only the most likely category and disregard relevant information from alternatives. Research in category-based induction tends to elicit explicit, verbal responses, which may be subject to reasoning biases. The present research explores whether changing response mode can promote more normative use of category information. Experiment 1 used an implicit measure of prediction: eye movements. Here, inductions did reflect integration across categories. The results of Experiment 2 suggest that this integration was not a result of explicit strategies. In Experiment 3, subjects made explicit

categorization judgments prior to performing an implicit induction task. The results suggest that the categorization has a large influence on subsequent predictions.

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(5166)

The Influence of Experience and Expertise on Category Essence Beliefs. JESSECAE K. MARSH, *Lehigh University*, DIANA HOOTEN, *University of Texas at Arlington*, JESSICA A. COOPER, *University of Texas at Austin*—People act as if categories possess causal essences that define membership, despite knowing little about what could make up these essences (Gelman, 2003). Does experience with a category affect people's willingness to endorse such essences? Experts in mental health endorse essentialism less within their expertise domain than laypeople (Ahn, Flanagan, Marsh, & Sanislow, 2006). In two experiments, we explored whether reduced essentialist beliefs are a general phenomenon of increased experience or dependent on the type of experience. People with a close family member or friend who had a mental disorder endorsed the presence of causal essences in these disorders more than people with no experience or people who were members of disorder categories (Experiment 1). Furthermore, physicians did not differ from laypeople in endorsing essences in medical categories, but did for mental disorder categories (Experiment 2). We discuss implications of these findings for how experience moderates beliefs about categories.

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(5167)

Order and Frequency Effects in Unsupervised Categorization. STEVEN VERHEYEN, WOUTER VOORSPOELS and BRAM VAN RENSBERGEN, *University of Leuven*, EMMANUEL M. POTHOS, *City University London*—Unsupervised categorization is thought to be primarily determined by the abstract stimulus structure: Participants categorize items on the basis of the items' dimensions of variation. In two experiments we show that the influence of stimulus structure can be overridden by manipulating the frequency of items and the order in which items are presented to participants. Items that are presented more than once or that are presented on the first trials will act as reference stimuli for further categorization. Dimensions along which these reference stimuli differ are accentuated in subsequent categorization decisions. The results tie in with earlier work showing that unsupervised categorization can be influenced in a variety of different ways. They identify constraints for current models of unsupervised categorization and highlight commonalities with supervised categorization, for which similar effects have been documented.

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(5168)

Learning to Believe: The Impact of the Type of Learning Task on Confidence Judgments. MIRJAM A. JENNY and THORSTEN PACHUR, *Max Planck Institute for Human Development* (Sponsored by Eric-Jan Wagenmakers)—Pachur and Olsson (2012) showed that people's decision making is

affected by whether they have been trained with learning by comparison (LBC), where feedback is provided as to which of two objects has a higher criterion value, or direct criterion learning (DCL), where the absolute criterion value for individual objects is shown. Are there similar effects on people's confidence judgments and the processes producing them? We trained participants either via LBC or by DCL and subsequently asked them to indicate their subjective probability that a given object belongs to one of two categories. We compared participants' accuracy and confidence judgments as a function of the type of learning tasks and modeled their judgments with a number computational cue-based, exemplar-based, and hybrid models. Categorization accuracy was higher and judgments were slower after LBC than after DCL. Moreover, LBC led to more extreme confidence judgments, suggesting a greater role of cue-based mechanisms.

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(5169)

Investigating the Processing of Integral-Dimensioned Stimuli in the Garner Paradigm. TONY WANG and DANIEL R. LITTLE, *The University of Melbourne*—A classic distinction between types of dimensions in categorisation is that of separable and integral dimensions. Separable dimensions are analysable such that one can selectively attend to one dimension of the stimulus whilst ignoring the other. Attention to separate dimensions of integral stimuli however, is less efficient. Garner and Felfoldy (1970) reported an interference effect for Munsell colours when only one dimension (brightness or saturation) was relevant for categorisation. Conversely, a facilitation effect was reported for when both dimensions were relevant for categorisation. We report a study that investigated the source of the Garner effect. One possibility is that variation on the irrelevant dimension for categorisation reduces the quality of perceptual information available to the participant for their classification. Alternatively, the participant might become more cautious in their response when presented with more confusable stimuli. We fitted a response time model in order to resolve these two possibilities.

