Concepts and Categories
Illinois, Friday Morning, 8:00–9:15

Chaired by Barbara C. Malt, Lehigh University

8:00–8:15 (1)

Where Are the Concepts? What Words Can and Can't Tell Us. BARBARA C. MALT, *Lehigh University*, ASIFA MAJID, *Max Planck Institute for Psycholinguistics*, EEF AMEEL, *Katholieke Universiteit Leuven*, MUTSUMI IMAI, *Keio University*, & SILVIA GENNARI, *University of York*—Concepts are so fundamental to human cognition that Fodor declared the heart of a cognitive science to be its theory of concepts. To study concepts, though, cognitive scientists need to be able to identify some. The prevailing assumption has been that they are revealed by words such as *triangle*, *table*, and *robin*. But languages vary dramatically in how they carve up the world with names. Either ordinary concepts must be heavily language dependent, or names cannot be a direct route to concepts. We asked speakers of English, Dutch, Spanish, and Japanese to name a set of 36 video clips of human locomotion and to judge the similarities among them. We investigated what name inventories, name extensions, scaling solutions on name similarity, and scaling solutions on nonlinguistic similarity from the groups, individually and together, suggest about the underlying concepts. Aggregated naming data and similarity solutions converged on results distinct from individual languages.

8:20–8:35 (2)

Semantic Alignment in Number Comparison. JAMIE I. D. CAMPBELL & SEAN G. SACHER, *University of Saskatchewan*—Are quantity representations activated by Arabic digits influenced by semantic context? Participants viewed a word pair connoting relative magnitude (less/more) or quantity (few/many). After 480 msec, a pair of single-digit targets (e.g., 2 8) appeared above the words, and participants decided whether the prime and target pairs agreed in ascending or descending order. Digits either were successors (near) or differed by at least four (far). The RT advantage for far digit pairs over near pairs (the distance effect) was greater with magnitude primes (81 msec) than with quantity primes (17 msec). This difference disappeared in Experiment 2 when participants named the larger of the two digits and could ignore the primes. Nonetheless, mean RT in Experiment 2 was faster, with prime and target pairs both ascending or both descending only with quantity primes. The results indicate that number comparison recruits distinct numerical representations as a function of semantic context.

8:40–8:55 (3)

Induction With Cross-Classified Items. BRETT K. HAYES, *University of New South Wales*, HENDY KURNIAWAN, *University of Sydney*, & BEN R. NEWELL, *University of New South Wales*—Two studies examined property induction with cross-classified foods. Two kinds of cross-classified foods were first identified: those associated primarily with a taxonomic category (e.g., *fruit*) or with a script-based category (e.g., *snack foods*). Taxonomic categories were perceived as more coherent than script-based categories. In Experiment 1, participants completed a property induction task in which information from multiple categories could be searched and then combined to generate a prediction about a novel target food. Multiple categories were more frequently consulted and used for predictions about script-primary foods than for those about taxonomic-primary foods. Experiment 2 replicated this finding across a range of property types but found that multiple category reasoning was reduced under a concurrent cognitive load. The use of multiple categories in induction is promoted when cognitive resources are available and when a cross-classified item is associated primarily with a category that has low internal coherence.

9:00–9:15 (4)

Intonation Stress and the Disambiguation of NN Compounds. JAMES A. HAMPTON, *City University London*, & DANIEL HEUSSEN, *Katholieke Universiteit Leuven*—Stress assignment can serve to disambiguate meaning in English compound noun phrases; A *brick* factory is a factory that makes bricks, whereas a brick *factory* is a factory made of bricks. We propose an account based on general ontological types and the semantic relations that they most commonly provide. The unstressed noun provides the preferred relation for interpreting the phrase. An empirical study is reported that supports this account.

Human Learning and Instruction
Missouri, Friday Morning, 8:00–9:35

Chaired by Suparna Rajaram, Stony Brook University

8:00–8:15 (5)

Examining the Immediate and Delayed Aspects of the Testing Effect. ADAM CONGLETON & SUPARNA RAJARAM, *Stony Brook University* (read by Suparna Rajaram)—A large body of research has demonstrated that the act of taking a test promotes long-term retention of material, a phenomenon known as the *testing effect*. Furthermore, there appears to be an interaction embedded within the testing effect between one's learning history and delay, such that repeatedly studying material leads to superior retrieval on immediate tests of memory, whereas repeatedly being tested on material sustains retrieval across time on delayed tests. Recent findings (Zaromb & Roediger, in press), including our own work, show that repeated retrieval of material strengthens one's retrieval organization, which, in turn, protects against the negative effects of forgetting across time. The present study investigates the relationship between retrieval organization and long-term retention by directly investigating the interaction between learning history and delay. We discuss the findings for the two learning histories in terms of differential processing of "item-specific" versus "relational" information (Hunt & McDaniel, 1993).

8:20–8:35 (6)

Testing Prior Knowledge Facilitates Its Subsequent Replacement. HAL PASHLER & SEAN H. K. KANG, *University of California, San Diego*, & MICHAEL C. MOZER, *University of Colorado, Boulder*—Does reviewing of old information affect subsequent learning of new information? Subjects learned facts about 12 things on Day 1. On Day 2, subjects reviewed some of those facts—one third were tested (cued recall), one third were reread, and the remainder were not presented again—after which they were given new facts about the same 12 things to learn. A final test on Day 8 showed that when the new facts were supplementary to those learned on Day 1, reviewing of the old information had no impact on the learning of new information (Experiment 1). However, when the new facts contradicted and were to supplant the information learned on Day 1, reviewing of the old information enhanced learning of the replacement information (Experiment 2). Rereading, but not testing, increased intrusions of the old obsolete facts on the final test, suggesting that retrieval of to-be-replaced information facilitates its subsequent updating.

8:40–8:55 (7)

Test Taking Facilitates Later Learning. KATHLEEN B. McDERMOTT & KATHLEEN M. ARNOLD, *Washington University*—The concept of test-potentiated learning (i.e., that an earlier test can prime or facilitate acquisition of information when it is encountered at a later time) was introduced in the 1960s in Izawa's work in the verbal-learning tradition (e.g., Izawa, 1971). However, this concept has not received much attention in the recent literature, despite a growing body of work focused on the role test taking can play in knowledge acquisition and retention. We investigate its credibility with educationally relevant materials over many experiments and with multiple analytic approaches, providing converging approaches to understanding the phenomenon. Taking a test prepares a learner to benefit from subsequent study of the tested material.

9:00–9:15 (8)

Why Does Testing Promote Memory? The Mediator Effectiveness Hypothesis. MARY A. PYC & KATHERINE A. RAWSON, *Kent State University* (read by Katherine A. Rawson)—The benefits of practice tests for memory are well documented, but the mechanisms underlying testing effects are not well understood. We propose the mediator effectiveness hypothesis, stating that more effective mediators are generated during encoding with test–restudy versus restudy practice. Effective

mediators must be memorable (i.e., retrieved at time of test) and must be decoded (i.e., elicit the target response). The present experiment evaluated these two components of mediator effectiveness for learning paired associates using a keyword-encoding strategy, with practice involving either test–restudy or restudy only. On the final test trials, participants were shown the cue word only, the cue along with their own mediator from practice, or the cue along with a prompt to recall their own mediator prior to recalling the target. Supporting claims from the hypothesis, mediators generated during encoding were more effective (i.e., more likely to be retrieved and decoded) with test–restudy than with restudy practice.

9:20–9:35 (9)
The "Pure" Learning Curve: Learning Without Testing. HENRY L. ROEDIGER III & MEGAN A. SMITH, *Washington University*—Learning curves derived from repeated study/test trials have been examined for 125 years. The usual assumption is that learning occurs during a study phase and is expressed in a test phase. However, experiments asking about the relative contributions of study and test trials in the development of learning have shown surprisingly little difference; test trials substitute for study trials over wide ranges, so there is no difference in learning rates, although test trials produce much better long-term retention (e.g., Karpicke & Roediger, 2007). The conclusion would seem to be that test trials do not affect rates of learning. We designed a procedure for asking about development of learning via study trials in the absence of testing. Contrary to prior evidence, test trials do play an important role in the development of learning in both free recall and paired-associate learning. The role of tests must be included in theories of learning.

Letters and Word Processing
Mississippi, Friday Morning, 8:00–9:35

Chaired by Laurie Beth Feldman, University at Albany

8:00–8:15 (10)
Must Analysis of Meaning Follow Analysis of Form? LAURIE BETH FELDMAN, *University at Albany and Haskins Laboratories*, FERMÍN MOSCOSO DEL PRADO MARTÍN, *CNRS, Lyon, and Rhône-Alpes Institute for Complex Systems Research*, & PATRICK A. O'CONNOR, *University at Albany*—Many models of word recognition assume that processing proceeds sequentially from analysis of form to analysis of meaning. In the context of morphological processing, some interpret the apparent absence of differences in target (RAT) recognition latencies in prime contexts that are similar in form and semantically similar (*ratty–*RAT) and similar in form and semantically dissimilar (*ratify–*RAT) as consistent with this claim. We examine conditions under which semantic similarity between morphologically related pairs influences recognition in the forward-masked priming variant of the lexical decision paradigm. Across a range of conditions, latencies were significantly faster after semantically similar than after dissimilar primes. In addition, both exhaustively parsable (*waged–*WAG) and nonparsable (*wagon–*WAG) phonologically dissimilar pairs did not facilitate. The results limit the scope of form-then-semantics models of recognition and demonstrate that semantic context influences even the very early stages of recognition.

8:20–8:35 (11)
Eye Movements and Word Skipping During Reading: Effects of Word Length and Predictability. DENIS DRIEGHE, *University of Southampton*, TIMOTHY J. SLATTERY, *University of California, San Diego*, SIMON P. LIVERSEDGE, *University of Southampton*, & KEITH RAYNER, *University of California, San Diego*—The extent to which target words were predictable from prior context was varied: Half of the target words were predictable, and the other half were unpredictable. In addition, the length of the target word varied: The target words were short (4–6 letters), medium (7–9 letters), or long (10–12 letters). Length and predictability both yielded strong effects on the probability of skipping the target words and on the amount of time readers fixated the target words (when they were not skipped). However, there was no interaction in any of the measures examined for either skipping or fixation time. The results demonstrate that word predictability (due to contextual

constraint) and word length have strong and independent influences on word skipping and fixation durations. Furthermore, since the long words extended beyond the word identification span, the data indicate that skipping can occur on the basis of partial information in relation to word identity.

8:40–8:55 (12)
Are Shallow Orthographies Easier to Learn? The Ortholinguistic Equilibrium Hypothesis. MARK S. SEIDENBERG, *University of Wisconsin, Madison*—There is now an extensive literature on learning to read different writing systems representing different spoken languages. Many studies suggest that it is easier to learn to read shallow alphabetic writing system (Welsh, Finnish, Spanish, Albanian, and others) than English, which is deep. However, most studies have equated "reading" with "reading aloud" (decoding). Whereas existing studies establish that it is easier to learn to read aloud in shallower orthographies, it is less clear whether this advantage carries over to reading with comprehension. I propose an ortholinguistic equilibrium hypothesis concerning relationships between properties of spoken languages and writing systems. Trade-offs between the two tend to minimize differences in ease of learning to read. The relative depth of written English represents an obstacle in learning to read; however, whether shallow orthographies are easier to learn depends on additional factors.

9:00–9:15 (13)
Bias in Number Line Estimation. DALE J. COHEN & DARYN R. BLANC-GOLDHAMMER, *University of North Carolina, Wilmington*—In a number line task, participants are generally presented a number line bounded on both ends and are asked to place a tick mark on the number line in the position that is symbolized by a target number. The participants' errors are taken as an indication of their numerical bias. Young children tend to have a logarithmic error pattern, whereas older children and adults tend to have a relatively errorless (linear) pattern. The traditional interpretation is that people are born with a logarithmic representation of quantity and that experience with integers results in a more linear representation. Here, we present two experiments that demonstrate that adults have a biased estimation pattern in the bounded number line task. The adults' numerical bias is masked by a response strategy that incorporates the use of reference points. We present a new number line task that eliminates the use of a reference point strategy.

9:20–9:35 (14)
Word Structure Determines Letter Transposition Effects: Evidence From Eye Movements. HADAS VELAN, AVITAL DEUTSCH, & RAM FROST, *Hebrew University of Jerusalem* (read by Avital Deutsch)—Previous studies in Hebrew revealed marked differences between orthographic processing of morphologically complex words with the classical root-based structures and simple words from which no root can be extracted, resembling base words in Indo-European languages. In the present study, we recorded readers' eye movements during sentence reading, and contrasted the effects of letter transpositions for complex and morphologically simple words. We found a much higher cost of letter transpositions in reading time for root-derived words than for morphologically simple words. Moreover, the impact of interference was modulated by the lexical status of the transposed root letters—whether or not they produced another root. Online tracking of fixation duration allowed a more precise delineation of the root's role in processing the printed words. Since Hebrew has an alphabetic orthography, like English, French, or Spanish, the results suggest that morphological structure determines the nature of orthographic coding.

Cognitive Control
Meramec, Friday Morning, 8:00–9:35

Chaired by Robert L. West, Iowa State University

8:00–8:15 (15)
Temporal Dynamics of the ACC and Lateral Frontal Activity in Cognitive Control. ROBERT L. WEST, KIRA M. BAILEY, & BRANDY N. JOHNSON, *Iowa State University*—Interaction between the anterior

cingulate cortex (ACC) and the lateral prefrontal cortex (LPFC) is known to be important for the effective tuning of cognitive control over time. Considerable evidence demonstrates that ACC activity related to conflict detection is transient in nature. Less is known about the time course of LPFC activity. Here, we examine the time course of neural recruitment related to cognitive control in three tasks (counting Stroop, blackjack, first-person shooter video game) using ERPs. In the Stroop and blackjack tasks, the behavioral data provided evidence for context updating across trials. In all three tasks, conflict detection was associated with transient medial frontal activity likely involving the ACC. In contrast, sustained activity related to conflict processing was observed over the lateral frontal regions in all three tasks. These findings indicate that tuning goal representations supported by the LPFC involves sustained neural recruitment lasting 1 sec or more.

8:20–8:35 (16)
Individual Differences in Susceptibility to Inattentional Blindness. JANELLE K. SEEGMILLER, JASON M. WATSON, & DAVID L. STRAYER, *University of Utah* (read by David L. Strayer)—Inattentional blindness (IB) refers to the finding that people do not always see what appears to be in their gaze. Although IB affects large percentages of people, it is unclear why there are individual differences in susceptibility. The present study addressed whether individual differences in attentional control modulate susceptibility to IB. Using an operation span task, participants were sorted into low, medium, and high levels of attentional control. Participants watched a classic IB video (Simons & Chabris, 1999) and were instructed to count passes among basketball players, wherein 42% failed to notice the unexpected: a person wearing a gorilla suit. When participants were on-task with their pass counts, susceptibility to IB decreased dramatically across the low, medium, and high groups (64%, 48%, and 35%, respectively). These results suggest that variability in attentional control is a potential mechanism underlying the apparent modulation of IB across individuals.

8:40–8:55 (17)
The Relationship Between Creativity, Mood, and Dopamine: More Complex Than It Seems. SOGHRA AKBARI CHERMAHINI & BERNHARD HOMMEL, *Leiden Institute for Brain and Cognition* (read by Bernhard Hommel)—Human creativity is assumed to vary with mood and to rely on the neurotransmitter dopamine, but evidence is still sparse and contradictory. Our findings suggest that this is because (1) all creativity tasks are not the same and (2) creativity, mood, and dopamine relate to each other in nonlinear ways. In particular, we found that performance in divergent and convergent thinking is predicted by the individual spontaneous eye blink rate (EBR), a clinical marker of dopaminergic functioning. However, whereas the relationship between divergent thinking and the EBR is independent of intelligence and follows an inverted U-shape function, convergent thinking is positively correlated with intelligence but negatively correlated with the EBR; that is, higher dopamine levels seem to impair convergent thinking. Moreover, engaging in divergent and convergent thinking systematically changes mood and executive control efficiency, and it does so in opposite ways, suggesting that individual base levels of dopamine can be adapted to the task.

9:00–9:15 (18)
Context-Specific Proportion Congruence Effects: What Makes an Effective Contextual Cue? JULIE M. BUGG, ERICA DAYAN, & JACQUELINE GREB, *Washington University*—Interference (e.g., Stroop, flanker) is attenuated for stimuli that appear in mostly incongruent, as compared with mostly congruent, locations (context-specific proportion congruence [PC] effect). Whereas location cues are readily adopted as signals for modulating cognitive control, identity-based cues (e.g., color, shape) are not. First, we replicate this pattern in a flanker task, showing a location-specific PC effect and the absence of a color-specific PC effect. Then we examine two hypotheses to explain this asymmetry. Consistent with the relevance hypothesis (Crump, Vaquero, & Milliken, 2008), a color-specific PC effect is observed when participants' attention is directed to the task-irrelevant color. Consistent with the novel head-start hypothesis, the effect is also observed when the color is briefly presented prior to stimulus onset. These findings suggest that, unlike

location, color may typically not be attended or processed sufficiently rapidly in the flanker task, thereby limiting its effectiveness as a contextual cue for control.

9:20–9:35 (19)
Hierarchical Error Detection Produces Cognitive Illusions of Authorship in Skilled Typing. GORDON D. LOGAN & MATTHEW J. C. CRUMP, *Vanderbilt University*—Studies of error detection in human performance typically focus on simple tasks and propose single-process theories of detection. We examined error detection in skilled typewriting and found cognitive illusions of authorship that provide evidence for two hierarchically nested error detection processes. We corrected errors typists made and inserted errors into their correct responses. Typists' explicit error reports counted the errors we corrected as correct responses and the errors we inserted as actual errors, claiming authorship for the appearance of the screen. Implicit error detection, evident as slower typing after errors, counted corrected errors as errors and inserted errors as correct responses. This dissociation between explicit and implicit error detection supports a hierarchical error detection theory, with an outer loop that is sensitive to the appearance of the screen and an inner loop that is sensitive to keystrokes.

Visual Search
Chouteau, Friday Morning, 8:00–9:55

Chaired by Charles L. Folk, Villanova University

8:00–8:15 (20)
How Singular Is Singleton Detection Mode? CHARLES L. FOLK, *Villanova University*, & BRANDON ASHINOFF & HOWARD E. EGETH, *Johns Hopkins University*—It has been argued that when the target of search is a salient item in an array of nontargets, observers can adopt the singleton detection mode, in which any featural discontinuity in the display will capture attention, or the feature search mode, in which only discontinuities matching the particular feature of the target capture attention (e.g., Bacon & Egeth, 1994). Using both spatial-cuing and RSVP experiments, we provide evidence for a new, intermediate level of attentional control consisting of a set for singletons of a particular feature dimension or class. Observers searched for targets defined by either one of two colors (i.e., red or green). Evidence of attentional capture was observed for distractors that were red, green, or blue (a nontarget color). However, motion distractors produced no evidence of capture, suggesting an attentional set operating at the level of dimension (color vs. motion) or class (static vs. dynamic).