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• REASONING AND PROBLEM SOLVING II •

(5170)

Finding an Embedded Rule is Difficult for Older Adults: Studies With the Groton Maze Learning Task. ETSUKO T. HARADA, *University of Tsukuba*, SATORU SUTO, *Shizuoka University*, KAZUHIRO YAMAGUCHI, *University of Tsukuba*—The Groton Maze Learning Task (GMLT) was used to investigate mechanisms and limitations of humans in their learning of a complex system. While thinking-aloud, participants learned to navigate a hidden maze path on a 10 x 10 matrix across 5 trials, through sequential decision-making and trial-and-error. Comparisons between younger adults (YA; 24 undergraduates) and older adults (OA; n= 24; age 65 more) showed that YA learned the path much more

efficiently, and that this resulted from different processes and strategies between groups, as inferred from verbal-behavioral protocol analysis. In Exp. 2, an embedded-rule condition was introduced by adding triangles to tiles, to mimic implicit rules that typically appear on the interface of complex systems (e.g., smartphones). Half of the YA and OA were assigned to this condition, where 50% of the triangles indicated direction of the next correct tile, while other participants executed the original GMLT. Results showed that rule-following errors were reduced in the embedded-rule condition for both age groups, and only some YA explicitly noticed the meaning of triangles. Interactions in explicit-implicit learning of complex sequential learning and its age differences will be discussed.

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(5171)

Solvable or Not, That is the Question. SUJIN PARK and JOOYONG PARK, *Seoul National University*—Research on problem solving has mostly examined solvable tasks. However, in real life, we encounter more often problems that have no apparent solutions. Given the lack of research on problem solving when faced with unsolvable problems, we investigated the effect of giving information about the presence of unsolvable anagrams among solvable ones. In Experiments 1 and 2, for the same set of anagrams, half of the participants were informed about the presence of unsolvable anagrams and the other half were not. The results consistently showed that the uninformed group outperformed the informed one and the former group spent more time on the task. We replicated the results in Experiment 3 in a within-subject design. These findings suggest that the information about solvability of a problem strongly influences the effort spent and thus the performance on the task.

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(5172)

Causal-Knowledge and Information Search During Categorization. JAY B. MARTIN and BOB REHDER, *New York University*—The effect of causal knowledge on classification is well established, but its role in information search is still largely unknown. This study assesses how causal knowledge influences the order in which classifiers seek information. Undergraduates learned two novel categories. One category's features exhibited a common cause network (one feature causes two others), and the other exhibited a common effect network (one feature is caused by two others). One neutral dimension did not take part in any causal relations. Participants chose which of two feature dimensions they would like to see in order to classify an object. Participants preferred to query features involved in two causal relations over those involved in one, which in turn were preferred to those involved in none. In addition, when some features of the to-be-classified item were already known, participants chose to query causally-related dimensions in spite of the fact that there was no difference in the amount of information conveyed. Existing models of causal-based classification failed to account for these results.

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(5173)

Magnitude Processing by Apes (*Pongo pygmaeus*, *P. abelii*, *Gorilla gorilla gorilla*) and Monkeys (*Macaca mulatta*). REGINA PAXTON GAZES, *Zoo Atlanta*, RACHEL F.L. DIAMOND and ROBERT R. HAMPTON, *Emory University*, TARA S. STOINSKI, *Zoo Atlanta* (Sponsored by Jon Crystal)—Humans comparing magnitudes show performance patterns that suggest specific properties of underlying cognitive representations. To assess the extent to which these representations are shared across primates, we assessed magnitude processing by apes and monkeys. Subjects discriminated between arrays that differed in numerosity in two conditions. In one condition, subjects were required to select the larger numerosity, in the other condition they were required to select the smaller numerosity. As in humans, both groups of primates showed response latencies that conformed to Weber's law, with faster response latencies associated with larger ratios between the numerosities. Additionally, both groups of primates showed the semantic congruity effect typical of human magnitude comparisons, responding more quickly when comparing small numerosities in the "select smaller" condition and when comparing larger numerosities in the "select larger" condition. Finally, initial results suggest that apes show effects consistent with a spatial representation of magnitude similar to that displayed by humans. The implications of these findings for the evolution of magnitude processing will be discussed.