8:20–8:35 (21)
Identifying and Reducing Satisfaction-of-Search Errors: How to Alleviate Dual-Target Search Costs. STEPHEN R. MITROFF, KAIT CLARK, & MATTHEW S. CAIN, *Duke University*—Some occupations (e.g., airport luggage screeners, military personnel, radiologists) require highly accurate visual searches. To maximize performance, it is important to identify factors that decrease accuracy and then identify means to alleviate their detrimental effects. One negative factor on search accuracy is satisfaction of search (SOS)—when the successful detection of a search target reduces the detectability of a second target present in the same array. Our prior work (Fleck, Samei, & Mitroff, 2010) suggests that SOS arises when searchers have an expectation about the likelihood of a given target type being present and when they are under pressure to perform quickly. We introduce new evidence that SOS errors are eliminated when ambiguity between potential targets and distractors is removed and are modulated by expectations about target prevalence. We provide a clearer picture of the pressures that engender SOS by examining those factors that both provoke and alleviate the effect.

8:40–8:55 (22)
The Importance of Target–Distractor Relationships in Guiding Attention and Eye Movements. STEFANIE I. BECKER, *University of Queensland*, CHARLES L. FOLK, *Villanova University*, & ROGER W. REMINGTON, *University of Queensland*—What factors guide visual attention? Traditionally, theories posit that attention is guided by activity

in separate visual feature maps. Recent visual search studies support, instead, a relational account in which attention and eye movements are guided by information about target–distractor relationships (e.g., redder, larger; Becker, 2010, Becker, Folk, & Remington, in press). In the relational theory, features are represented in a continuous feature space (instead of, e.g., separate feature maps), and target–distractor relationships are described by the direction of vectors pointing from the target to the distractor features. If this view is correct, observers would be tuning attention to a direction in feature space, rather than to a specific feature or feature category. Here, we present new evidence in support of this view, arguing that relational search can explain a multitude of findings that were previously attributed to a categorical or a saliency-based search mechanism.

9:00–9:15 (23)

Covert Recognition of Distractors Under High Perceptual Load. JOSHUA D. COSMAN & SHAUN P. VECERA, *University of Iowa* (read by Shaun P. Vecera)—When attentional resources are exhausted, salient distractors receive little attention and do not produce a flanker effect. However, the flanker effect—typically used to assay the effects of perceptual load—requires an arbitrary stimulus–response (S–R) mapping. We looked for evidence of distractor recognition by using more sensitive measures that do not require arbitrary S–R mappings. We found that directional arrows produced a Simon effect while participants searched high-load displays for a target letter, indicating that the arrows had been recognized. In another set of experiments, we found that merely changing the identity of the distractor letter affected the time to search through high-load displays. These findings indicate that distracting information can be processed to a high level (recognition) under high perceptual load.

9:20–9:35 (24)

Does Visual Marking Leave a Lasting Trace? CARRICK C. WILLIAMS, *Mississippi State University*—Visual marking—top-down inhibition prioritizing new objects—has primarily been examined using simple features and homogeneous distractor sets. In the present study, participants searched real-world objects for conjunction targets (e.g., red apple) among category distractors (e.g., green and yellow apples), color distractors (e.g., red bicycle), and unrelated distractors (e.g., yellow boots). For some trials, category distractors were previewed for 2 sec before the remaining objects were added. For other trials, the unfilled 2-sec delay was followed by a conjunction search or a "feature" search (color and unrelated distractors). An unannounced memory test for the objects followed. Even though previewed objects differed in shape and color, participants were able to successfully ignore them during search. However, ignoring these objects did not create a long-lasting negative effect on previewed objects' memories. These results indicate that visual marking is not tied to the individual object's representation but, rather, to its location.

9:40–9:55 (25)

Neurally Constrained Multiple-Accumulator Model of Perceptual Decision Making. THOMAS J. PALMERI, BRADEN A. PURCELL, RICHARD P. HEITZ, JEFFREY D. SCHALL, & GORDON D. LOGAN, *Vanderbilt University*—We recently showed that a stochastic accumulator model of perceptual decision making, with drift rates defined by firing rates of visually selective neurons in the frontal eye field (FEF), can account for saccade response time distributions and dynamics of FEF movement neurons (Purcell et al., in press, *Psychological Review*). We extend this framework with multiple accumulators to account for performance during a saccade visual search task with different numbers of distractors. Models that assumed competition between the visual inputs (feedforward inhibition) or between the accumulators (lateral inhibition) provided an excellent account of observed response time distributions. These competitive models also account for the error response time distributions when neurophysiological recordings of visual neurons from error trials are used. These results further extend accumulator models of perceptual decision making to multiple alternatives, demonstrate how presaccadic movement neurons in FEF instantiate stochastic accumulation, and establish a foundation for bridging computational models and neurophysiological data.

Memory Processing
Lewis and Clark, Friday Morning, 8:00–9:55

Chaired by Caren M. Rotello, University of Massachusetts, Amherst

8:00–8:15 (26)

Binary and Rating ROCs in Perception, Reasoning, and Memory Are Curved. CHAD DUBE & CAREN M. ROTELLO, *University of Massachusetts, Amherst* (read by Caren M. Rotello)—Broder and Schutz (2009) published a meta-analysis of 59 receiver-operating characteristic (ROC) studies of recognition memory. They concluded that ROCs obtained from independent (binary response) bias conditions were linear, consistent with threshold models and multinomial processing tree models. In contrast, most research in memory relies on confidence-rating-based ROCs, which are unanimously curvilinear, asymmetric, and consistent with Gaussian underlying distributions as assumed by signal detection theory. We will demonstrate the weaknesses in Broder and Schutz's meta-analysis, review the literature on ROCs generated with these two methods in three domains (perception, recognition memory, and reasoning), and report new data. In all cases, we reach the same conclusion: Both methods yield curvilinear ROCs that are inconsistent with the assumptions of threshold models in general and multinomial processing tree models in particular.

8:20–8:35 (27)

Method Matters: Systematic Effects of Testing Procedure on Visual Working Memory Sensitivity. TAL MAKOVSKI, LEAH M. WATSON, WILMA KOUTSTAAL, & YUHONG V. JIANG, *University of Minnesota*—Visual working memory (WM) is traditionally considered a robust form of visual representation. Here, however, we show that memory sensitivity is dramatically influenced by small variations in the testing procedure. Participants were shown an array of colors to remember. After a short retention interval, memory was tested with either a same–different task or a two-alternative forced choice (2AFC) task. Memory sensitivity was much lower in the 2AFC task than in the same–different task. This difference was found regardless of encoding similarity or whether visual WM required a fine memory resolution or a coarse resolution. The 2AFC disadvantage was reduced when participants were informed shortly before testing which item would be probed. It diminished in perceptual tasks and was not found in tasks probing visual long-term memory. These results support memory models that acknowledge the labile nature of visual WM and have implications for the format of visual WM and its assessment.

8:40–8:55 (28)

Generation, Transfer-Appropriate Processing, and Part-Set Cuing. DANIEL R. KIMBALL & WILLIAM J. MUNTEAN, *University of Oklahoma*—Presenting a subset of studied items as test cues often leads paradoxically to impaired retrieval of other items. Such impairment can persist after removal of the part-set cues, even when testing with item-specific probes—a finding attributed to item-specific suppression. However, such persistence abates with an increase in interitem relational processing at encoding—a finding attributed to reestablishment of a retrieval strategy after its disruption by part-set cues. The present experiments tested this dual-process account. We manipulated use of generation versus reading of items at encoding and use of free recall versus item-specific probes at testing, to vary the relative transfer-appropriate advantages of item-specific, interitem, and cue–target processing at encoding. The dual-process account predicts that part-set cuing effects—and their persistence following cue removal—should reflect use of interitem relational processing at encoding and item-specific probes at testing. We discuss the extent to which these predictions were supported.

9:00–9:15 (29)

Training Executive Control Functions Improves Garden Path Recovery. SUSAN TEUBNER-RHODES, ERIKA HUSSEY, J. ISAIAH HARBISON, MICHAEL R. DOUGHERTY, MICHAEL F. BUNTING, & JARED M. NOVICK, *University of Maryland, College Park* (read by Jared M. Novick)—Recent research has demonstrated the importance of general executive functions (EFs) in syntactic ambiguity

resolution—namely, when readers/listeners must adjust sentence interpretations when new evidence conflicts with initial processing commitments. We explore whether enhancing EF through training on performance-adaptive, nonsyntactic EF tasks improves garden path recovery. A 20-h, 5-week regimen was designed to boost EF, in view of other findings revealing that such training benefits EF performance on untrained tasks. Forty-six adults were assigned to training or no-contact control groups and completed several pre-/posttraining assessments, including reading garden path sentences ("While Anna dressed the baby cried loudly"). Comprehension questions forcing reanalysis were presented ("Did Anna dress herself"); incorrect "no" responses gauged persistent effects of misinterpretation. Pretraining assessments revealed 30% comprehension errors and no group differences. After training, trainees' accuracy improved reliably, whereas controls' did not. Individual training gains on other EF tasks also predicted degree of garden path recovery improvement. We ascribe better sentence reinterpretation abilities to domain-general benefits of EF training.

9:20–9:35 (30)
Similar Principles Govern Recall From Episodic and Semantic Memory: Evidence From Presidents and Prime Ministers. IAN NEATH, *Memorial University of Newfoundland*, JEAN SAINT-AUBIN, *University of Moncton*, & AIMÉE M. SURPRENANT, *Memorial University of Newfoundland*—Serial position functions exhibiting primacy and recency effects are ubiquitous in episodic memory tasks. Such functions are less commonly reported in semantic memory tasks, but they have been observed when the presidents of the U.S. (Roediger & Crowder, 1976) and the verses of hymns (Maylor, 2002) have been recalled. We report another example: A serial position function is observed when Canadian students recall Canadian prime ministers. A local distinctiveness model of memory, SIMPLE, was successfully fit to the prime ministerial data. The key dimension corresponded to item distinctiveness, and the pages returned by a search on Google was used as a proxy measure for knowledge of each prime minister. According to SIMPLE, primacy and recency effects in semantic memory are due to the same mechanisms that give rise to primacy and recency effects in both short- and long-term episodic memory: All reflect the relative distinctiveness principle (Surprenant & Neath, 2009).

9:40–9:55 (31)
Tip-of-the-Tongue States: A Role for Cortisol Response But Not Laboratory Stressor Tasks. LORI E. JAMES, *University of Colorado, Colorado Springs*, MICHELLE A. HENDRICKS, *Saint Louis University*, ASHLEY GUNN, *University of Colorado, Colorado Springs*, & CHRIS SCHMANK & TONY W. BUCHANAN, *Saint Louis University*—We tested whether stress has an impact on the frequency of tip-of-the-tongue (TOT) incidence for proper names. In Study 1, young and older adult participants named photographs of celebrities and uncommon objects, indicating any TOTs. Participants were in either a low-anxiety condition or a high-anxiety condition (involving a third-party observer ostensibly present to evaluate their performance). The anxiety manipulation did not impact TOTs or self-ratings of anxiety for either age group. In Study 2, young adults named celebrity photographs after completing a standard laboratory stressor and also on a "nonstress" day (another manipulation that did not affect TOT rate). However, saliva samples measuring cortisol indicated that the stressor elicited a cortisol response in a subset of participants and that these "responders" reported more TOTs overall than did nonresponders.

SYMPOSIUM I
Practical Benefits of Bayesian Data Analysis
Illinois, Friday Morning, 9:45–11:55

Chaired by John K. Kruschke, Indiana University, Bloomington

9:45–10:00 (32)
Introduction. JOHN K. KRUSCHKE, *Indiana University, Bloomington*—(Please note: Symposium attendees may also be interested in the optional Bayesian tutorial on Thursday November 18 at the conference of the Society for Computers in Psychology.)

10:05–10:20 (33)
Practical Advantages and Applications of Bayesian Hypothesis Tests in Experimental Psychology. ERIC-JAN WAGENMAKERS, *University of Amsterdam*—Experimental psychologists can profit greatly from the adoption of Bayesian hypothesis tests. Through a series of practical examples, I illustrate how Bayesian hypothesis tests allow researchers to quantify evidence in favor of the null hypothesis; how they allow researchers to monitor the evidence as the data accumulate and stop whenever they feel so inclined; how they put a premium on parsimony, such that a high-N study will not automatically lead to a "significant" result; and, finally, how they relate to concepts that are intuitive and relevant. Throughout this presentation, I emphasize the recent software developments that make Bayesian hypothesis testing feasible, easy, and fun.

10:25–10:40 (34)
Examples of Using Flexible Psychological Models in the Bayesian Analysis of Data. MICHAEL D. LEE, *University of California, Irvine* (sponsored by John K. Kruschke)—Bayesian methods allow for a more flexible and mature approach to analyzing data than do traditional methods. The flexibility comes because it is straightforward in a Bayesian setting to make realistic assumptions about the complexities of experimental data, including pervasive issues like individual differences. The maturity comes because generic descriptive statistical models can easily be replaced by domain-specific models of psychological processes, with meaningful psychological parameters replacing default statistical ones. We give two case studies that make these general points, coming from the memory retention and category-learning literatures. The memory retention example focuses on the form of the forgetting curve. The category-learning example focuses on the role of selective attention in learning. In both cases, a Bayesian analysis reveals more information in the data than the traditional analysis can manage and allows for stronger and more general claims to be drawn.

10:45–11:00 (35)
A Hierarchical Bayesian Dual-Process Model Reveals That Recognition Memory May Be Mediated by a Single Process. JEFFREY N. ROUDER & MICHAEL S. PRATTE, *University of Missouri, Columbia*—The dual-process signal detection (DPSD) model of Yonelinas has proved pivotal in assessing processes underlying recognition memory. In conventional analysis, data are averaged over people or items to form hit and false alarm rates. We show how this averaging may distort parameter estimates and threaten prior conclusions of separate recollection and familiarity processes. We develop a Bayesian hierarchical DPSD model that posits variation in multiple processes across conditions, individuals, and items. This model yields simultaneous estimates of recollection and familiarity effects across conditions, people, and items. Analysis across a number of confidence-rating recognition memory tasks reveals no strong evidence for separate processes. Recollection and familiarity estimates covary strongly across conditions, people, and items, indicating that much of the variation in confidence-rating recognition memory can be accounted for by a single mnemonic process.

11:05–11:20 (36)
A Hierarchical Bayesian Framework for Series of Response Times. PETER F. CRAIGMILE, MARIO PERUGGIA, & TRISHA VAN ZANDT, *Ohio State University* (read by Trisha Van Zandt) (sponsored by John K. Kruschke)—Response time (RT) data arise from reactions to a succession of stimuli under varying experimental conditions over time. Because of the sequential nature of the experiments, there are trends (due to learning, fatigue, fluctuations in attentional state, etc.) and serial dependencies in the data. The data also exhibit extreme observations that can be attributed to lapses, intrusions from outside the experiment, and errors occurring during the experiment. Any adequate analysis should account for these features and quantify them accurately. We demonstrate how simple Bayesian hierarchical models can be built for several RT sequences, differentiating between subject-specific and condition-specific effects.

11:25–11:40 (37)
Multiple Comparisons and Power Make Sense in Bayesian Analysis. JOHN K. KRUSCHKE, *Indiana University, Bloomington*—In

experiments with multiple conditions, Bayesian methods encourage thorough data analysis and discovery, including numerous multiple comparisons, because Bayesian analysis provides rational estimates of individual and group parameters without being affected by which comparisons the analyst might intend to conduct. Bayesian analysis produces a complete distribution of credible combinations of parameter values. From this distribution, simulated data reveal the probability of achieving any research goal. Bayesian analysis thereby provides straightforward estimates of statistical power and replication probability, even for the complex experimental designs and goals of real research. These points are illustrated with actual analyses of choice and response time data from experiments in human learning.

Vision
Missouri, Friday Morning, 10:00–11:55

Chaired by Thomas A. Busey, Indiana University, Bloomington

10:00–10:15 (38)
The Nature of Expertise in Fingerprint Examiners As Revealed by Eyetracking. THOMAS A. BUSEY & CHEN YU, *Indiana University, Bloomington*—Latent print examinations can be difficult visual comparisons because they are often performed on very degraded and partial fingerprints. Visual detail that is useful for individualization or exclusion can take the form of minutiae, ridge flow, or, potentially, clusters of other features that have yet to be documented. We approach this problem by collecting eye gaze data from latent print examiners and novices to determine those features that capture fixations. Under time-limited viewing conditions, experts show more consistency than do novices in terms of the locations they visit. In addition, their eyes move toward matching locations more quickly and more accurately. The image content (pixels) of fixated regions can also be analyzed to determine the characteristics of the ridge detail that attracts the gaze of experts, and we discuss various machine-learning approaches that separate experts from novices.

10:20–10:35 (39)
Individual Differences in Color Preference: An Ecological Account. STEPHEN E. PALMER & KAREN B. SCHLOSS, *University of California, Berkeley*—Palmer and Schloss (2010) reported that 80% of the variance in average color preferences for 32 colors was explained by an ecological measure of how much people like the objects that are characteristically those colors: the average weighted affective valence estimates (WAVEs). When individual participants' data are analyzed, personal-WAVEs (P-WAVEs) account for significantly more variance than do average WAVEs of the entire group. Linear regression of individual participants' preferences show that more than 30% of the variance in 932 data points is explained (with zero free parameters) by P-WAVEs alone and that more than 60% of the variance can be explained by adding color appearance variables (redness–greenness, blueness–yellowness, lightness, and saturation) to P-WAVE predictions. Moreover, when individuals are clustered into subgroups according to color preferences, a subgroup's average P-WAVEs predict its own average color preferences better than do the average P-WAVEs of other subgroups. Thus, ecological variables account for IDs in color preference.

10:40–10:55 (40)
Color Preferences in Japanese–American Bicultural Observers. KAZUHIKO YOKOSAWA, *University of Tokyo*, & KAREN B. SCHLOSS, ROSA M. POGGESI, & STEPHEN E. PALMER, *University of California, Berkeley*—Previous research has shown that Japanese observers like light colors and dislike dark colors relatively more than Americans do (Fushikida et al., 2009). Here, we tested color preferences of bicultural participants: U.S. students who can read and speak Japanese. We found their preferences to be intermediate between American and Japanese preferences. We then divided these participants into a "more-Japanese" subgroup of participants who had spent more than 8 years in Japan and were more fluent in Japanese than in English and a "less-Japanese" subgroup of participants who had spent fewer than 8 years in Japan and were more fluent in English than in Japanese. Surprisingly, the color preferences of the more-Japanese group were more highly correlated with

American than with Japanese preferences, and those of the less-Japanese group were more highly correlated with Japanese than with American preferences. Possible explanations of these effects will be discussed in terms of early experience, recent experience, and/or cultural influences.