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(5174)

The Einstellung Effect in Chess: Evidence From Eye Movements. HEATHER SHERIDAN and EYAL M. REINGOLD, *University of Toronto*—In a wide range of problem-solving settings, the presence of a familiar solution can block the discovery of better solutions (i.e., the Einstellung effect). To investigate this effect, we monitored the eye movements of expert and novice chess players while they solved a variety of chess problems that were designed to induce Einstellung effects. The problems contained a familiar checkmate solution that had been modified such that checkmate was no longer possible. Similar to prior work (Bilalić, McLeod, & Gobet, 2008), chess players continued to fixate on the squares containing this familiar solution, even though a better solution was located in a different region of the board. This pattern of results was shown by both novices and experts, and regardless of whether the familiar solution contained a good move, or only blunders. However, relative to the novices, the experts were faster at initially fixating on the familiar solution, and they were better able to choose the optimal solution on the board. We discuss the implications of these results for theoretical perspectives concerning visual expertise, problem-solving, and the mechanisms underlying the Einstellung effect.

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(5175)

Dissociating Conflict Detection and Response Inhibition as Sources of Analytic Engagement Using a Rapid-Response Base-Rate Task. GORDON PENNYCOOK, JONATHAN

A. FUGELSANG and DEREK J. KOEHLER, *University of Waterloo*—We investigate the cognitive processes that guard against reasoning failures by isolating and manipulating two potential sources of analytic reasoning engagement: conflict detection and response inhibition. To do this, we developed a rapid-response base-rate task where stereotypical diagnostic information and corresponding base-rate probabilities (that were either congruent or incongruent) were presented to participants to judge in a stage-like serial succession. Inserting moderate base-rates (e.g., 700/300) selectively decreased response time for stereotypical responses relative to extreme base-rates (e.g., 995/5), indicating a decrease in the engagement of analytic reasoning following conflict detection. Conversely, making the stereotypes more salient by giving participants a small proportion of incongruent items (i.e., 25% vs. 75%) selectively increased response time for base-rate responses, indicating more difficulty inhibiting the stereotypical response. These data indicate that conflict detection and response inhibition are dissociable sources of analytic engagement that can be affected by subtle contextual factors.

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(5176)

Chronometric and Developmental Evidences for the Dual-Process Mental Model Theory of Conditional. CAROLINE GAUFFROY, *University of Geneva*, EVIE VERGAUWE, *University of Missouri*, THOMAS CHARREAU and PIERRE BARROUILLET, *University of Geneva* (Sponsored by Camos Valérie)—We assumed that, when individuals reason on a conditional statement, the formation of the initial model (i.e., $p \rightarrow q$) is underpinned by heuristic processes, which are fast, tacit, unconscious and remain stable across development, contrary to analytic processes which intervene for the construction of the fleshed out models (i.e., $\neg p \rightarrow \neg q$ and $\neg p \rightarrow q$). To support the hypothesis that the construction of initial model relies on automatic processes whereas additional models rely on controlled processes, we analyzed the time course of responses in a truth table task as a function of their nature and the interpretation of the conditional adopted by third, sixth and ninth graders. Results revealed that response times are a function of the number of models each response involves, confirming what we observed in a previous study conducted in adults (Vergauwe, Gauffroy, Morsanyi, Dagry and Barrouillet, 2013).

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(5177)

Ignoring Individual Differences in Belief Bias Leads to Incorrect Conclusions. DRIES TRIPPAS, MICHAEL F. VERDE and SIMON J. HANDLEY, *Plymouth University*, GORDON PENNYCOOK, *University of Waterloo*—The interference of prior belief with reasoning is called belief bias. There is currently a debate in the literature on whether belief bias only affects the response stage of deduction (response bias) or whether it also affects the reasoning stage (motivated reasoning). We present five SDT experiments showing that belief can result in motivated reasoning and that ignoring individual differences in cognitive ability and cognitive style

incorrectly leads to the opposite conclusion. In Experiments 1 and 2 we present ROC and forced choice data inconsistent with a pure response bias account. In Experiment 3 and 4 we show that motivated reasoning is exclusively exhibited by high cognitive ability and high analytic style groups. In Experiment 5 we replicate the previous findings and show that cognitive style is a better predictor of motivated reasoning than cognitive ability. We conclude that individual differences are crucial for the correct interpretation of belief bias.