11:00–11:15 (41)
Time Course of Active Affective Priming Differs From Affective Priming. DEAN G. PURCELL, *Oakland University*, & ALAN L. STEWART, *Stevens Institute of Technology*—Faces conveying either anger or happiness were primed by congruent or incongruent face or word primes. Observers performed a conventional affective priming task or an active affective priming (AAP) task. AAP observers, rather than reporting the affect of the target, determine whether the prime and target are congruent. The AAP task does not produce affective priming. Rather, a happy superiority (HS) effect occurs, where happy primes produce faster responding than do angry primes. Previous experiments used stimulus onset asynchronies (SOAs) of 305–320 msec. The present experiments extend the range of conditions under which the HS effect can be found by testing values of SOA that are outside the range of conventional affective priming. The AAP at SOA values of 1,500 and 2,250 msec was similar to that found at the 305- to 320-msec SOAs. There was no evidence of simple affective priming at a 1,500-msec SOA.

11:20–11:35 (42)
Magno and Parvo Contributions to Masked and Unmasked Sensorimotor Priming. BRUNO G. BREITMEYER & EVELINA TAPIA, *University of Houston*—Parvo channels have been implicated in sensorimotor priming. The extent, if any, of magno channel contribution to such priming has not been investigated. Two separate theoretical approaches—one based on the putative role of the cortical magno-dominated, dorsal visual stream in vision for action, the other based on its role in establishing an rapid but coarse representation of possible objects in the orbitofrontal area of the prefrontal cortex—indicate that magno channels should be involved. Our results support the involvement of both magno and parvo channels, with magno channels making the sole/major contribution when primes are visible/unmasked and a combination of magno and parvo channels contributing when primes are invisible/masked. We present a model based on feedforward and reentrant activation in the ventral object-processing stream to account for our results and to guide future research on conscious and nonconscious visual processing.

11:40–11:55 (43)
When the Measure Is Valid, Holistic Processing Predicts Face Expertise. ISABEL GAUTHIER, JENNIFER J. RICHLER, & OLIVIA S. CHEUNG, *Vanderbilt University*—Recent work questions the assumption that holistic processing (HP) is related to performance in face perception (Konar et al., 2010), forcing us to question the central place of HP in the study of face (and object) expertise. However, this finding and those in the broader literature on HP are constrained by important measurement issues, since two different indexes of HP in the composite paradigm lead to incompatible results. We replicated our recent finding that one common index of HP (partial design; alignment effect) is influenced by spurious response biases and showed that this measure does not predict individual differences in face perception or memory. In contrast, with a measure independent of response biases (complete design; congruency × alignment interaction), HP predicts face expertise. Despite appearances of inconsistencies, provided a valid measure of HP, the literature converges to show that expertise both for faces and for nonface objects is associated with greater HP.

Psycholinguistics
Mississippi, Friday Morning, 10:00–11:55

Chaired by Patrizia Tabossi, University of Trieste

10:00–10:15 (44)
Processing Idiomatic Expressions in the Passive Form. PATRIZIA TABOSSI, *University of Trieste*, EVELYN C. FERSTL, *University of Sussex*, & GUIDO BARCHIESI, *University of Trento*—In syntactic

variant forms, idioms often lose their figurative meaning and are interpreted literally (e.g., *The bucket was kicked by John*). But what does it mean that an idiom loses its figurative interpretation? What are the underlying processes? An eyetracking experiment showed that idiomatic sentences are read faster than literal controls, both in the active and in the passive forms. Using the cross-modal paradigm, Experiments 2 and 3 showed that the figurative meaning of an idiom, whether in the active or the passive form, is active at its offset. However, 750 msec later, in the passive form, it is no longer active. The findings suggest that when the passive form of an idiom is interpreted literally, this is the result of a two-step process. Initially, the construction of the literal meaning of the string goes in parallel with the activation of the figurative meaning. Subsequently, the literal interpretation is selected.

10:20–10:35 (45)
Comprehending Sentences About Quantity Affects Responses on the Up/Down Axis. ANDREA J. SELL & MICHAEL P. KASCHAK, *Florida State University* (read by Michael P. Kaschak)—We investigate the use of space in comprehension of quantity in text. Previous work suggests that the left–right axis is useful in spatial representations of number and quantity, whereas linguistic evidence points toward the use of the up–down axis. In Experiment 1, participants read sentences containing quantity information and pressed a button in either an up position or a down position. In Experiment 2, participants read the same sentences but pressed a button in either the right position or the left position. We found spatial-compatibility effects on the up–down axis, but not on the left–right axis. Additionally, the spatial compatibility effect was observed whether the participants moved to make their responses or not. We discuss the results in the context of approaches to the comprehension of quantity information.

10:40–10:55 (46)
Comprehending the Impossible: Is There a Role for Selectional Restriction Violations? TESSA C. WARREN, *University of Pittsburgh*—Readers' eye movements show earlier and greater disruption to impossible events than to similarly unlikely, but possible, events (Warren & McConnell, 2007). This could result if (1) the comprehension system is specially tuned to impossibility in general or (2) verbs generate coarsely semantically constrained predictions for upcoming arguments (e.g., Boland, 2005) and violations of those semantic constraints are a strong, early-detected mismatch cue to the comprehension system. The present eye movement study attempted to distinguish between these two mechanisms, using a baseline condition, an impossible condition that was impossible because an agent (subject) could not perform an action on a patient (object) (e.g., a hamster lifting a large backpack), and an impossible condition that was impossible because a patient (object) violated the semantic constraints of its verb (e.g., a boy comforting a large backpack). The results support the second mechanism above.

11:00–11:15 (47)
Influence of Instrument Roles and Role Fillers on Reading Times. HONGOAK YUN, GAIL MAUNER, JEAN-PIERRE KOENIG, & DOUGLAS ROLAND, *University at Buffalo* (read by Gail Mauner)—Processing instrument nouns is easiest when both instrument roles and their role fillers are expected. To determine their conjoint influence on reading times, we manipulated instrument role filler predictability and verb type (whether instrument roles are obligatory or optional for a verb; Koenig et al., 2003) in declarative sentences, while equating instrument predictability and plausibility across verb type. Both the effect of role filler predictability and its interaction with verb type were significant in random mixed effect modeling. A crossover interaction revealed faster reading times for highly predictable instruments and slower reading times for unpredictable instruments when an instrument role was obligatory than when it was optional. In short, we find that the influence of role filler predictability is greatest when verbs require an instrument role.

11:20–11:35 (48)
The Emergence of Structure in Iterated Artificial Grammar Learning. HANNAH CORNISH & SIMON KIRBY, *University of Edinburgh*, & MORTEN H. CHRISTIANSEN, *Cornell University* (read by Morten H. Christiansen)—Recent theories of language evolution hypothesize that much of the structure in modern languages may derive from weak cognitive and communicative constraints amplified through cultural transmission. To test this hypothesis, we developed an iterated artificial-grammar-learning study to investigate whether constraints on sequence memory could promote cultural evolution of a language-like structure. Participants received several blocks of exposure to a set of consonant strings, each presented individually. After training, participants were asked to recall all the strings. The output from this recall test then became the input string set for the next learner. This process was repeated 10 times, across multiple "generational" chains. Although the initial string sets were constructed to have a flat distributional structure, the distribution of bigrams in the final string set showed a Zipfian pattern and was easier to learn. Thus, sequence memory constraints, amplified by cultural transmission, can give rise to a distributional structure characteristic of language.

11:40–11:55 (49)
First- and Second-Language Idiom Processing Differentially Involves Direct Retrieval and Decomposition: Evidence From Eye Movements and Linear Mixed Effects Regression (LMER). KYLE LOVSETH & DEBRA A. TITONE, *McGill University* (read by Debra A. Titone)—Idioms are simultaneously amenable to compositional analysis and direct lexical retrieval, yet it is unclear which processes operate during comprehension. Idioms also pose challenges for second-language learners, who may rely more on decomposition than do first-language users, due to reduced second-language experience. Here, first- and second-language users read sentences containing idioms followed by figurative- or literal-biased disambiguating regions. First-language users' gaze durations on idiom-final words decreased as familiarity and decomposability increased; however, only increased familiarity facilitated reading of figurative-biased disambiguating regions. Second-language users' gaze durations on idiom-final words were facilitated by increased familiarity but were slowed by increased decomposability. However, both increased familiarity and decomposability led to facilitated reading of figurative-biased disambiguating regions. Thus, consistent with multidetermined idiom models (Libben & Titone, 2008), first-language idiom interpretations arise more from direct retrieval (indexed by familiarity) than from compositional analysis. Second-language idiom interpretations, however, arise from both.

Metamemory
Meramec, Friday Morning, 10:00–11:55

Chaired by Ayanna K. Thomas, Tufts University

10:00–10:15 (50)
Retrieval Difficulty Improves Metacognition and Reduces Memory Distortion. JOHN B. BULEVICH, *Rhode Island College*, & AYANNA K. THOMAS, *Tufts University* (read by Ayanna K. Thomas)—In a typical misinformation experiment, when subjects retrieve erroneous information, they often do so with high confidence. The goal of the present study was to manipulate retrieval demands in order to improve metacognition in the misinformation paradigm. We hypothesized that increasing retrieval demands would enhance the contextual cues used to assess confidence in memory. The subsequent improvements in confidence would further lead to better discrimination between veridical and suggested memories. Thus, we hypothesized that improvements in metacognition would yield improvements in overall performance. Subjects encoded an original event and were presented with misleading postevent information. In order to examine the retrieval demands hypothesis, we manipulated type of memory test (cued recall vs. recognition), retrieval instructions (speeded vs. elaborate), and response demands (free vs. forced). The results from three experiments suggested that increasing retrieval demands improves the correspondence between confidence ratings and objective memory performance, thereby reducing the misinformation effect.

10:20–10:35 (51)
Illusions of Remembering and Directed Forgetting. NATHANIEL L. FOSTER, LILI SAHAKYAN, & EDWARD J. WISNIEWSKI, *University of North Carolina, Greensboro* (read by Lili Sahakyan)—Directed

forgetting (DF) research has shown that people can make themselves forget recently learned information. Prior work suggests that metacognitive processes may contribute to the magnitude of the DF impairment (Sahakyan, Delaney, & Goodmon, 2008). The present research involved manipulating font size, which was shown to create an illusion of remembering, in light of no objective effects on recall (Rhodes & Castel, 2008). Would information that was mistakenly believed to be more memorable be differentially sensitive to DF? Participants studied large- and small-font words, provided immediate judgments of learning, and were then cued to either remember or forget that word. We also included a baseline group, where each item was followed by a remember cue (Sahakyan & Foster, 2009). This allowed estimating the costs and benefits of item-method DF. The font size manipulation was shown to differentially affect the costs and the benefits, suggesting new insights for the theoretical mechanisms of item-method DF.

10:40–10:55 (52)

Metamemorial Influences on Recognition Memory Response Bias. JUSTIN KANTNER, D. STEPHEN LINDSAY, & PRIYA ROSENBERG, *University of Victoria* (read by D. Stephen Lindsay)—Recognition memory judgments regarding words tend to be unbiased, with false alarm rates roughly equivalent to miss rates (unless proportion old is far from .50 or instructions/incentives encourage a conservative or a liberal bias). We found that, in contrast, when the materials were scans of masterwork paintings, subjects showed a pronounced conservative response bias, with miss rates much higher than false alarm rates (despite .50 proportion old and no biasing instructions/incentives). We assessed the relationship between this materials-based bias shift and subjects' beliefs, after the study phase, as to their ability to recognize paintings versus words. The more subjects expected their memories of the paintings to be superior to their memories of the words, the greater the size of the materials-based bias shift.

11:00–11:15 (53)

What People Believe About How Memory Works: A Nationally Representative Survey. DANIEL J. SIMONS, *University of Illinois, Urbana-Champaign*, & CHRISTOPHER F. CHABRIS, *Union College*—Common misunderstandings about the mechanisms of memory have broad implications: The media approach cases of forgetting and distorted memory with a misguided conception of what should be recalled, juries issue verdicts based on flawed intuitions about the accuracy of testimony, and students misunderstand the role of memory in learning. Although several studies have assessed intuitive beliefs held by undergraduates, juries, lawyers, police, and judges, no studies have directly examined the prevalence of misconceptions about memory in the broader public. We conducted the first nationally representative telephone survey that assessed public agreement with six memory-related statements. Substantial numbers of respondents agreed with propositions that experts believe are dubious at best. Greater education and psychology background predicted greater understanding, but even highly educated respondents demonstrated high levels of misunderstanding. We discuss the implications of our survey for education, the legal system, and the communication of scientific consensus to the media and the public.

11:20–11:35 (54)

Bias and Selection: An SDT Account of the Distinctiveness Heuristic. MICHAEL F. VERDE, *University of Plymouth*—The reduction in false alarms observed with distinctive materials is often attributed to the distinctiveness heuristic, according to which lures are rejected because they lack expected, distinctive qualities. Three experiments manipulated the imagery and encoded strength of word lists. It is argued that their findings (as well as other findings used as evidence for the distinctiveness heuristic) are better explained by a signal detection model with two decision components: Bias determines the amount of retrieved evidence deemed sufficient, and selection determines the weighting of feature dimensions on the basis of their perceived usefulness.

11:40–11:55 (55)

The Jacoby–Whitehouse Illusion Meets the Recall-to-Reject Heuristic. LEONEL GARCIA-MARQUES, *University of Lisbon*, & SERGIO MOREIRA, *Lisbon University Institute*—We investigated whether the recall-to-reject heuristic could reduce the Jacoby and Whitehouse (1989) illusion. In our studies, we made participants learn four nonoverlapping lists of objects (Study 1) or two nonoverlapping and two overlapping lists of objects (Study 2) that belonged to four target persons. At recognition, participants were presented with target–object pairs (targets briefly preceding objects) and were asked to accept old and reject new pairs (pairs with new objects or with mismatching old targets and objects). On half of the test trials, an object was subliminally presented and masked with the target name immediately before the target and object were presented together for test. In Study 1, we replicated the Jacoby–Whitehouse effect for pairs that contained new objects, but not for mismatching pairs. Moreover, the illusion disappeared when participants' performance was speeded. In Study 2, the Jacoby–Whitehouse illusion did not emerge. These results are accountable by a recall-to-reject heuristic framework.

Working Memory
Chouteau, Friday Morning, 10:20–11:55

Chaired by Andrew R. A. Conway, Princeton University

10:20–10:35 (56)

Phonological Similarity Effects in Simple and Complex Memory Span Tasks. ANDREW R. A. CONWAY, BROOKE N. MACNAMARA, & ADAM B. MOORE, *Princeton University*—Two experiments were conducted to test whether phonological similarity facilitation in complex span tasks is caused by sentence context or simply because it serves as an efficient list retrieval cue. In the first experiment, phonological similarity was manipulated in word span and two versions of reading span, in which sentence context was either weak (unrelated sentences) or strong (related sentences). In the second experiment, phonological similarity was again manipulated in two versions of reading span (short and long sentences), but the to-be-remembered words were removed from the sentences, thus eliminating sentence context. The classic phonological similarity decrement was observed in word span. In contrast, phonological similarity facilitation was observed in all reading span conditions across the experiments, supporting the list retrieval cue hypothesis.

10:40–10:55 (57)

Process Estimates of Recollection and Familiarity in Working Memory Span Tasks. DAVID P. McCABE & VANESSA M. LOAIZA, *Colorado State University*—Although complex span tasks (e.g., operation span) are believed to require controlled retrieval from working memory, the role of familiarity in complex span task recall and its influence on the relationship between complex span tasks and fluid intelligence are not well understood. Participants completed two blocks of reasoning span, during which trials of five discrete to-be-remembered digits (0–9) were presented for either 1 or 3 sec, each preceded by a reasoning problem (Does B follow C?: BC). In the inclusion block, participants were instructed to report the five presented digits in serial order. During the exclusion block, however, participants were instructed to report the five digits that were not presented. Estimates of recollection, but not familiarity, differed as a function of presentation rate. Furthermore, recollection was significantly correlated with fluid intelligence, whereas familiarity was not. These results elucidate the functionally distinct roles of recollection and familiarity in complex span tasks.

11:00–11:15 (58)

WMC: Weighing Up Multitasking and Cognition. THOMAS S. REDICK, *Georgia Institute of Technology*, DAVID Z. HAMBRICK, *Michigan State University*, MICHAEL J. KANE, *University of North Carolina, Greensboro*, NASH UNSWORTH, *University of Oregon*, & ZACHARY M. SHIPSTEAD & RANDALL W. ENGLE, *Georgia Institute of Technology* (read by Randall W. Engle)—Research investigating the role of cognitive correlates of multitasking ability has been hampered by the use of specialized multitasks, limited samples, and single-task indicators of cognitive ability predictors. To address this, we administered multiple measures of working memory capacity, attention control,

updating, maintenance, fluid intelligence, and multitasking to a diverse sample of 586 young adults. Hierarchical regression, confirmatory factor analysis, and structural equation modeling revealed several key findings. First, although the cognitive ability measures were all strongly interrelated, specific latent constructs emerged. Second, the ability predictors accounted for substantial variance in fluid intelligence and in multitasking. Third, accounting for the other cognitive predictors attenuated but did not fully mediate the relationship between any one cognitive predictor and the fluid intelligence and multitasking criteria variables. Finally, the magnitude of the relationships among the cognitive abilities and multitasking varied as a function of the complexity and structure of the various multitasks assessed.

11:20–11:35 (59)
Benefits of the Aging Mind: Improved Complex Category Learning. LINNEA KARLSSON & EDWARD T. COKELY, *Max Planck Institute for Human Development* (read by Edward T. Cokely)—We examined the effects of normal aging on category learning, comparing performance and strategy choice on two learning tasks (i.e., category membership was governed by either a one-dimensional or a multidimensional rule). In the task of interest—which required that multiple dimensions be integrated—simpler integration rules enabled more rapid achievement of reasonable levels of performance. Since cognitive aging is associated with a reduction in working memory resources, older adults tended to adopt these simpler decision rules more often, facilitating complex category learning and outperforming younger adults. Given the large body of research on the benefits of simple decision strategies for decision making (e.g., fast and frugal heuristics), if cognitive aging biases older adults toward the use of simpler (yet more robust) decision processes, there may be many cognitive benefits associated with aging that are currently underappreciated.

11:40–11:55 (60)
Cognitive Processes in Complex Planning: The Breakfast Task. FERGUS I. M. CRAIK, *Rotman Research Institute*, & ELLEN BIALYSTOK & LIN LUO, *York University*—Planning involves complex cognitive activities, but the exact nature and combination of component processes in any given task remains difficult to specify. To address this problem, we used a simulated "cooking breakfast" task in which participants had to manage the cooking of five foods so that all the foods were "ready" at the same time, while also performing a table-setting filler task. Thirty middle-aged adults (ages, 30–60 years) completed the breakfast task and a battery of tasks measuring working memory, executive control, and inhibition. Correlational and principal component analyses showed that these cognitive functions contributed to different aspects of performance in the breakfast task. Specifically, working memory and executive control together contributed to the ability to formulate an efficient cooking strategy to ensure that the foods were ready at the same time, whereas inhibition contributed to the ability to stop the filler task and attend to cooking operations at appropriate times.

Cognitive Control II
Lewis and Clark, Friday Morning, 10:20–11:55

Chaired by Thomas T. Hills, University of Basel

10:20–10:35 (61)
Evidence for a Unitary Central Executive Search Process. THOMAS T. HILLS, *University of Basel*—Cognitive control has, at times, been regarded as having either the domain generality of a Turing machine or the domain specificity of a Swiss army knife. Many cognitive models hold similar positions, with an executive process considered to be either a domain-general component of the cognitive system (a central executive) or an emergent property of competing subsystems (an executive committee). Here, I show comparative biological and recent empirical evidence for a componential, domain-general aspect of the central executive. This process handles subgoal persistence in the capacity of search. Consistent with evolutionary origins of goal-directed cognition following from animal foraging in space, shared neural components mediate a trade-off between exploration and exploitation across species. Recent studies also

demonstrate that subgoal persistence can be primed from spatial search to lexical search. This search process can be modeled in existing cognitive architectures by adding a tunable component for abandoning active subgoals.

10:40–10:55 (62)
Effects of Video Game Practice on Executive Control Skills: Evidence From Dual-Task and Task-Switching Tests. TILO STROBACH, *Ludwig Maximilians University Munich*, PETER A. FRENSCH, *Humboldt University Berlin*, & TORSTEN SCHUBERT, *Ludwig Maximilians University Munich* (sponsored by Peter A. Frensch)—Video game practice leads to transfer effects on task situations measuring low-level attentional skills. The present work, however, examines whether video game practice transfers to higher executive control skills associated with optimized coordination of two different tasks. These skills are particularly measured in dual-task and task-switching situations with two different tasks performed simultaneously and sequentially, respectively, when compared with performance in single-task conditions with only one task performed. In dual-task and task-switching tests, we found performance advantages in experienced video gamers, as compared with nongamers, in situations including the processing of two different tasks; this advantage was absent in single-task conditions indicating specific transfer effects of video game practice on executive control skills. Similar findings in nongamers after 15 h of demanding video game practice, when compared with nongamers with nondemanding practice, demonstrated the causative relationship between video game practice and optimized executive control.

11:00–11:15 (63)
Automatic Implementation of Task-Defined Rules: Active Maintenance or Memory Retrieval? MOTONORI YAMAGUCHI & ROBERT W. PROCTOR, *Purdue University* (read by Robert W. Proctor)—Although the concept of automaticity is closely associated with extensive training, evidence suggests that task-defined stimulus–response (S–R) mappings can be implemented in parallel (Hommel, 1998) and involuntarily (Eriksen & Eriksen, 1974) without much training, as if their implementation is automatic. These observations may be because task-defined rules are actively maintained in working memory (active maintenance account) or because the task context automatically retrieves prior S–R episodes (memory retrieval account). The present experiment demonstrated that cross-talk between two tasks showed a time course different from that of task-switching cost and occurred even when these tasks were separated into different blocks. Thus, task-defined S–R mappings can be implemented automatically even if they are inhibited or unloaded from working memory. Therefore, automatic S–R translation occurs on the basis of memory retrieval. Active maintenance of S–R mappings is not necessary, although it may still contribute to the cross-talk effect when the uncertainty of task-relevant rules is involved.

11:20–11:35 (64)
Investigating Interactions Between Transient and Sustained Cognitive Control: Differential Conflict Adaptation Patterns for Stroop and Flanker Interference in a Color Response Task. MARK E. FAUST & JOSH D. EBNER, *University of North Carolina, Charlotte*, & KRISTI S. MULTHAUP, *Davidson College*—Conflict adaptation during performance of interference tasks (e.g., Stroop, flanker) refers to the reduction in interference on trials following incongruent trials (e.g., the word RED in blue) versus congruent trials (e.g., the word RED in red). Such effects have been proposed to reflect transient (i.e., trial-by-trial) cognitive control to better handle conflict on a subsequent trial. We used a color patch identification task to allow different types of interference, Stroop (i.e., word overlaps color patch) and flanker (i.e., word flanks color patch). We also manipulated sustained cognitive control processes by varying the proportion of incongruent trials in a block of trials. Consistent with previous work in our labs, we found that interference type and proportion of incongruent trials yielded different patterns of conflict adaptation effects. The results suggest an interaction of systems of sustained and transient cognitive control that is sensitive to type of interference.

11:40–11:55 (65)

Evidence for a Binding Account of Response Repetition Effects. CHRIS HYDOCK & MYEONG-HO SOHN, *George Washington University* (read by Myeong-Ho Sohn)—Although repeating a response typically results in performance benefits, in task-switching studies, this effect is reversed on task switch trials, a pattern of results labeled as *response repetition effects* (RREs). Recent research has suggested that response categories, not motor responses, are the source of the RRE. In Experiment 1, subjects performed two tasks with the same response categories, while utilizing independent motor responses for each. Response repetition costs occurred when the response category were repeated. To investigate the mechanism that drives the RRE, in Experiment 2, subjects either directly produced the response on a categorization task (classification condition) or confirmed/disconfirmed the given response (verification condition). Whereas the classification condition revealed typical RREs, the verification condition yielded an interaction of task transition, response category, and motor response. These results suggest that bindings between responses and task elements, rather than inhibition of the previous responses, may be responsible for the RRE.

Visual Search II
Illinois, Friday Afternoon, 1:30–2:45

Chaired by Sowon Hahn, University of Oklahoma

1:30–1:45 (66)

Top-Down Influence of Action on Visual Search. SOWON HAHN & DANIEL R. BUTTACCIO, *University of Oklahoma*—We investigated whether acting upon a feature would influence a subsequent visual search task. Participants were first presented with a color name or digit, followed by a colored shape. Participants responded toward the shape on the basis of the congruency of the features and conducted a visual search task that contained the previous viewed stimulus among other colored shapes. Our results showed that action has a significant effect on the subsequent visual search task, but only when action was combined with congruency of the features. An RT distribution analysis using the ex-Gaussian model demonstrated that adding an external action toward the prime shifted the entire RT distribution of the visual search task without significant changes in variability. On the basis of the present results, we suggest that acting upon a feature can strengthen the existing representation of a stimulus. The hypothesis of competition among multiple levels of representations is discussed.

1:50–2:05 (67)

Emotional Target Detection Is Moderated by Political Temperament in a Visual Search Task. MARK MILLS, JOHN R. HIBBING, KEVIN B. SMITH, & MICHAEL D. DODD, *University of Nebraska, Lincoln* (read by Michael D. Dodd)—Previous research has demonstrated that individuals are faster to detect angry faces amid neutral distractors, as compared with other facial expressions, indicative of angry expressions preferentially attracting attention. In contrast, others researchers have reported a superiority effect for happy, but not angry, faces. It is possible that these discrepancies may be attributable to individual differences in dispositional threat sensitivity, yet this possibility has not been examined outside of populations with chronic anxiety. The present study examined whether attentional biases to angry and happy faces are moderated by political temperament, given recent research suggesting that conservatives are more attentive to negative stimuli, relative to liberals, whereas liberals are more attentive to positive stimuli, relative to conservatives (Dodd et al., *Abstracts of the Psychonomic Society*, 2009). Consistent with this prediction, target detection of angry and happy faces is moderated by political temperament in both a target detection task (happy vs. angry) and a target-present/absent task.

2:10–2:25 (68)

Fear Factor: Visual Search and Memory for Objects and Words. SERGE V. ONYPER, ALAN SEARLEMAN, CHRISTINA E. LIVINGSTON, & CAITLIN A. SULLIVAN, *St. Lawrence University* (read by Alan Searleman)—Previous research has shown that threatening stimuli may delay detection of objects in a visual search task by capturing and holding attention. However, other research suggests that exposure to fearful stimuli may, in some instances, enhance detection of subsequent nonthreatening objects. Participants viewed arrays of either words or pictures preceded by a happy, neutral, or fearful face cue, followed by a surprise memory task for both target items (animal names or pictures of buildings, respectively) or distractor items (inanimate nouns or pictures of common objects). The results showed that items that followed threatening stimuli (fearful faces) were neither detected more quickly nor remembered better than those preceded by nonthreatening stimuli (happy or neutral faces). Target words, but not pictures, were remembered at a significantly higher rate than were distractors. Overall, exposure to threatening stimuli may not always increase or reduce the ability to detect or remember other objects.

2:30–2:45 (69)

Sex Differences in Visual Search Performance Seem Incompatible With the Hunter/Gatherer Hypothesis. GIJSBERT STOET, *University of Leeds*—The hunter/gatherer hypothesis of sex differences proposes that cognitive sex differences are related to a male adaptation to hunting and a female adaptation to gathering tasks. Existing evidence for women outperforming men in gathering is indirect and is primarily based on women excelling in object memory. Three experiments were conducted to find direct evidence for women excelling in gathering tasks. In Experiment 1, 80 participants were compared using a visual search task with 5–20 distractors. Search slopes for men and women were similar, but the males were faster. In Experiment 2, 80 participants had to find and click targets (fruits or specific letters). Again, the male group was faster. In Experiment 3, participants searched for six cartoonlike items on one trial, one of which was searched for beforehand. No object memory advantage for women was found. Altogether, no direct evidence for the hunter/gatherer hypothesis was found.

Explicit Memory
Missouri, Friday Afternoon, 1:30–3:05

Chaired by Steven M. Smith, Texas A&M University

1:30–1:45 (70)

Video Context-Dependent Memory for Swahili–English Word Pairs. STEVEN M. SMITH, JUSTIN D. HANDY, GENNA M. ANGELLO, & ISABEL MANZANO, *Texas A&M University*—Are educationally realistic materials susceptible to environmental context-dependent memory effects? Explicit memory for newly learned material should be susceptible to context-dependent forgetting, which affects memory for words, syllables, and faces. However, experiments in educational settings consistently fail to show context-dependent forgetting. Furthermore, memory tests that provide good cues tend to show weak or no context-dependent forgetting, a prediction of the outshining hypothesis. A set of 20 Swahili–English word pairs (e.g., *mbwa–dog*) was studied once, and memory for each English translation (e.g., *dog*) was cued at test with its Swahili equivalent (e.g., *mbwa*). Each was studied superimposed over an unrelated video of an environment (e.g., a grocery store, a playground) and was tested with either the same studied video context or a different one. Memory of words tested with reinstated contexts was more than double that of words tested with changed contexts, a clear case of context dependence with educationally relevant materials.

1:50–2:05 (71)

Language Proficiency and Divided Attention Effects on Recognition of High- and Low-Frequency Words. WENDY S. FRANCIS & NATALIA STROBACH, *University of Texas, El Paso*—A recognition memory experiment was conducted to examine whether working in a less proficient language better resembles working under conditions of divided attention or working with less familiar words. Spanish–English bilinguals and English- and Spanish-speaking monolinguals memorized high- and low-frequency words under intentional learning conditions. Bilinguals learned one set of words in English and one in Spanish, whereas monolinguals learned two lists in the same language, one under full and one under divided attention conditions. At test, a yes–no recognition test was performed, and confidence ratings were given for each response. Standard and signal detection analyses were performed. As in previous research, low-frequency words were expected to be recognized better than high-frequency words, and dividing attention at study was expected to diminish recognition performance. Bilingual proficiency effects were explored by comparing dominant and nondominant language performance in bilinguals and by comparing bilingual with monolingual performance.

2:10–2:25 (72)

Nonsimilarity-Based Sources of Interference in Remembering. DENNIS J. DELPRATO & JOHN K. LINDSTEDT, *Eastern Michigan University*—The relative contribution of similarity- and nonsimilarity-based sources of interference remain unclear in the interference class of memory theory. We conducted a retroactive interference (RI) experiment in which 956 participants were assigned to 1 of 14 conditions interpolated between study of a word list and free recall testing. Findings revealed seven overlapping clusters of conditions over increasing levels of forgetting. The least forgetting occurred in "sit quietly" conditions; studying another word list produced maximum forgetting (similarity based). Considerable variations in effects in 12 conditions (e.g., music video, tone discrimination, chord ratings, digit series completion, studying a list of forenames) not requiring study of materials similar to target stimuli suggest that nonsimilarity-based RI occurs over a wide range of

conditions in varying degrees and that straightforward cue overload is but one factor in RI. The disparate effects in conditions not requiring new learning have implications for determining neutral time-control activity (Shaklee & Jones, 1956).

2:30–2:45 (73)

A Memory-Based Model of Hick's Law. DARRYL W. SCHNEIDER & JOHN R. ANDERSON, *Carnegie Mellon University*—We propose and evaluate a memory-based model of Hick's law, the approximately linear increase in choice reaction time with the logarithm of set size (the number of stimulus–response alternatives). According to the model, Hick's law reflects a combination of associative interference during retrieval from declarative memory and occasional savings for stimulus–response repetitions due to nonretrieval. Fits to existing data sets show that the model accounts for the basic set-size effect, changes in the set-size effect with practice, and stimulus–response repetition effects that challenge the information-theoretic view of Hick's law. The model's prediction of an interaction of set size, stimulus fan (the number of responses associated with a particular stimulus), and stimulus–response transition was tested and confirmed in two experiments. Collectively, the results support the model and its explanation of Hick's law in terms of basic memory effects.

2:50–3:05 (74)

Test Position Effects: Implications for Item Noise and Context Noise Models. AMY H. CRISS, *Syracuse University*, & KENNNETH J. MALMBERG, *University of South Florida*—Two sources of information are assumed to cause interference in episodic memory: other items, referred to as item noise, and previous encounters with a test item, referred to as context noise. Recently, the presence of item noise in the single-item recognition memory task has been challenged (e.g., Dennis & Humphreys, 2001). The dominant empirical evidence in favor of a context noise approach is the null list length effect (e.g., Dennis & Chapman, 2009; Dennis, Lee, & Kinnell, 2008). In this paper, we present several experiments showing interference from the test list. Implications for item and context noise models are discussed.

Letters and Word Processing II
Mississippi, Friday Afternoon, 1:30–3:25

Chaired by Alison L. Morris, Iowa State University

1:30–1:45 (75)

The Facilitatory Length Effect in Visual Word Recognition. ALISON L. MORRIS, *Iowa State University*, & MARY L. STILL, *Missouri Western State University*—In a multiple regression study using a large database (the English Lexicon Project [ELP]; Balota et al., 2007), New, Ferrand, Pallier, and Brysbaert (2006) demonstrated that the function relating lexical decision latencies and word length is U-shaped: facilitatory for 3- to 5-letter words, null for 5- to 8-letter words, and inhibitory for 8- to 13-letter words. The facilitatory length effect demonstrated for short words is particularly problematic for existing models of visual word recognition. However, because the ELP used a short (300-msec) interstimulus interval (ISI) between the fixation symbols (three asterisks) and the target letter string, it is possible that the facilitatory length effect stems from interactions in the processing of the fixation and target. In several experiments, we demonstrate that the magnitude of the facilitatory effect varies as a function of the fixation–target ISI, as well as the type of fixation symbols used. Implications for conducting word recognition studies are discussed.

1:50–2:05 (76)

Competing Accounts of Competition in Visual Word Recognition. KENNETH I. FORSTER & JOSEPH D. THOMAS, *University of Arizona*—Cascaded activation models depend on competition between word units in order to select the unit that best matches the input. A major problem for such accounts is the fact that in English, words with many neighbors do not take longer to recognize. However, strong support for competition is provided by evidence that masked form priming is much weaker when the prime is a word (e.g., *contrast*–CONTRAST) rather than a nonword (e.g., *contrapt*–CONTRACT). This prime lexicality effect is

thought to result from the fact that the prime activates not only the target, but also its chief competitor, leading to an inhibitory effect. However, whether this effect is obtained depends on several task factors, and data from new experiments are reported that have implications for alternative models that do not involve competition.

2:10–2:25 (77)

Is Reading Truly Automatic? Evidence From Forced Reading in the Stroop Task. AMI EIDELS & KATHRYN RYAN, *University of Newcastle, Australia*, & DANIEL ALGOM, *Tel Aviv University*—The Stroop effect is typically calculated as the difference in mean latency to name the colors of congruent (the word RED printed in red) and incongruent (RED in green) stimuli. Because the calculation rests on the means, it is not clear that each and every word is actually read, thereby contributing to the observed effect. The automaticity account of the Stroop effect argues that reading is obligatory and, hence, is present on every trial. In order to test this account, we introduced a new task—the forced reading task—in which the participants respond to the color of only a subset of the presented words. In a series of experiments, participants exhibited a larger Stroop effect in the forced reading task than in the usual Stroop task. We conclude that reading does not occur on all trials, thus challenging the alleged automaticity of reading. A simple probability-mixture model is suggested.

2:30–2:45 (78)

The Nanopsycholinguistic Approach: Item Performance in Disyllabic Word Naming. ARNAUD REY & MURIELE BRAND-D'ABRESCIA, *CNRS, Provence University*, RONALD PEEREMAN, *CNRS, Pierre Mendes France University*, DANIEL H. SPIELER, *Georgia Institute of Technology*, & PIERRE COURRIEU, *CNRS, Provence University, Marseille*—Computational models of word reading can generate precise predictions at the item level, leading to what we may call a nanopsycholinguistic approach. Since the seminal study by Spieler and Balota (1997), accounting for variance in item databases has become a major challenge for model testing. In the present study, using two large-scale databases collected in English and French disyllabic word naming, we first provided an estimation of the amount of reproducible variance that models should account for. Second, using stepwise multiple regressions, we calculated the amount of variance explained by standard factors, such as onset properties, log frequency, and word length. Third, we found that the orthographic frequency of the first syllable accounted for an additional and significant part of the variance, whereas phonological syllable frequency did not. These results should therefore provide new constraints for the development of computational models of polysyllabic word processing.