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(5178)

Breaking the Curse of Knowledge in Adults' False-Belief Reasoning. RACHEL A. RYSKIN and SARAH BROWN-SCHMIDT, *University of Illinois at Urbana-Champaign*—The ability to represent the beliefs of others is an essential, but non-trivial task. Extensive research demonstrates that young children struggle to separate their private knowledge from the beliefs of others. When sensitive-enough measures are used, adults also demonstrate an egocentric bias when attempting to evaluate the views of a more naïve individual, i.e., “The Curse of Knowledge.” In an influential study, Birch and Bloom (2007) examined adults' susceptibility to the curse of knowledge in reasoning about false-belief. They found that adults are more likely to commit egocentric errors, due to the curse of knowledge, in a false-belief task when the egocentric response is plausible. Here we report the results of five experiments that fail to replicate this finding. Across the experiments, manipulations of the visual properties of test vignettes show that visual salience may play a role in modulating adult behavior in this task.

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(5179)

The Effect of Emotions on Deductive Reasoning: A Balance Between Relevance, Emotionality and Arousal. SERGE CAPAROS and ISABELLE BLANCHETTE, *Université du Québec à Trois-Rivières*—Emotional semantic content can have either a deleterious or a beneficial effect on logicity. Using a standard deductive-reasoning task, we tested the role of three factors – relevance, emotionality and arousal – in determining the direction of this effect. Relevance was manipulated by having participants reason about semantic contents linked to a personal emotional experience or not. Emotionality was assessed using subjective ratings and measures of experience severity. Arousal was indexed using measures of skin conductance. Findings showed that irrelevant emotional contents and relevant high-emotionality contents hindered logicity, compared to neutral content, the former while increasing arousal and the latter while decreasing arousal. By contrast, relevant moderate-emotionality content had little effect on arousal and improved logicity compared to neutral content. In sum, the direction of the effect of emotional semantic content on logicity seems to be determined by (1) the interaction between relevance and emotionality and (2) the presence of changes in arousal.

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(5180)

Explaining the Seductive Allure of Neuroscience. REBECCA E. RHODES, *University of Michigan*, FERNANDO RODRIGUEZ, *WestEd*, PRITI SHAH, *University of Michigan*—Several studies have found that individuals rate scientific evidence to be of higher quality when irrelevant neuroscience information or images are present, but others have not always replicated this effect. To shed light on these inconsistencies, we examined the influence of neuroscience on evaluations of flawed scientific studies after taking into account individual differences in scientific reasoning skills, dispositions towards open-minded thinking, and prior beliefs about a claim. We assessed the effect of neuroscience not only on quantitative ratings, but also on the reasoning process. After controlling for individual differences, we found that neuroscience information had a significant effect on ratings of convincingness. Additionally, neuroscience information made participants less likely to give critical evaluations and point out flaws in study methodology, especially when the evidence was congruent with their prior beliefs. These results suggest that neuroscience can influence scientific reasoning, perhaps especially when a study's claim supports what one already believes.

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• JUDGMENT AND DECISION MAKING III •

(5181)

Choice Deafness of Expert Musicians to Preferred Performance. YURIKA ISHIMATSU, SHUJI MORI and NOBUYUKI HIROSE, *Kyushu University*—Johansson et al. (2005, *Science*) first reported choice blindness, in which a good proportion of people did not detect changes in the choice of preferred faces that they had just made. Since their seminal study, choice blindness has been shown to take place in a variety of situations with different modalities. One aspect common to past research is that participants are non-experts. It is well known that experts are different from non-experts in decision-making in tasks related to their expertise because they utilize their experience and knowledge in the task. It is thus an important research question whether past findings of choice blindness are generalizable to experts. Here we show that choice blindness occurs in experienced musicians in terms of their choice of preferred musical performance. We presented orchestral musicians with two performances of the same musical composition that were easily discriminable by musicians, and asked which of the two they liked. Right after their choice, we told them to listen to their preferred performance, which was actually the one they had not chosen. The results showed that one-third of the musicians did not notice the change, indicating their choice deafness of musical performance.