2:50–3:05 (79)

Visual Search for Words Defined by Their Category: Both the Meaning and Visual Appearance of Words Matter. JULIEN DAMPURÉ, JEAN-FRANÇOIS ROUET, & CHRISTINE ROS, *CeRCA, CNRS, Université de Tours, Poitiers*, LAURE LÉGER, *Université Paris-Ouest*, & NICOLAS VIBERT, *CeRCA, CNRS, Université de Poitiers, Université de Tours, Poitiers* (read by Nicolas Vibert)—This study was designed to specify whether visual search for an unknown word defined only by its category would be guided by the semantic relatedness and/or visual similarity of distractor words with the target word. Words were randomly distributed in the search display and well separated, so that only one word at a time could be foveated. Eye movement recordings revealed that the semantic associates of the target word were fixated more often and for longer durations than were neutral words. This extends previous data and supports the role of parafoveal vision in accessing the meaning of words during visual search for verbal material. Interestingly, orthographic distractors looking like the target word were also fixated more often and for longer durations than were neutral words, even though the exact target word was not known in advance. The potential role in this phenomenon of unconscious parafoveal perception of the target word is discussed.

3:10–3:25 (80)

When Is Addition Word Neighbor Priming Inhibitory? SACHIKO KINOSHITA, *Macquarie University*, & DENNIS NORRIS, *MRC*

Cognition and Brain Sciences Unit—Competitive network models predict that word neighbors interfere with the recognition of orthographically similar words. In five lexical decision experiments investigating masked priming by addition word neighbors (e.g., *house*–HOSE) and nonword neighbors (e.g., *hoise*–HOSE), we found that the pattern of priming is critically dependent on the nature of nonwords. In three of the experiments, we examined the RT distribution and also carried out an analysis using the linear mixed model, as well as a conventional analysis of mean RTs. None of the analyses showed inhibitory word or nonword priming effects when standard nonword targets were used. Word addition neighbor priming was inhibitory only when the nonword targets were generated by deleting a letter in a word (e.g., *magic*–AGIC). Two further experiments manipulating prime lexicality and prime type within an experiment confirmed that inhibitory addition neighbor priming from word primes emerged only when the nonword decision required discrimination from its addition word neighbor.

Spatial Cognition
Meramec, Friday Afternoon, 1:30–3:45

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

1:30–1:45 (81)
Human Path Integration in Multifloor Buildings. WHITNEY STREET & RANXIAO FRANCES WANG, *University of Illinois, Urbana-Champaign* (read by Ranxiao Frances Wang)—Previous research on navigation and path integration (PI) has primarily focused on 2-D flat environments. However, humans can navigate in 3-D environments, such as complex buildings. Four experiments examined the mechanism of PI in 3-D space by comparing target localization performance within and across floors. Participants navigated across two floors of a building, using either the stairs or the elevator, and pointed to targets along the routes on both floors. Across both conditions, participants were more accurate at pointing to objects within a floor than across a floor. The across-floor cost could not be attributed to Euclidean or walking distance to the targets, number of turns taken, or recency effects. These results suggest that the floors of a building set up a navigational boundary and that spatial updating entails a cost when one operates across environmental boundaries.

1:50–2:05 (82)
Learning About Objects Along a Route Through a Novel Environment. LAURA A. CARLSON, *University of Notre Dame*, THOMAS F. SHIPLEY, *Temple University*, XIAO OU LI, *University of Notre Dame*, & CHRISTOPH HÖLSCHER, *University of Freiburg*—Learning a route through a novel environment involves building up an internal representation of the objects and their locations within that environment. Most past research has considered the objects and their locations as single units, focusing on identifying the spatial reference frames with which these units are encoded. In the present study, we question the idea that objects and locations are represented as integrated units, using tasks that differentially tap into the perceptual and spatial features of the objects. The results suggest that early in learning, there is a marked dissociation between object and location memory, with good recognition of objects encountered along the route but poor localization of these objects. With learning, memory for locations becomes better integrated with memory for objects.

2:10–2:25 (83)
Economic Navigation: Planning Routes Across Terrains Varying in Cost. LAURENCE T. MALONEY & HANG ZHANG, *New York University*—We designed a navigation task to investigate how humans trade off costs in selecting a route across inhomogeneous terrains. Subjects faced an optimization problem framed in terms of geometry and cost. We compared human performance with optimal performance maximizing expected utility. Method: On a large touch screen, subjects moved their finger from a starting point to a destination. Their path might run across "field" and "desert." The distance traveled in the desert cost C times more than did that in the field. On each trial, subjects won a fixed sum of money minus the cost of their path. We compared performance on five spatial configurations while varying cost ratios C. Twelve naive

subjects participated. The results showed that performance was close to that maximizing expected utility if we computed utility of cost as an accelerating power function of actual cost. We discuss implications for decision making and spatial cognition.

2:30–2:45 (84)
The Role of Landmark–Goal Distance on Spatial Control and Integration in Pigeons. CYNTHIA FAST, DENNIS GARLICK, & AARON P. BLAISDELL, *UCLA* (read by Aaron P. Blaisdell)—Pigeons learned to peck to a grid of dots on a touchscreen. One dot was the rewarded goal. The screen location of the goal dot varied across trials. In Experiment 1, different landmarks signaled the location of the goal as being near to, intermediate with respect to, or far from the landmark (only one type of landmark appeared on each trial). Pigeons showed lower spatial variance when responding to the near location, whereas spatial variance to the intermediate and far locations did not differ from each other. Thus, longer landmark–goal distances resulted in less precision in spatial control of responding. We further explored the role of landmark–goal spatial relationships in two experiments using a sensory preconditioning procedure in which we manipulated either the first-order landmark–goal distance (Experiment 2) or the distance between the first-order landmark and the second-order landmark (Experiment 3), to test how spatial information is integrated in spatial maps.

2:50–3:05 (85)
Individual Differences in the Use of External Representations in Spatial Thinking. ANDREW T. STULL & MARY HEGARTY, *University of California, Santa Barbara*, & BONNIE L. DIXON & MIKE STIEFF, *University of Maryland, College Park* (read by Mary Hegarty)—People can partially offload internal cognitive processes on the external world by manipulating external representations. We examine the case of using 3-D models in a diagram translation task in the domain of organic chemistry. In three experiments, participants translated between common diagrams of the same molecule that differed in perspective, represented properties of the molecule, and diagrammatic conventions. In some experimental conditions, they had available a 3-D model of the molecule, and their model use was coded from videotapes. In general, participants performed better when models were available than in control conditions (no models), but this was strongly dependent on whether and how they manipulated the models. There were large individual differences in model use. Some participants did not manipulate the models and performed no better than controls. The most successful participants were those who used the models to externalize the mental transformations necessary for representation translation.

3:10–3:25 (86)
Cross-Modal Influence of Reference Frames in Spatial Memory. JONATHAN W. KELLY, *Iowa State University*, & MARIOS N. AVRAAMIDES, *University of Cyprus*—Previous research has indicated that spatial memories are often organized around reference frames. The present experiments investigated whether reference frames are amodal or modality specific by exploring the cross-sensory influence of spatial reference frames. Participants experienced a visual environment emphasizing an environmental axis and later studied object locations through touch. Haptic learning was held constant, and visual environmental cues were manipulated across conditions. Manipulation of the visual cues influenced subsequent recall of touched object locations, which was best from perspectives aligned with visually defined axes. These experiments provide evidence for cross-sensory reference frame transfer and demonstrate that multimodal spatial information is integrated within a common representation.

3:30–3:45 (87)
Can a Cross-Modal Stimulus Elicit a Prevalence Effect? KATSUMI MINAKATA & KIM-PHUONG L. VU, *California State University, Long Beach* (read by Kim-Phuong L. Vu)—The right–left prevalence effect is the phenomenon whereby reaction times for responses made to two-dimensional (2-D) stimuli are shorter for the horizontal dimension than for the vertical dimension (Nicoletti & Umiltà, 1984). Prior studies on 2-D stimulus–response compatibility (SRC) have examined compatibility effects only in a single modality or have compared the results from

unimodal visual conditions with those from unimodal auditory conditions. The relative salience account attributes the right–left prevalence effect to the horizontal dimension's being more salient than the vertical dimension (Vu & Proctor, 2002). The present investigation extends current findings to multisensory stimulus displays by using audiovisual stimuli to determine whether a cross-modal prevalence effect occurs in a 2-D SRC context. Implications of the results for spatial coding of multimodal stimuli are considered.

Animal Cognition
Chouteau, Friday Afternoon, 1:30–3:05

Chaired by Thomas R. Zentall, University of Kentucky

1:30–1:45 (88)
Now You See It, Now You Don't: Object Permanence in Dogs. HOLLY C. MILLER, KRISTINA L. PATTISON, REBECCA M. RAYBURN-REEVES, & THOMAS R. ZENTALL, *University of Kentucky* (read by Thomas R. Zentall)—Dogs have been found to search appropriately for objects that move behind an occluder (visible displacement) but do not always search appropriately when the object and the occluder are then displaced (invisible displacement). We find that they do search appropriately when contextual cues make it clear that displacement has occurred, even after some time has passed between displacement and choice. Furthermore, using gaze duration as a measure of novelty, we find that dogs will look longer at an "impossible" event (an occluder apparently moving through a hidden object) than at a "possible" event (an occluder stopping when it reaches a hidden object). The results indicate that when appropriate tests are conducted, dogs show good evidence for Stage 6 object permanence.

1:50–2:05 (89)
A Transitivity Effect in Pigeons. PETER J. URCUIOLI, *Purdue University*—Pigeons were concurrently trained on hue–form and form–hue successive matching tasks. Afterward, their emergent go/no-go performances were assessed on nonreinforced probe trials, using the samples from one task and the comparisons from the other (i.e., on hue–hue and form–form matching). For some pigeons, the emergent relation of transitivity was clearly evident in their pattern of responding on both kinds of probe trials.

2:10–2:25 (90)
Comparing Biconditional and Patterning Discriminations. JESSE W. WHITLOW, *Rutgers University, Camden*—According to the attentional buffer model of Harris (2006), negative patterning discriminations (A+, B+, AB0) should be easier to learn than biconditional discriminations (AB+, CD+, AC0, BD0), and this result was found by Harris and his colleagues in human causal reasoning and in rat appetitive conditioning. These results pose problems for traditional accounts of these discriminations in terms of configural cues, which predict the opposite result. We find that with a more carefully controlled comparison of negative patterning and biconditional discriminations, the results predicted by configural cue theories are found, instead of the results predicted by Harris. Additionally, biconditional discriminations provide further evidence for the role of outcome valence on complex discriminations. A cue-constellation account offers an integrated explanation.

2:30–2:45 (91)
Commonalities Among Retroactive Cue Interference and Other Stimulus Interactions in Elementary Learning Situations: Retrospective Revaluation, Renewal, and Spontaneous Recovery. RALPH R. MILLER & GONZALO MIGUEZ, *Binghamton University*—There are four classes of stimulus interaction in elementary learning situations, distinguished by whether, during training, the interacting stimuli occur together or apart (i.e., competition or interference, respectively) and whether the interacting stimuli consist of cues or outcomes (i.e., antecedent or subsequent events, respectively). Despite unrelated theoretical models commonly being used to account for stimulus interference and stimulus competition, there is a growing body of data demonstrating similar effects across interference and competition paradigms, as well as across the interacting stimuli being cues and outcomes. Some of these similarities are reviewed, and new data are presented concerning

retrospective revaluation, renewal, and spontaneous recovery in retroactive cue interference, paralleling prior findings with stimulus competition and other types of interference. Whether these similarities are best viewed as analogous or homologous is discussed, along with implications for prevailing models of learning that address only stimulus competition or only stimulus interference.

2:50–3:05 (92)
Information Seeking and the Comparative Study of Metacognition. MICHAEL J. BERAN, *Georgia State University*, & J. DAVID SMITH, *University at Buffalo*—Animal metacognition is a growing research area. Recently, it was shown that pigeons have difficulty seeking needed information before trying to perform a matching-to-sample task (Roberts et al., 2009). Pigeons consistently tried to perform the matching phase despite having not seen the sample, even when they could make a response to reveal it. We gave this test, and extensions of it, to rhesus monkeys and capuchin monkeys. Both species passed the Roberts et al. test of information seeking. We then gave both species new trial types, where the amount of necessary information for correct matching was varied. Sometimes the sample was present, sometimes it was not. Sometimes everything was present. Rhesus monkeys demonstrated flexible information management, asking only for what they needed. Capuchins, however, did not. This difference among primate species is important for what it might show about the underlying psychological requirements for metacognitive and information-seeking performances.

Judgment and Decision Making
Lewis and Clark, Friday Afternoon, 1:30–3:05

Chaired by Andreas Wilke, Clarkson University

1:30–1:45 (93)
Human Foraging Behavior in External and Internal Search Tasks. ANDREAS WILKE, *Clarkson University*, BENJAMIN SCHEIBE-HENNE & RUI MATA, *University of Basel*, PETER M. TODD, *Indiana University, Bloomington*, & H. CLARK BARRETT, *UCLA*—The human mind is filled with evolved decision mechanisms designed to meet adaptively important goals. We outline a framework for studying those mechanisms from an evolutionary cognitive psychology perspective, which emphasizes the role of the environment in shaping organisms' decision strategies. We illustrate these ideas with research examples from our work on human foraging cognition: deciding when to leave a resource patch, searching for information in memory, predicting when a sequence of events will stop or continue, and detecting sequential dependencies when simultaneously foraging for multiple resources.

1:50–2:05 (94)
Influences of Working Memory on Exploration and Exploitation. A. ROSS OTTO, ARTHUR B. MARKMAN, & BRADLEY C. LOVE, *University of Texas, Austin* (read by Arthur B. Markman)—Settings in which people make repeated choices require resolving the trade-off between exploration and exploitation. Exploitation involves selecting options that have been good in the past, whereas exploration involves selecting new options or ones that have not been good in the past, in order to determine whether they are better than the current best option. Environments differ in whether exploration or exploitation is optimal. In previous work, we have examined motivational factors that influence exploration and exploitation. In the present studies, we examined effects of working memory on the tendency to explore or exploit. In domains in which exploration requires a systematic pattern of choices, we find that working memory loads decrease exploration. Thus, individuals with a high working memory load perform poorly in domains that favor systematic exploration and perform well in domains that favor exploitation. These studies have important implications for our work on motivation.

2:10–2:25 (95)
The Influence of Information Sharing Between Individuals on Wisdom-of-Crowd Effects. MARK STEYVERS & BRENT MILLER, *University of California, Irvine*—We analyze the collective performance of individuals in a series of general knowledge tasks involving the rankings

of events and items (e.g., "what is the order of U.S. presidents?"). We compare situations in which a group of individuals independently answer these questions with an iterated learning environment in which individuals pass their solution to the next person in a chain. We introduce Bayesian models for these environments, where information sharing might be present or absent, and treat the collective group knowledge as a latent variable that can be estimated from the observed judgments across individuals. Importantly, the models allow for individual differences in expertise and confidence in other individuals' judgments. Our initial results suggest that information-sharing environments lead to better collective performance (a stronger "wisdom-of-crowds" effect), despite the fact that information sharing increases correlations between judgments.

2:30–2:45 (96)
Memory Interference Constrains the Emergence of Cooperation. JEFFREY R. STEVENS, JENNY VOLSTORF, & LAEL J. SCHOOLER, *Max Planck Institute for Human Development*, & JÖRG RIESKAMP, *University of Basel*—Studies of cooperation have focused on decision strategies that depend on a partner's previous choices. The findings from this work assume that players accurately remember past behavior. Here, we show that human memory may not meet the requirements needed to implement these strategies. When asked to recall the previous behavior of partners in a cooperative memory task, participants performed poorly, making more errors on 10%–24% of the trials. Participants made more errors when required to track more partners. We conducted agent-based simulations to evaluate the robustness of cooperative strategies to error. These simulations confirmed that, even with few errors, cooperation could not be maintained, and defection dominated for the error rates demonstrated by our participants. Our results suggest that the strategies typically used in the study of cooperation likely do not reflect the underlying cognitive capacities used by humans and other animals in social interactions.

2:50–3:05 (97)
The Impact of Forecast Uncertainty on Decision Making. SUSAN L. JOSLYN, *University of Washington*—Whether nonexperts can make good use of uncertainty information has long been the subject of debate from both a theoretical and a practical standpoint. The studies reported here took a novel approach by directly comparing weather-related decisions made with and without uncertainty forecasts. Although decision making was suboptimal from a normative perspective, uncertainty information improved decision quality overall. Participants, given a complex, realistic decision task, made multiple decisions with immediate feedback and cash rewards. Participants with uncertainty forecasts took appropriate precautionary action more often and withheld action more often, when it was appropriate to do so, than did participants using deterministic forecasts. When error in the forecast increased, participants were reluctant to act, an effect that was attenuated by uncertainty forecasts. Furthermore, acknowledging the uncertainty in the forecast increased trust in the prediction. Implications of these results for the effort to increase compliance with weather warnings (e.g., hurricane) are discussed.

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SYMPOSIUM II
Using ERPs to Track Visuospatial Cognition As It Happens
Illinois, Friday Afternoon, 3:15–5:45

Chaired by John J. McDonald, Simon Fraser University

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3:15–3:30 (98)
Introduction. JOHN J. McDONALD, *Simon Fraser University*

3:35–3:50 (99)
Tracking Target and Distractor Processing in Visual Search. JOHN J. McDONALD, *Simon Fraser University*—Different accounts of visual search postulate that attentional selection is achieved by distractor suppression or target enhancement. Recent ERP studies from my laboratory indicate that selection in visual search involves both excitatory and inhibitory processes that give rise to ERP components of opposite polarity. Attended objects elicit a sequence of lateralized ERP negativities believed to reflect perceptual selection (N2pc), frontal lobe access to

working memory (ACN), and active maintenance of visual representations (SPCN), whereas unattended objects often elicit lateralized ERP positivities that likely reflect disruption of processing at these stages. We have used this approach to track the processing of task-relevant targets and more salient distractors in the additional singleton paradigm. The results show that although a salient distractor sometimes gains access to higher stages of visuospatial cognition, observers can suppress processing of the distractor in order to select the less salient target.

3:55–4:10 (100)
On the Interplay of Stimulus Saliency and Top-Down Control in Perceptual Competition. EDMUND WASCHER & DANIEL SCHNEIDER, *Leibniz Research Centre for Working Environment and Human Factors* (sponsored by John J. McDonald)—Irrelevant signals in a visual display can impair the processing of relevant information even without task relevance. When participants had to detect a luminance change while a motion transient was presented in the opposite hemifield, the influence of distracting information was determined in its relative strength, as compared with relevant signals. This relation was reflected in asymmetries in the N1 range, and a subsequent N2pc was evoked only when reallocation of attention was necessary. To separate bottom-up from top-down mechanisms, the task has been extended to the instruction to attend orientation changes. This time, the luminance change impaired the detection of the simultaneously presented orientation change. Early asymmetries were biased toward the intended orientation change and were modulated only in an initial phase by competing information. Thus, processing spatial saliency maps and amplifying intended information are at least partially independent processes.