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(5182)

Decision Making, Expertise, and Non-Analytic Cognition in Human Fingerprint Matching. MATTHEW B. THOMPSON and JASON M. TANGEN, *The University of Queensland*, DUNCAN J. MCCARTHY, *Queensland Police Service*—When a fingerprint is found at a crime scene it is a human expert, not a machine, who is faced with the task of identifying the person who left it. We know from similar domains of expertise, such as medical diagnosis, that experts are accurate even with very little information and that much of expert decision making is based on rapid and unconscious recognition of previously encountered instances—non-analytic cognition. I will present evidence for non-analytic cognition in fingerprint matching, such that experts can discriminate fingerprints in noise, spaced in time, and in two seconds. And I will show that, unexpectedly, fingerprint experts did not show the classic inversion effect seen in face recognition.
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(5183)

Dopamine-related Genetic Influences on Exploratory Decision-making. NATHANIEL J. BLANCO, *University of Texas at Austin*, A. ROSS OTTO, *New York University*, JOHN E. MCGEARY, *Brown University*, BRADLEY C. LOVE, *University College London*, W. TODD MADDOX, *University of Texas at Austin*—Genes underlying dopaminergic function have been associated with individual differences in decision-making. COMT affects frontal dopamine levels and is associated with executive function. DRD2 affects striatal dopamine and is implicated in avoidance learning. We explore genetic individual difference effects on exploratory decision-making under single and dual task conditions. Computational modeling analyses assessed participants' exploration strategies. We propose that (a) the COMT Met allele facilitates the use of model-based decision-making strategies, and (b) the DRD2 T allele supports avoidance learning and reduces exploration. We found support for both predictions. COMT genotype correlated with model parameters determining the extent that choices are directed by uncertainty (i.e. are model-based)—Val homozygotes explored more randomly than Met carriers. Additionally, COMT genotype predicted performance in the dual task. DRD2 genotype predicted overall exploration rates, regardless of strategy. Our study establishes that genetic factors underlying dopamine function play an important role in exploratory choice behavior.
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(5184)

To Buy or not to Buy? That is the Question. KRISTA RYDECKY, ANGELE YAZBEC and MARIO FIFIC, *Grand Valley State University*—The topic of this study is the various rules people use to assist them in their decision making. We created an experiment on the basis of the Stopping Rule Selection (SRS) theory, which hypothesizes that the decision maker selects different strategies and stopping rules specific to the decision at hand from a decision operative space (DOS). The decision that our participants were faced with was whether to buy or not to buy the unknown product based on a series of simplistic reviews. In attempts to create a real life situation,

the participants lost or gained a small sum depending on their choice of each product. We investigated how the time pressure and the quality of recommendations affect the process of selection of stopping rules in decision making. The strategies that they used were assessed by conducting a pattern analysis (a sequence of recommendations opened), and in a short questionnaire proceeding the final session. Results showed the striking differences in a number of reviews inspected, as result of both manipulations. The pattern analysis showed utilization of various stopping rules in different conditions.
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(5185)

Uncertainty Drives Exploration During Decision-Making. KAILEIGH A. BYRNE and DARRELL A. WORTHY, *Texas A&M University*—We examined how the level of uncertainty regarding the rewards provided by each option affected exploratory behavior during decision-making using a two-choice task which required maximizing cumulative reward. It was predicted that participants would explore an option more if there was greater uncertainty about the rewards it provided, relative to the other option. We utilized an RL model that included an uncertainty term for each option, which was defined as the recency-weighted variance in the rewards received after each selection. Larger variance in recent rewards was assumed to indicate greater uncertainty about the accuracy of the predicted reward for each option. The results revealed that individuals chose options that they were more uncertain about and switched, or explored the alternative option more following trials in which the selected option's uncertainty had been greatly reduced. These results provide strong evidence that reducing uncertainty is a major goal of exploratory behavior.
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(5186)