4:15–4:30 (101)
Top-Down Control and the Allocation of Visual Attention. ANNA SCHUBÖ & AGNIESZKA WYKOWSKA, *Ludwig Maximilians University* (sponsored by John J. McDonald)—There is some debate on the impact of top-down control on salience-based bottom-up processing in visual selection and on the temporal interrelation of both processes in attentional guidance. We investigated the impact of the observer's intention on visual search. A search task was combined with a probe detection task, with the probe appearing at variable time intervals after the search display. Different ERP components (N2pc, P1) were analyzed to investigate attentional allocation at various points in time: ERPs locked to the search display showed that attention was allocated to the target, and not to an irrelevant salient singleton. ERPs locked to probes showed a benefit of probes at target locations over other locations in the display. The results show that the allocation of visual attention is guided mainly via top-down control processes.

4:35–4:50 (102)
Top-Down Control of Attentional Capture in Visual Search. MARTIN EIMER & MONIKA KISS, *Birkbeck College, University of London* (sponsored by Pierre Jolicœur)—We present findings from a series of experiments that combined behavioral and ERP markers of attentional capture by salient feature singletons in visual search tasks. The results demonstrate that capture is almost exclusively determined by top-down task set, and not by bottom-up salience. We also address the hypothesis that the initial phase of attentional capture is driven by salience, whereas top-down factors affect only subsequent stages of strategically controlled attentional processing. Our results demonstrate that task-set-contingent attentional capture is rapid and involuntary.

4:55–5:10 (103)
Direct Electrophysiological Measurement of the Storage of Attentional Templates in Visual Working Memory. GEOFFREY F. WOODMAN, *Vanderbilt University*—When we look for a target object in a complex scene, some kind of internal representation of what we are looking for must guide our search through the objects in the cluttered visual environment. Many theories of attention explicitly propose that we hold target representations, known as attentional templates, in working memory to provide top-down biasing signals to perceptual attention mechanisms. Although this is a critical component of many theories, we lack neurophysiological evidence from humans supporting this hypothesis. Here, we show that when humans search complex visual scenes, a representation

of the target is maintained in visual working memory, provided that the identity of the searched-for item changes across trials. Thus, in the face of dynamic task demands, working memory representations do guide perceptual attention mechanisms in the human visual system.

5:15–5:30 (104)
Dual-Task Modulations of Early, Middle, and Late Event-Related Potentials in Studies of Visual Attention and Visual Short-Term Memory. PIERRE JOLICŒUR, *University of Montreal*—Event-related potentials (ERPs) provide a fine-grained moment-to-moment view of processing between stimulus and response in perceptual and cognitive processing. Recent studies in my laboratory combined the ERP technique and dual-task methodology to study the mechanisms of visuospatial attention and visual short-term memory and their role in the cognitive architecture. These studies revealed a variety of previously unsuspected forms of dual-task interference at various stages of processing, ranging from the registration of salient local feature discontinuities to the deployment of visuospatial attention, the transfer of information into visual short-term memory, the short-term consolidation of modality-independent short-term memory, and the contextual integration of semantic features. Taken together, the studies show how we can use ERPs as powerful probes into the nature, timing, and approximate brain locus of the underlying processing mechanisms mediating perception, attention, and memory functions in human cognition.

Explicit Memory II
Missouri, Friday Afternoon, 3:30–5:25

Chaired by Neil W. Mulligan, University of North Carolina, Chapel Hill

3:30–3:45 (105)
Individual Differences in Working Memory Capacity Predict Sleep-Dependent Memory Consolidation. KIMBERLY M. FENN & DAVID Z. HAMBRICK, *Michigan State University* (read by David Z. Hambrick)—Declarative memory is enhanced after sleep, and performance improvement has been shown to be positively correlated with Stage 2 sleep spindles. Furthermore, spindle density has been found to be positively correlated with performance on some memory and reasoning scales. This suggests that individuals who are highly skilled in these tasks might benefit more from sleep-related consolidation processes, but little is known about whether individual differences in cognitive function affect sleep-dependent consolidation processes. The present study explored the role of working memory capacity (WMC) in the consolidation of paired associates. Word recall increased after sleep, but not after an equal waking retention interval. Furthermore, WMC was positively correlated with the increase in number of correctly recalled words, or memory enhancement, after sleep, although it was not predictive of performance change across a waking interval. These findings suggest that working memory may modulate offline consolidation processes during sleep for declarative memory.

3:50–4:05 (106)
Survival Processing Does Not Enhance Implicit Memory. CHI-SHING TSE, *Chinese University of Hong Kong*, & JEANETTE AL-TARRIBA, *University at Albany* (read by Jeanette Altarriba) (sponsored by Chi-Shing Tse)—Recent research shows that human memory may have evolved to remember information that has been processed for the purpose of survival, more so than information that has been processed for other purposes, such as home moving. We investigated this survival-processing advantage using both explicit and implicit memory tests. In Experiment 1, participants rated words in one of three scenarios—survival, pleasantness, and moving—followed by a timed stem-cued recall/stem-cued completion task. Items were completed more quickly in the survival scenario, as compared with the other two, for the explicit task, but no differences were found across conditions in the implicit task. In Experiment 2, the implicit task was changed to concreteness judgments to encourage more conceptual processing. Again, the survival-processing advantage occurred in the explicit task (speeded item recognition), but not in the implicit task. These results suggest that a survival-processing advantage may benefit participants' memory performance only during explicit retrieval.

4:10–4:25 (107)
Adaptive Memory: Does Survival Processing Enhance Memory for Source? JAMES S. NAIRNE, *Purdue University*, JOSEFA N. S. PANDEIRADA, *University of Aveiro*, MEGAN A. SMITH, *Washington University*, & PHILLIP J. GRIMALDI & ALTHEA BAUERNSCHMIDT, *Purdue University*—Survival processing has been shown to produce excellent long-term retention—better, in fact, than most well-known encoding procedures. The present experiments investigated whether the survival-processing advantage extends to memory for source—either memory for temporal position, as measured through a list discrimination task, or memory for spatial position. Participants made survival or pleasantness decisions about words either presented in two lists or positioned on the left or right side of a screen. People then recalled all the words but placed the words from a given list (or spatial position) on a particular side of the recall sheet. Strong survival-processing advantages were found in overall recall, but not in source memory performance. Consistent with some evolutionary predictions, women showed superior source performance than did men, but only for the spatial position task. Survival advantages were also found when people identified whether a word had been rated for survival or pleasantness.

4:30–4:45 (108)
Emotional Pictures Following Successful Retrieval Enhance Later Recall. BRIDGID FINN & HENRY L. ROEDIGER III, *Washington University*—When information is retrieved, it can enter a labile state in which it may be amenable to change (e.g., Dudai, 2006). This process of reconsolidation may explain, in part, the benefits observed following successful retrieval of information (i.e., the testing effect). In three experiments, we examined whether the benefits of a successful retrieval could be modulated by a postretrieval event. Participants studied Swahili–English vocabulary pairs and took an initial cued recall test. Following successful retrieval of a pair, subjects received a blank screen, a neutral picture, or a negatively valenced arousing picture. On a final cued recall test given later, performance was better for previously tested items that had been followed by an emotional picture. Another experiment showed that the effect still occurred when the picture was delayed by 2 sec following initial retrieval. Emotional arousal following retrieval may enhance reconsolidation.

4:50–5:05 (109)
Enhanced Recognition Memory for Taboo Words in a Two-Alternative Forced Choice Paradigm. RENÉ ZEELENBERG, *Erasmus University Rotterdam*, & YOONHEE JANG & DAVID E. HUBER, *University of California, San Diego*—Several studies have shown seemingly enhanced memory for emotional stimuli. Recent studies (Dougal & Rotello, 2007; Thapar & Rouder, 2009) suggest that emotional enhancements in recognition performance reflect a bias to classify emotional stimuli as "old," rather than enhanced sensitivity. Furthermore, as was argued by Grider and Malmberg (2008), the assumptions underlying standard signal detection analysis are not generally met, which may result in incorrect estimations of bias and sensitivity. Two-alternative forced choice recognition provides a better way to investigate whether recognition memory for emotional words is truly enhanced. In two experiments, we showed that subjects' performance was better when they chose between a studied taboo word and a nonstudied taboo foil, as compared with when they chose between a studied neutral word and a nonstudied neutral foil. This advantage cannot be explained by a bias in favor of emotional stimuli and reflects an increase in sensitivity.

5:10–5:25 (110)
I Said, You Said: The Production Effect Gets Personal. COLIN M. MACLEOD, *University of Waterloo*—Saying a word aloud makes it more memorable than simply reading it silently. This benefit—the production effect—has been attributed to enhanced distinctiveness for the produced items (MacLeod et al., 2010). In two experiments, the production effect was shown to be reliable when production was done by someone other than the remberer (i.e., by the experimenter or by another participant) but was substantially smaller than the benefit from self-production. Intriguingly, when production was done by both the remember and another person, this reduced the benefit of self-initiated production.

Distinctiveness—and hence, the production effect—is greatest when it is personal.

Speech Perception
Mississippi, Friday Afternoon, 3:50–5:25

Chaired by Robert E. Remez, Barnard College, Columbia University

3:50–4:05 (111)
Acoustic Analysis of Speech by Numerical Estimation and by Hand. ROBERT E. REMEZ, KATHRYN R. DUBOWSKI, MORGANA L. DAVIDS, EMILY F. THOMAS, NINA U. PADDU, & MARINA MOSKALENKO, *Barnard College, Columbia University*—Automatic methods of estimation are common for measuring acoustic properties of speech, although these are error prone. One way to benchmark such methods is to use spectral estimates as synthesis parameters and intelligibility tests of the synthetic speech to assess accuracy. New tests extended our project to include variation in voicing and consonant manner. Linear prediction estimates were compared with estimates made by hand, and sine wave synthesis was used to force perception to depend on the dynamic properties of synthetic signals. Our prior study had revealed a small intelligibility cost due to errors in estimating the instantaneous spectrum shape of continuously voiced sentences, a consequence of the model of linear prediction. With rapid changes in the spectrum, due to contrasts in voicing and manner, the greater cost was observed here when acoustic discontinuities were estimated automatically. The results are instructive about the efficacy of automatic estimation in the acoustic measurement of speech.

4:10–4:25 (112)
Resolution of Phonemic Ambiguity Occurs After Lexical Identification: Evidence From Audio-Morphed Speech. MATTHEW H. DAVIS & JACK C. ROGERS, *MRC Cognition and Brain Sciences*—Listeners perceive sounds that are acoustically intermediate between two speech tokens categorically—perhaps as a result of competition between co-activated prelexical representations (e.g., phonemes). However, studies of speech perception typically use limited stimulus sets and massed item repetition. This permits perceptual and lexical learning processes that may not be accessible outside of laboratory conditions. Here, we use an automated audio-morphing procedure implemented with the "straight" vocoder to study perception of natural-sounding phonetic continua without stimulus repetition. We show that (1) lexical effects on phonemic categorization are observed under natural listening conditions but may reflect postlexical processes, (2) perceptual discrimination is better than predicted by categorization, due to auditory comparisons between paired syllables and/or stimulus repetition, and (3) phonemically ambiguous segments slow recognition of familiar words, but not of pseudowords. These results suggest that phonemic interpretations of speech are computed post- rather than prelexically. Implications for accounts of categorical perception are discussed.

4:30–4:45 (113)
Spectral Shape and Duration As Cues to Vowel Perception. WEBSTER TILTON IV & JAMES R. SAWUSCH, *University at Buffalo* (read by James R. Sawusch)—The spectral peaks corresponding to the first three formants have been repeatedly shown to be the dominant cues for vowel perception. However, models of perception based on these cues have failed to classify vowels as accurately as human listeners, even when dynamic information about the changes in the formants over time is included. In a series of perceptual studies, both the duration of the vowel information and the shape of the short-term spectrum were shown to be sufficient cues to vowel identity for some vowel contrasts in Midwestern English. Furthermore, variation in either cue alters the perception of a vowel on the basis of the frequencies of the formants. The results support models of speech perception that incorporate spectral shape and duration as cues to vowel recognition.

4:50–5:05 (114)
Synchronization With English and French Speech Rhythms. PASCALE LIDJI & CAROLINE PALMER, *McGill University*, ISABELLE PERETZ, *University of Montreal*, & MICHELE MORNINGSTAR, *McGill University* (read by Caroline Palmer)—We investigated listeners' sensitivity to speech rhythm in English, a stressed-timed language (stresses perceived as equally spaced in time), and in French, a syllable-timed language (syllables perceived as equally spaced in time). Monolingual French and English speakers tapped with the subjective beat they perceived in French and English spoken sentences, as a measure of their sensitivity to underlying periodicities. Stimulus analyses confirmed that vocalic intervals displayed greater variability in English than in French. The speech rhythms influenced tapping performance: All participants tapped with greater temporal regularity to English than to French sentences, and listeners synchronized their taps better with English syllable onsets than with French syllable onsets. Surprisingly, native English speakers tapped more regularly than native French speakers with both languages. These findings suggest that stressed-timed languages are perceived as more regular than syllable-timed languages and result in more accurate synchronization that may generalize beyond the listeners' native language.

5:10–5:25 (115)
Detecting Speech-Evoked Cortical Activity in Deaf Children Following Cochlear Implantation. HEATHER BORTFELD, *University of Connecticut and Haskins Laboratories*, ALEC B. G. SEVY, *Baylor College of Medicine*, THEODORE J. HUPPERT, *University of Pittsburgh*, ROSS E. TONINI, *Texas Children's Hospital*, MICHAEL S. BEAUCHAMP, *University of Texas, Houston*, & JOHN S. OGHALAI, *Stanford University*—Behavioral measurements of auditory sensitivity in young children using a cochlear implant (CI) are often unreliable. However, many of the noninvasive techniques used for detecting cortical activity in response to sound have critical limitations when applied to the pediatric CI population. We therefore used near-infrared spectroscopy (NIRS) to detect cortical responses to speech stimuli in pediatric CI users. NIRS estimates blood-oxygen-level-dependent cortical changes by measuring the transmission of near-infrared light through brain tissue. We first compared responses measured with NIRS and fMRI in normal-hearing adults and then examined four cohorts with NIRS alone. Speech-evoked cortical activity was observed in 100% of normal-hearing adults (11 of 11), 82% of normal-hearing children (9 of 11), 78% of deaf children who had used a CI >4 months (28 of 36), and 78% of deaf children who completed NIRS testing on the day of initial CI activation (7 of 9).

Working Memory II
Meramec, Friday Afternoon, 4:10–5:25

Chaired by Emily M. Elliott, Louisiana State University

4:10–4:25 (116)
The Developmental Trajectory of Primary and Secondary Memory. SHARON L. EAVES, ALICIA M. BRIGANTI, & EMILY M. ELLIOTT, *Louisiana State University* (read by Emily M. Elliott)—One of the unanswered questions about working memory is the following: What cognitive processes function during working memory task performance, and how do these processes directly relate to intelligence? Recent research (Unsworth & Engle, 2006) suggested that performance on working memory tasks is determined by two abilities: the capacity of primary memory and the ability to efficiently retrieve information from secondary memory. We replicated and extended Unsworth and Engle's research with two groups of children (ages, 8 and 10 years) and a group of college-aged adults to identify the developmental trajectory of primary and secondary memory and to examine whether these abilities predict fluid intelligence in the same way as in Unsworth and Engle. By including scope of attention measures, which are theoretically similar to measures of primary memory, we also hope to differentiate between Cowan et al.'s (2005) predictions concerning the relationship between primary memory and intelligence and Unsworth and Engle's findings.

4:30–4:45 (117)
Chunking and Data Compression in Short-Term Memory. FABIEN MATHY, *Université de Franche-Comté*, & JACOB FELDMAN, *Rutgers University, New Brunswick*—Short-term memory is famously limited in capacity to Miller's (1956) magic number seven or, in many more recent studies, about four chunks of information, but the definition of

"chunk" in this context has never been clear. We propose a new, more quantitatively precise conception of chunk derived from the notion of Kolmogorov complexity and compressibility: A chunk is a unit in a maximally compressed code. We present a series of experiments in which we manipulated the compressibility of stimulus sequences by introducing sequential patterns of variable length. Our subjects' measured digit span (raw short-term memory capacity) consistently depended on the length of the pattern after compression—that is, the number of distinct sequences it contained. The true limit appears to be about three or four chunks after compression, equivalent to about seven uncompressed items of typical compressibility.

4:50–5:05 (118)
Error Detection, Memory, and the Medial Temporal Lobe: Evidence From Amnesic H.M. DONALD G. MacKAY, *UCLA*—This talk presents evidence for strong and previously unsuspected links between the medial temporal lobe (MTL), memory, and error detection in language and visual cognition. The evidence comes from 10 studies of H.M. (44 to 72 years of age), an amnesic with MTL damage but virtually no neocortical damage. Three studies examined detection of erroneous objects experimentally planted in complex visual scenes—for example, a bird flying in a fish bowl and erroneous words substituted into otherwise grammatical sentences, such as *I helped themselves to the birthday cake*—and 7 studies examined uncorrected errors in H.M.'s spoken discourse, reading of sentences and low-frequency words, and visual cognition. The results indicated that H.M. detected reliably fewer erroneous items than did carefully matched memory-normal controls, and his uncorrected errors exhibited three consistent features: noncorrection, anomaly, and omission. Binding theory readily explained these results, together with the links between error detection, memory, and the MTL.

5:10–5:25 (119)
Adaptive Optimal Experimental Design for Model Discrimination. JAY I. MYUNG, DANIEL R. CAVAGNARO, & MARK A. PITT, *Ohio State University*—Experimentation is fundamental to the advancement of cognitive science. Adaptive design optimization, in which design variables are updated (i.e., reoptimized) at regular intervals during the experiment, is a particularly attractive methodological tool for simultaneously improving the efficiency of data collection and the informativeness of the knowledge learned in the experiment. We demonstrate the potential of a Bayesian adaptive design optimization framework for improving experimentation in psychology in discriminating formal models of memory in a simulation experiment and an experiment with participants.

Visual Attention
Chouteau, Friday Afternoon, 3:30–5:25

Chaired by Anthony J. Lambert, University of Auckland

3:30–3:45 (120)
Behavioral and Electrophysiological Dissociations Between Visual Orienting and Conscious Perception. ANTHONY J. LAMBERT, NARISA E. MARRETT, & MYOUNG-JU SHIN, *University of Auckland*—Two experiments explored the role of dorsal and ventral processing streams in visual orienting and conscious perception. Both experiments included an attention task, where participants responded to peripheral letters by orienting attention toward a target location, and a perception task, where participants made an explicit, conscious response to the same letters. Luminance contrast of the peripheral letters was manipulated in Experiment 1. Perception of low-contrast letters was massively slower and less accurate, but rapid visual orienting in response to peripheral letters was unaffected by contrast. In Experiment 2, participants performed the attention and perception tasks, while neural activity was recorded with high-density EEG. The results from both experiments support the hypothesis that rapid orienting in response to peripheral objects is mediated by the dorsal stream, whereas conscious perception of the same objects is mediated by the ventral stream.

3:50–4:05 (121)
A Countermanding Investigation of the Anti-Hick's Effect for Exogenous Saccades. CHING-YI WU, *Case Western Reserve University*, PO-HSIANG LAI, *Washington University*, & BONNIE M. LAWRENCE, *Case Western Reserve University* (read by Bonnie M. Lawrence)—Lawrence and colleagues (2008, 2009, 2010) found that exogenous saccade reaction times (RTs) decrease with in an increase in response alternatives, a violation of Hick's law that they termed the *anti-Hick's effect*. They hypothesized that the effect arises from proactive inhibitory processes, which are stronger when there are fewer response alternatives. To investigate this hypothesis, we used a countermanding task, which required subjects either to execute (go trial) or inhibit (no-go trial) a saccade to a target in separately blocked trials of two or six potential target locations. We found that RTs decreased from two to six response alternatives (i.e., the anti-Hick's effect) on go trials, whereas the proportion of errors on no-go trials (i.e., failures to inhibit saccades) increased from two to six response alternatives. These results are consistent with the inhibitory hypothesis of the anti-Hick's effect.

4:10–4:25 (122)
Predictable Paths Increase the Use of Motion in Object Tracking. ADRIANE E. SEIFFERT & REBECCA ST. CLAIR, *Vanderbilt University*—People can attend to and keep track of objects as they move among identical distractors, using only location and motion information. Using textured objects, we showed previously that tracking accuracy was lower when the textures moved in the direction opposite to that of the objects, as compared with textures that moved in the same direction as the objects (St. Clair, Huff, & Seiffert, 2010, *JOV*). This texture effect suggested that people predict future locations of targets using local motion information. Here, we investigated whether the paths the objects take affect how people use motion to predict target locations. When objects moved in straight paths, the texture effect was larger than when objects randomly changed direction. The more predictable the target paths, the more motion information was used for tracking. We conclude that people track objects by using motion to predict future locations of targets.

4:30–4:45 (123)
Measuring the Spatial Span of the Meta-Attentional Spotlight. JUN-ICHIRO KAWAHARA, *National Institute of Advanced Industrial Science and Technology*—Researches have shown that the deployment of visual attention operates under spatial limitations, rendering its assignment to multiple locations difficult or costly. This study explored whether this conventional understanding applies to human meta-attention as well. I measured the spatial distribution of meta-attention during viewing of natural scenes and found that participants believed that they could attend to multiple locations simultaneously. Study 2 tested whether this tendency could be modified by information about the tendency to overestimation. After participants were informed of this tendency toward overestimation with both verbal instruction and demonstrations of attentional blindness and blindness to these phenomena, the selectivity of meta-attention increased. Study 3 demonstrated that participants overestimated their attentional abilities, by comparing the meta-attentional drawings and the actual behavioral performances of the same participants. These results were consistent with recent findings of meta-attentional overestimation in change detection and suggested human insensitivity in monitoring attentional limitations.

4:50–5:05 (124)
Orienting Attention in a Sustained Attention Task: Temporal and Spatial Predictability. MELISSA R. BECK, *Louisiana State University*, & S. LEE HONG, *Indiana University, Bloomington*—We examined the combined effects of spatial and temporal stimulus predictability on simple reaction time (RT) and scanning behavior in a sustained attention task. Participants were asked to respond as quickly as possible to a stimulus during nine blocks of 112 trials while their RTs and eye fixation durations were measured. Temporal and spatial predictability of the stimulus were varied from block to block by altering the number of (1) different time intervals between a response and the next stimulus and (2) possible spatial locations of the stimulus. We found a significant interaction of spatial and temporal predictability on both RT and fixation duration, where (1) greater temporal predictability increased fixation durations only when spatial predictability was high and (2) greater spatial predictability decreased RTs, but only when temporal predictability was

high. These findings suggest different interactions of spatial and temporal stimulus predictability on the scanning and response phases of attention.

5:10–5:25 (125)

It Is Not Just Guessing: Behavioral and Electrophysiological Evidence for an Order-Reversal Illusion in RSVP. BRAD WYBLE & DEREK HENIG, *Syracuse University*, & HOWARD BOWMAN, *University of Kent, Canterbury*—At a 100-msec SOA in RSVP, subjects frequently reverse the order of the targets during report. However, it is not clear whether subjects are guessing or whether they are perceiving an incorrect representation of the world. If subjects are guessing, the percentage of swaps should never be worse than 50%. However, an experiment using SOAs of 40 msec per item showed that target order is reliably reversed (57% incorrect, $SE = 4$%) at very rapid presentation speeds. An EEG experiment with two targets presented at an 80-msec SOA showed a difference in the shape of the P3, with a higher amplitude peak on trials in which subjects reported the items in reversed order. Both of these findings confirm predictions of the eSTST model, which simulates temporal attention and stimulus encoding in visual processing. Furthermore, this evidence supports the theory that order reversals are a genuine illusory percept, rather than the outcome of guessing.

Judgment and Decision Making II
Lewis and Clark, Friday Afternoon, 3:30–5:25

Chaired by Jonathan D. Nelson
Max Planck Institute for Human Development

3:30–3:45 (126)

Information Search Under Asymmetric Reward Conditions. JONATHAN D. NELSON & BJÖRN MEDER, *Max Planck Institute for Human Development*—Can people adapt their information search behavior to asymmetric reward structures, in which maximizing accuracy and maximizing reward would lead to contradictory behaviors? We addressed this via two probabilistic category-learning and information search experiments. Both experiments involved learning environmental probabilities through personal experience in categorizing stimuli and, subsequently, choosing one of two features to view for categorization. Experiment 1 found that it is difficult for subjects to identify the reward-maximizing (rather than accuracy-maximizing) feature in the information search phase. Experiment 2 found that subjects can learn under an asymmetric reward structure but cannot flexibly adapt their search if the reward structure changes in the information search phase. We therefore posit (1) that maximizing accuracy may be a primary subjective reward function, both for learning and for information search, and (2) that psychological models of information search may need to take into account idiosyncrasies in each person's learning history.

3:50–4:05 (127)

Correct Acceptance Weighs More Than Correct Rejection: A Decision Bias Induced by Question Framing. YAAKOV KAREEV, *Hebrew University of Jerusalem*, & YAACOV TROPE, *New York University*—We propose that in attempting to detect whether an effect exists or not, people set their decision criterion so as to increase the number of hits and decrease the number of misses, at the cost of increasing false alarms and decreasing correct rejections. As a result, if one of two complementary events is framed as the positive response to a question and the other as the negative response, people will tend to predict the former more often than the latter. Performance in a prediction task with symmetric payoffs and equal base rates supported our proposal, with positive responses more prevalent than negative responses, irrespective of question phrasing. The bias, slight but consistent and significant, was evident from early in a session and remained unchanged. A regression analysis revealed that, in addition, individuals' decision criteria reflected their learning experiences, with the weight of hits being greater than that of correct rejections.

4:10–4:25 (128)

Priming Cognitive Consistency Both As a Goal and As a Mind-Set. J. EDWARD RUSSO & ANNE-SOPHIE CHAXEL, *Cornell University*—The testing of cognitive consistency theories would be substantially enhanced by the ability to experimentally increase the level of consistency. The authors introduce two priming methods for activating cognitive consistency, either as a goal or as a mind-set. Participants in the goal activation manipulation attempt to answer a difficult conundrum, whereas participants in the mind-set activation manipulation solve a series of anagrams. The success of the two primes was observed in all three tasks that served as dependent measures: word naming, information distortion in a choice, and 10 SAT-like sentence completions. Inserting a delay after a manipulation increased the effect on cognitive consistency in the goal activation condition, but not in the mind-set activation condition, as would be expected from theories of the time course of goal and mind-set activation.

4:30–4:45 (129)

Relative Rank Effects in Judgment and Choice. GORDON D. A. BROWN, *Warwick University*—Several cognitive models of judgment and decision making suggest that the relative ranked position of an option within a comparison context is an important determinant of judgment and choice. We summarize evidence for the importance of individuals' subjective beliefs about real-world distributions in determining the comparison context. We show how the relative rank principle operates on objective and subjective distributions in a number of different domains, ranging from actual product choice, through life satisfaction and its relation to income, to students' satisfaction with their university experience. We also show how rank-based social comparison can lead to herd behavior in interconnected networks of status-conscious agents.

4:50–5:05 (130)

Disjunction Fallacies in Probability Judgments About the Past and Future. VALERIE F. REYNA, *Cornell University*, JORDANA M. LIBERALI, *Erasmus University, Cornell University, and PUCRS*, & CHARLES J. BRAINERD, *Cornell University*—Disjunction fallacies in human probability judgment have been studied in many real-world contexts (e.g., the medical, legal, and investment arenas), both because they violate the axioms of probability theory and because they are featured predictions of support theory. The memory ideas that have been used to explain these errors are dated, because they do not incorporate contemporary dual-trace distinctions. However, fuzzy-trace theory provides a dual-trace account that ties these errors to gist rather than to verbatim traces. We report findings from a paradigm that supplies tests of this account by manipulating the strength of verbatim and gist memories of prior choices and eliciting probability judgments about the past and future. As predicted by the theory, the two types of judgments were related, as they are in memory. Moreover, disjunction fallacies were proportional to the strength of gist memory but were inversely proportional to the strength of verbatim memory.

5:10–5:25 (131)

Memory Is Irrational, Too: Disjunction Fallacies in Episodic Memory. CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*, ROBYN E. HOLLIDAY, *University of Leicester*, & KOYUKI NAKAMURA, *Cornell University*—Disjunction fallacies have been widely studied in probability judgment, as core illustrations of the irrationality of human judgment. Considering that assumptions about memory retrieval are commonly invoked to explain these errors (notably, support theory), it is remarkable that disjunction fallacies have not been studied in memory itself. Furthermore, there are at least two theoretical bases for predicting memory disjunction fallacies: fuzzy-trace theory's gist explanation of traditional disjunction fallacies and the conjoint-recognition model's principle of description-dependent memory. We confirmed this prediction in two sets of conjoint-recognition experiments. In the first, echoing the gist explanation of traditional disjunction fallacies, these errors could arise from gist memories of semantic relations that were present in study materials. In the second, disjunction fallacies could arise from item memories that did not carry contextual information. Across experiments, control of memory disjunction fallacies was achieved with several theoretically motivated manipulations (e.g., delay, concreteness, frequency, number of disjuncts).

Metamemory II
Illinois, Saturday Morning, 8:00–9:15

Chaired by Bennett L. Schwartz, Florida International University

8:00–8:15 (132)
Effects of Being in Tip-of-the-Tongue States on Subsequent Items.
BENNETT L. SCHWARTZ, *Florida International University*—The tip-of-the-tongue (TOT) state is the feeling that an inaccessible item will be recalled. In the TOT induction paradigm, participants are given a list of general-information questions or word definitions, and the participants must indicate whether they are in a TOT state for each item. The present study explored the effect that being in a TOT state has on the recall and the likelihood of a TOT state for the subsequent item. We conducted three experiments that used variants of the TOT induction paradigm. Each study found that TOT states do not affect the rate of recall for the next item but decrease the likelihood of a TOT state for the next item. Experiment 1C demonstrated that this effect extended to items occurring two items after the initial TOT state. Thus, TOT states are less likely to occur after another TOT state than after an item not involved in a TOT state. These data are interpreted within a metacognitive framework.

8:20–8:35 (133)
Metacognitive Control, Serial Position Effects, and the Effectiveness of Transfer to Self-Paced Study. MICHAEL C. FRIEDMAN & ALAN D. CASTEL, *UCLA* (read by Alan D. Castel)—Serial position effects illustrate that certain pieces of information are better remembered than others by sheer virtue of when they occur on a list. However, learners are aware of these effects only under very specific encoding conditions. The present research examines whether people can implicitly learn about these effects under fixed study-time conditions and then transfer what they learned to self-paced study-time conditions. Participants were given three lists of 15 words and studied each word for a set amount of time before being tested on that list. Participants were then given three additional lists but were now allowed to self-pace their study time. Recall was significantly greater and became more efficient on those subsequent lists, and participants' self-paced study times oppositely mirrored serial position recall (i.e., briefer study times toward the beginning and end of the list). Implications are discussed within the framework of metacognitive monitoring and control.

8:40–8:55 (134)
The Consensuality Principle for Confidence Judgments. ASHER KORIAT, *University of Haifa*—A confidence–accuracy (C–A) correlation is typically observed for general-information questions, suggesting that people can monitor the correctness of their answers. However, it was shown that this is because the correct answer is typically the consensual answer—the one that is consistently selected across participants. For a set of items for which the wrong answer is the consensual answer, the C–A correlation is negative (Koriat, 2008). The consensuality principle—that confidence actually monitors the consensuality of the answer, rather than its correctness—is shown to generalize to perceptual judgments and social beliefs. It is also shown to extend to a within-person analysis, so that confidence is high for responses that are made consistently by the same person, regardless of their correctness. The processes underlying the consensuality principle are discussed.

9:00–9:15 (135)
Is the Two-Alternative Forced Choice Recognition Test Really Criterion Free? JERWEN JOU & SHANEY FLORES, *University of Texas, Pan American*—According to the signal detection theory, people set a criterion in a yes/no recognition decision but use no criterion in a two-alternative forced choice (2AFC) test. We tested this theory in a 2AFC recognition test by using null test items in which neither item or both items were presented at study (so there should be no answer). Theoretically, these two types of items should be equally difficult. However, we found that both-presented pairs were answered as quickly as normal pairs (in which one item was and one was not presented), whereas neither-presented pairs were answered much more slowly. This result contradicts the idea that 2AFC is criterion free and suggests that a criterion may still be used in the 2AFC recognition test. This finding may have important theoretical implications.

Human Learning
Missouri, Saturday Morning, 8:00–9:55

Chaired by John B. Black, Teachers College, Columbia University

8:00–8:15 (136)
Embodied Interaction: Gestural Interfaces Promote Performance.
AYELET SEGAL, JOHN B. BLACK, & BARBARA TVERSKY, *Teachers College, Columbia University* (read by John B. Black)—Can action support cognition? This question is addressed by observing children's performance in arithmetic and numerical estimation. Arithmetic is a discrete task and should be supported by discrete, rather than continuous, actions. Estimation is a continuous task and should be supported by continuous, rather than discrete, actions. Children used either a gestural interface (multitouch; e.g., iPad) or a traditional keyboard/mouse interface. The actions either mapped congruently to the cognition or did not. If action supports cognition, performance should be better with a gestural interface that allows a higher level of direct manipulation of the objects and even better when the actions map conceptually to the desired cognition–gestural conceptual mapping.

8:20–8:35 (137)
Attempts to Circumvent the Failure-of-Further-Learning Effect: Activities, Meaning, and Delay. PETER E. MORRIS & CATHERINE O. FRITZ, *Lancaster University*—Little benefit is achieved through weekly repeated study and recall of text passages beyond initial learning: the failure-of-further-learning effect. We hypothesized that the effect occurs because a situation model of the text's gist is formed that dominates recall after verbatim memories are lost. Experiment 1 attempted to circumvent the effect by varying the activities of participants and requiring interactive exploration. Recall after four weekly sessions showed little benefit beyond performance on the first trial. The effect is very resistant to efforts to improve learning once texts have been comprehended. Experiment 2 examined learning of passages that were hard to comprehend without a title. Performance improved across four sessions when titles were not supplied, but the standard effect was replicated when titles were given. Experiment 3 incorporated re-presentations and tests into one session in which verbatim memories would still be available, and, as was predicted, recall improved over successive tests.

8:40–8:55 (138)
Learning Specificity: Modality Transfer in Following Navigation Instructions. VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado, Boulder*, & IMMANUEL BARSHI, *NASA Ames Research Center*—Learning has been shown to be specific to many conditions of training. This study investigated whether learning is specific to training modality. Subjects followed navigation instructions for movement in grids on a computer screen simulating a 3-D space by mouse clicking on the grids. They were trained, given a distractor task, and then tested. The modalities used as presentation formats included auditory verbal (hear words), visual verbal (read words), spatial (see path), and symbol (see arrows) modalities. Transfer was assessed from each of these formats to all of the others, including itself, and significant transfer was found only for testing with the visual format. If training is format specific, test performance should be lower when training and test formats differ than when they are the same. Significant specificity was found only for the symbol format. These results imply that the representations used to retain navigation instructions are partially modality dependent.

9:00–9:15 (139)
The Clicker Technique: An Effective Way to Compress Teaching Time. LINDSAY S. ANDERSON, ALICE F. HEALY, JAMES A. KOLE, & LYLE E. BOURNE, JR., *University of Colorado, Boulder* (read by Alice F. Healy)—The clicker technique is a newly developed system that uses frequent testing in the classroom to enhance students' understanding and provide feedback to them. In two experiments, students learned facts about unfamiliar plants and were given immediate and delayed multiple-choice tests of their knowledge. Each fact had two forms: general and specific. Experiment 1 compared fact acquisition under the clicker technique, with partially individualized teaching-time compression, with full study

(no teaching-time compression), dropout (individualized teaching-time compression), and yoked (nonindividualized teaching-time compression) control conditions. Experiment 2 examined the clicker components of studying and testing to determine which components are more important to fact learning. With specific facts, extra studying and testing together led to better learning than did extra studying or testing on its own. Test performance was better when teaching involved specific, rather than general, facts. The results support clickers as effective tools for acquiring, retaining, and transferring knowledge while compressing teaching time.

9:20–9:35 (140)

Providing Multiple Representations for Learning Neuroanatomy Produces Transfer and Benefits Long-Term Retention. JOHN R. PANI, JULIA H. CHARIKER, & FARAH NAAZ, *University of Louisville*—In computer-based instruction, experimental participants explored 3-D and sectional models of neuroanatomy in repeated phases of study, test, and feedback until a high performance criterion was reached. There was substantial transfer of learning from whole to sectional anatomy. In addition, participants who learned whole and sectional anatomy had much better long-term retention for sectional anatomy after 6 weeks than did those people who learned only sectional anatomy. This was especially true for more difficult neuroanatomical structures. Transfer of knowledge to the identification of structures in biomedical images was very good, lending strong support to the effectiveness of these computer-based methods of instruction. Overall, integrating the learning of two forms of representation (whole and sectional anatomy) requires more trials than does learning just one form of representation, but two things are learned rather than one, and the more challenging representation (sectional anatomy) is learned more efficiently and effectively.