Self-Control Moderates a Framing Effect in History-Dependent Decision-Making. BO PANG and DARRELL A. WORTHY, *Texas A&M University*—We examined a framing effect in history-dependent decision-making and how self-control moderated the effect. Participants performed a decision-making task where they chose one of two options on each trial that had equivalent expected value over the long term, but differed in which one provided larger immediate versus delayed reward. We speculated that the larger delayed reward option would be viewed as less certain and more risky because the benefit from selecting it came on future trials, rather than immediately. The results showed a framing effect was present whereby participants selected the more risky increasing option more often when attempting to minimize losses than when attempting to maximize gains. Trait self-control moderated the framing effect by enhancing the effect for low self-control participants while attenuating it for high self-control participants. These results suggest that the framing effect extends to situations where people must juxtapose immediate versus delayed reward.
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(5187)

Knowledge Updating in Juror Decision Making. KARENNA F. MALAVANTI and CHARLES A. WEAVER III, *Baylor University*—Many factors such as eyewitness testimony, exculpatory evidence, and cognitive load influence juror receptiveness of evidence and subsequent decision-making. In Experiment 1, mock jurors read a trial summary describing the armed robbery of a convenience store in which the suspect appears guilty, and rendered a verdict. Participants rendered a verdict again after watching an exculpatory video or doing an unrelated task. Results indicate those who watched the video were significantly less likely to vote guilty at Time 2. These results show that mock jurors are able to process initial information and make changes when new information becomes available. In Experiments 2 and 3, all participants watched the video but were under conditions of high cognitive load, by memorizing numbers or having extraneous information. Mock jurors under no cognitive load were more likely to vote the defendant guilty at Time 1 and less likely to vote guilty at Time 2. However, mock jurors under cognitive load during both did not change their verdict. When jurors' ability to acquire and update knowledge is compromised by high cognitive loads, knowledge updating processes are impaired.

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(5188)

Expectations and Working Memory in Decision Making Under Stress. MATTHEW E. DAVIS and ANA M. FRANCO-WATKINS, *Auburn University*—Research supports that “enhanced expectations” about one’s ability to perform a task under pressure can actually improve performance compared to no expectations. This research investigated whether working memory capacity (WMC) moderates the ability to perform under pressure when expectations are present. Participants were randomly assigned to enhanced expectations, hindering expectations, or no expectations about their expected performance in the presence of a stressor. Participants completed a decision twice: once under stress, an adaptive time pressure, and then without time pressure. Results suggest that participants who receive enhanced expectations perform more accurately than those with no expectations or hindering expectations, and that this difference in performance is moderated by WMC. Consequently, expectations about performance can have beneficial consequences in the presence of a stressor.

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(5189)

Decision Complexity and Consistency in Choice Under Risk. TETIANA ZAPOROZHETS, *National Aviation University; Kingston University London*, PETKO KUSEV, *Kingston University London* (Sponsored by James Hampton)—A long history of research has explored the complexity and management of risky environments (e.g., Johnson & Bruce, 1994; Slovic, 2000). However, very little research explored the psychological factors (e.g., readiness, context, and psychological reactions to normative rules) underlying this complexity. Typically the content of psychological readiness,

as proposed in sport and work psychology, is based on physical and emotional parameters. In contrast, this research shows the cognitive mechanism underlying psychological readiness (sensitivity to context, computational rationality). In order to maintain the effectiveness of complex risky systems, managers are expected to implement (i) relevant knowledge and experience, and (ii) pre-designed normative rules and therefore to maintain accuracy in decision outputs/performance. Accordingly, in one experiment we explored the influence of context, content, and computational rationality on decision consistency and psychological readiness.

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(5190)

Extreme Outcomes Influence Risky Choice in Pigeons and Humans. JEFFREY PISKLAK, *University of Alberta*, ELLIOT LUDVIG, *Princeton University*, CHRISTOPHER MADAN and MARCIA SPETCH, *University of Alberta*—In a phenomenon known as the reflection effect, humans are risk averse for gains and risk seeking for losses when confronted with described choices. This effect, however, is reversed when humans learn the contingent outcomes of their choices from experience. This discrepancy can be explained by an extreme-outcome rule in which the best and worst possible outcomes in a context are overweighted, which leads to more risk seeking for relative gains than for relative losses when outcomes are learned through experience. Because little is known about how non-human animals behave under similar situations, we tested this extreme-outcome rule with both pigeons and humans. As predicted, both species were more risk seeking when a fixed and risky option led to high rewards than when the fixed and risky options led to low rewards.

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(5191-5192)

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