9:40–9:55 (141)

General Knowledge About Information Encountered in Reliable and Unreliable Sources: Illusory Truth As a Function of Source Reliability and Repetition. LINDA A. HENKEL, *Fairfield University*, & MARK E. MATTSON, *Fordham University*—People may come to believe that information they have encountered is true, with little or no knowledge as to where the information came from. After studying little-known but factual statements from different sources varying in their stated reliability, participants rated the degree to which they believed various statements to be true and separately indicated which statements they remembered reading from a given source. The results showed that statements read multiple times were perceived as more valid and were more often correctly identified on a general knowledge test than were statements read once or not at all. This occurred whether the statements originated from a reliable or an unreliable source and occurred when people had little memory for the statements themselves or their source. Familiarity may create an illusion of truth for statements when people lack source-specifying cues, especially cues regarding the reliability of the source.

Psycholinguistics II
Mississippi, Saturday Morning, 8:00–9:55

Chaired by Albert N. Katz, University of Western Ontario

8:00–8:15 (142)

The Gendered Pragmatics of Verbal Social Exchange. JONATHAN WOODBURY & ALBERT N. KATZ, *University of Western Ontario* (read by Albert N. Katz)—Social exchange is a basic facet of human interactions. Here, we look at the linguistic manifestations of asking for and having a favor performed. Participants were presented with very short passages in which Person A asked Person B for a favor, Person B performed the favor, and Person A expressed gratitude. Within this basic paradigm, we manipulated the social-dominance relationship between A and B, the gender of the favor-asker, and the directness with which the favor was asked. In contrast to theorists who argue that the gratitude exchange is phatic in nature, we observed that there were numerous tokens of acknowledgment, that these responses could be classified into four major categories (neutral, accommodating, nonaccommodating, and social interactive), and that the form of the acknowledgment varied directly with the social factors we manipulated. Of importance, both the

perceptions and acknowledgments were informed by the gender of the participants in the passages and of the respondents.

8:20–8:35 (143)

Age-Related Stability in Syntactic Constraints During Homophone Spelling. KATHERINE K. WHITE, GREGORY M. PALM, & ASHLEY M. LADD, *Rhodes College*, & LISE ABRAMS, *University of Florida*—Semantic primes influence homophone errors during sentence production, where primes (*month*) increase the likelihood of producing the alternate (*week*) instead of the target homophone (*weak*). This experiment investigated influences of a homophone's grammatical class and sound–spelling consistency on semantically primed homophone errors. Young and older adults typed auditorily presented sentences containing homophones preceded by a prime semantically related to the alternate or by an unrelated word. Homophones shared or differed in part of speech, and their shared phonology had a more consistent (*eak*) or less consistent (*eek*) spelling. While older adults made fewer errors overall, semantic priming increased errors for both age groups, but only when homophones shared part of speech. Independently of priming, both groups made more errors when homophones contained a more consistent spelling, with larger effects for young adults. These findings demonstrate age preservation in syntactic constraints on lexical selection but age differences in orthographic influences during orthographic encoding.

8:40–8:55 (144)

fMRI Activation in Language Network Predicts Future Reading Ability. CHRISTOPHER McNORGAN, AUBRY ALVAREZ, ANNUM BHULLAR, JESSICA GAYDA, & JAMES R. BOOTH, *Northwestern University*—Identifying early indicators of reading difficulty both is diagnostically useful and provides insight into normal reading development. A longitudinal study followed 25 normally developing children who were initially assessed for reading skill and performed a rhyming judgment task using fMRI. Patterns of brain activation in this task predicted changes between an initial and a follow-up assessment of reading skill administered up to 6 years later. Increased activity in two circuits associated with phonological processing was predictive of greater gains in reading fluency in younger children, whereas increased activity in orthographic and semantic processing circuits was predictive of smaller gains in reading fluency for older children. These results suggest that how communication between areas that process word spelling, sound, and meaning changes developmentally plays a major role in developing reading fluency and is predictive of reading achievement.

9:00–9:15 (145)

Differential Age Effects on Lexical Ambiguity Resolution Mechanisms. KARA D. FEDERMEIER & CHIA-LIN LEE, *University of Illinois, Urbana-Champaign*—One of the core features of human languages is that a single form is oftentimes associated with multiple interpretations (e.g., the word "duck" can refer to a bird or an evasive action). We investigated how these ubiquitous one-to-many mapping problems are resolved in a series of event-related potential studies manipulating the type of available disambiguating context information (syntactic only or both syntactic and semantic; biased toward the dominant or the subordinate meaning of the homograph). Data were collected from both younger and older adults to further determine how ambiguity resolution processes change with normal aging. The results revealed functionally and neurally separable mechanisms involved in lexical ambiguity resolution, including top-down executive processes and more automatic aspects of semantic processing, which are differentially affected by age. With advancing age, more automatic semantic-processing mechanisms are relatively well maintained, whereas top-down mechanisms tend to become less effective, with downstream consequences for comprehension.

9:20–9:35 (146)

Only To-Be-Named Objects Are Semantically Processed During Multiple Object Naming. ELIZABETH R. SCHOTTER, VICTOR S. FERREIRA, & KEITH RAYNER, *University of California, San Diego* (read by Keith Rayner)—Several studies on multiple object naming have shown that two objects can be processed in parallel. However, none of these studies have determined whether these objects are processed as a consequence

of being in the visual field or whether they are processed only if speakers intend to name them. In two experiments, we tested the extent to which semantic information is obtained from an object that is completely irrelevant to the task (i.e., never needs to be named). We presented brief previews of both to-be-named and never named objects that were either related (a mirror image) or unrelated (visually, phonologically, and semantically) to a named target object. In both experiments, only to-be-named objects provided a preview benefit (faster processing when the preview was related than when it was unrelated), indicating that only objects in locations that are part of the task set are processed for semantic information.

9:40–9:55 (147)
False Memories for Phonologically Similar Words: The Influence of the Clustering Coefficient. MICHAEL S. VITEVITCH & KIT YING CHAN, *University of Kansas*—In the false memory paradigm, participants "recall" items that were actually not presented to them. This effect is typically observed among semantically related words, but in the present case, participants heard phonologically related words that differed on a measure used in network science—the clustering coefficient—which refers to the extent to which phonological neighbors of a target word are also neighbors of each other. For example, the word CAT has as neighbors RAT and HAT (which are also neighbors of each other), whereas the word DOG has as neighbors LOG and DIG (which are not neighbors of each other). After hearing lists of phonological neighbors, participants falsely recalled more target words like DOG, with a low clustering coefficient, than target words like CAT, with a high clustering coefficient. This finding suggests that lexical retrieval processes are influenced by the structure of the network found among words in long-term memory.

Explicit Memory III
Meramec, Saturday Morning, 8:00–9:35

Chaired by Kristi S. Multhaup, Davidson College

8:00–8:15 (148)
The Effect of Accountability on Unconscious Plagiarism. BLAIRE J. WEIDLER & KRISTI S. MULTHAUP, *Davidson College*, & MARK E. FAUST, *University of North Carolina, Charlotte* (read by Kristi S. Multhaup)—Johnson, Hashtroudi, and Lindsay (1993) argued that motivation affects source-monitoring performance. Prior tests of this idea confounded increased motivation with additional instructions about how to improve performance or offered concrete rewards for improvement, something rarely encountered in everyday situations. The present study isolated the effect of motivation on source-memory performance by using accountability to increase motivation. Sixty undergraduates participated in an adaptation of Marsh and Bower's (1993) Boggle puzzle task. Half were rendered accountable by hearing that they would review their responses with the researcher later. All participants generated puzzle solutions with a computer partner, recalled their own previously generated solutions, and found new words in the puzzle. Accountable participants plagiarized less than did control participants when initially generating words and when generating new solutions, but not when they recalled their own words. The data support the source-monitoring framework and call for further study of how motivation affects source monitoring.

8:20–8:35 (149)
Two Alternatives to Switch-Cost Scoring in the Task-Switching Paradigm: Their Reliability and Resilience to Gaming. MEREDITH A. MISLEVY, ANITA R. BOWLES, JARED A. LINCK, JOEL T. KOETH, & MICHAEL F. BUNTING, *University of Maryland CASL* (read by Michael F. Bunting)—Two scoring methods for the task-switching paradigm are presented and compared with a traditional scoring method, a reaction time switch-cost score. The switch cost is a difference score, notorious for its low reliability, so a rate-score residual score and bin score are explored as more reliable alternatives. The threat of validity from rapid, random responding is also compared across the scoring methods, where switch-cost scoring often fails to identify and penalize participants with low motivation to complete the task as instructed or who "game" the task and appear to enhance their performance. The rate-score residual score and bin score incorporate information about participants' accuracy and are shown to

both identify and penalize rapid, random responders. The potential advantages and drawbacks of each scoring method are discussed.

8:40–8:55 (150)
Investigating Instructed-Compatibility Effects. BAPTIST LIE-FOOGHE, *Ghent University*, DORIT WENKE, *Max Planck Institute for Human Cognitive and Brain Sciences*, & JAN DE HOUWER, *Ghent University*—Not much is known on how instructions control actions. An interesting effect, in this context, is the instructed-compatibility effect. This effect is observed when participants are instructed to implement instructed stimulus–response mappings for an upcoming task. Before this task can be performed, an unrelated task is presented that uses the same stimuli and responses in a different context. Performance in this embedded task is biased by the instructed stimulus–response mappings. The present study investigated the characteristics of the instructed-compatibility effect. First, we investigated to what extent implementation is needed, or whether the mere maintenance of instructed stimulus–response mappings in verbal working memory is sufficient. Second, we tested the generality of the instructed-compatibility effect. The results indicate that implementation is a key component and that instructed-compatibility effects are generalizable to certain extent. The results are discussed in view of the possible processes underlying instruction-based action control.

9:00–9:15 (151)
Emotionally Negative and Positive Events Play Different Roles for Life Story and Identity. DORTHE BERNTSEN, *Aarhus University*, DAVID C. RUBIN, *Duke University*, & ILENE C. SIEGLER, *Duke University School of Medicine and Duke University*—Over 2,000 adults in their sixties completed the Centrality of Event Scale (measuring the centrality of an event for life story and identity) for their most positive and most negative or traumatic life events, as well as measures of current PTSD symptoms, depression, well-being, and personality. The positive events were judged to be markedly more central to life story and identity than were the negative events, consistent with the notion of a positivity bias. The centrality for positive events was unrelated to measures of emotional distress, whereas the centrality for the negative event showed clear positive correlations with these measures. The centrality for the positive events increased with increasing time since the events, whereas the centrality for the negative events decreased, consistent with the idea that negative events cause immediate mobilization, followed by minimization. Thus, positive and negative life events play different roles in the life story and identity.

9:20–9:35 (152)
Age Invariance in Episodic and Semantic Feeling-of-Knowing Accuracy. DEBORAH K. EAKIN, *Mississippi State University*, CHRISTO-PHER HERTZOG, *Georgia Institute of Technology*, & WILLIAM HARRIS, *Mississippi State University*—We examined whether age differences in feeling-of-knowing (FOK) resolution would be obtained for episodic memory, a type of memory for which age differences are typically obtained, as compared with semantic memory, a type of memory that is maintained with age. Younger and older adults viewed pictures of famous (semantic) versus nonfamous (episodic) face/name pairs and were tested on their memory for the name of the presented face. Participants viewed the faces again and made FOKs about future recognition of the name associated with the presented face. Finally, four-alternative forced choice recognition memory was tested, and confidence judgments were collected for each face. Age differences were not obtained in memory or FOK resolution (within-person Goodman–Kruskal gamma correlations) for semantic information. However, although age differences were obtained in episodic memory, FOK resolution was equivalent in young and old adults. The findings provide support for a separate-systems view of memory and metamemory.

Spatial Cognition II
Chouteau, Saturday Morning, 8:00–9:55

Chaired by Bradley R. Sturz, Armstrong Atlantic State University

8:00–8:15 (153)
Orientation in Trapezoid-Shaped Enclosures: Implications for Theoretical Accounts of Geometry Learning. BRADLEY R. STURZ,

Armstrong Atlantic State University, & KENT D. BODILY, *Georgia Southern University*—Participants learned to select one of four distinctively marked corners in a rectangular virtual enclosure. After training, control and test trials were interspersed with training trials. On control and test trials, all markers were equivalent in color, but only during test trials was the shape of the enclosure manipulated. For each test trial, a single long wall or short wall of the enclosure was increased to be twice as long as or was decreased to be half as long as that present in the training enclosure. These manipulations produced eight trapezoid-shaped enclosures. Participants selected one corner during control and test trials. Performance during control trials revealed that participants selected the correct and rotationally equivalent locations. Performance during test trials revealed that participants selected locations in trapezoid-shaped enclosures that were consistent with those predicted by global geometry (i.e., principal axis of space) but inconsistent with those predicted by local geometry (i.e., number of training features present at a location).

8:20–8:35 (154)

Precedence of Spatial Pattern Learning Revealed by Immediate Reversal Performance. MICHAEL F. BROWN, *Villanova University*, & BRADLEY R. STURZ, *Armstrong Atlantic State University*—In previously reported experiments, human participants searched for target locations in a 4×4 grid of locations on an LCD display. The target locations were arranged either in a structured spatial pattern or randomly. After participants learned the correct locations, the identities of the target and nontarget locations were reversed. Participants for whom target locations were arranged in a spatial pattern showed immediate reversal of performance, indicating that the targets were learned in terms of their spatial pattern, and not in terms of their individual locations. The experiments reported here show the generality of this effect, and an alternative explanation in terms of motor pattern learning is examined.

8:40–8:55 (155)

Scene Recognition Following Viewpoint Shifts Caused by Observers' Locomotion. HONG-JIN SUN, MARK WADE, CHRISTOPHER J. TEETER, & VEDRAN DZEBIC, *McMaster University*—Scene recognition performance is reduced when an observer undergoes a viewpoint shift, but the cost is less for shifts caused by observer locomotion, as compared with scene rotation. In this study, participants learned spatial arrangements of five identical objects positioned on top of a rotatable table and then identified changes to the scene (relative position change of one of the objects) after undergoing viewpoint shifts of various magnitudes. Experiment 1 showed that the facilitative effect of locomotion is robust across a wide range of viewpoint shifts. The results of Experiment 2 suggested that active control over the viewpoint shift may partially account for the benefit of locomotion. However, Experiment 3 showed that body-based cues gained during locomotion facilitate performance beyond actively controlling the viewpoint shift alone and that information about body movement that is acquired online during a viewpoint shift is used to facilitate scene recognition.

9:00–9:15 (156)

Remembering Objects in Unusual Locations: Effects of Imagery or Semantic Instructions. W. SCOTT TERRY, *University of North Carolina, Charlotte*—People sometimes put an object in an unusual place, mistakenly believing the distinctive location will be readily recalled later. In three experiments, college students studied object–location pairings and were tested for object-cued recall of the locations. Fewer unusual locations were recalled than usual locations both when the subjects selected the locations and when the experimenter made the assignment, and when testing occurred 20 min or 7 days after study. An instruction to use mental imagery reduced forgetting somewhat over 7 days, whereas a semantic elaboration that connected object and location was more effective in improving delayed recall. Subject-rated likelihood of remembering did not vary with instructions.

9:20–9:35 (157)

A Multisource Approach to Scene Representation: Evidence From Haptic Exploration. HELENE INTRAUB & SHANNA DELANEY, *University of Delaware*—Observers remember seeing beyond the edges of a view (boundary extension; BE). Providing a marker for boundary location (e.g., main object touching a boundary) draws eye fixations but fails to prevent BE (Michod, Dickinson, & Intraub, 2010). Three experiments tested a haptic analogue to determine whether touch (a contact sense) would support veridical representation of object/boundary contiguity. Blindfolded observers ($N = 93$) manually explored three bounded scene regions for 1.5 min each. At test, they indicated the remembered boundary location. When no objects touched a boundary, observers remembered feeling beyond them (mean area increase = 35%). When an object touched a boundary, surprisingly, observers remembered feeling a sizable swath of space between them (mean area increase = 38%–39%). Rather than indicating memory failure, the results are consistent with a multisource model of scene representation that does not simply reflect the sensory input (haptic or visual) but represents the world that a given view only partially reveals.

9:40–9:55 (158)

Effects of Spatial Cuing on the Onset Repulsion Effect. TIMOTHY L. HUBBARD, *Texas Christian University*, & SUSAN E. RUPPEL, *University of South Carolina, Upstate*—In the onset repulsion effect (ORE), memory for the onset location of a moving target (i.e., memory for the location at which a moving target initially appeared) is displaced in the direction opposite to target motion. In Experiments 1 and 2, spatial cues were presented prior to the appearance of a horizontally moving target. In Experiment 1, presentation of a cue that indicated target onset location decreased ORE, relative to a no-cue condition, but did not eliminate ORE. In Experiment 2, valid cues (located at actual onset locations) and invalid cues (located on the opposite side of the display from actual onset locations) of target onset location each resulted in significant ORE, and ORE was larger with invalid cues than with valid cues. The data suggest that at least one component of ORE involves an automatic process and is not eliminated by increases in attention to the location of target onset.

Judgment and Decision Making III
Lewis and Clark, Saturday Morning, 8:00–9:35

Chaired by Jerome R. Busemeyer, Indiana University, Bloomington

8:00–8:15 (159)

Interactions Between Categorization and Decision Making. JEROME R. BUSEMEYER, *Indiana University, Bloomington*, & ZHENG WANG, *Ohio State University*—In a categorization–decision task, participants are shown faces, and then they are asked to categorize them as belonging to either a "good" guy or a "bad" guy group, and/or they are asked to decide whether to take an "attack" or a "withdraw" action. Three test conditions are compared: In the C-then-D condition, participants make a categorization, followed by an action decision; in the C-alone condition, participants only make a categorization; and finally in the D-alone condition, participants only make an action decision. The results show that participants are more likely to attack in the D-alone condition than in the C-then-D condition, even when they categorized the face as a "bad" guy. These results cannot be explained by signal detection, Markov, and exemplar models but can be by a quantum decision model.

8:20–8:35 (160)

A Causal Model of Intentionality Judgment. STEVEN A. SLOMAN & PHILIP M. FERNBACH, *Brown University*, & SCOTT EWING, *Roger Williams Law School*—We propose a causal model theory to explain Knobe's (2003) finding of an asymmetry in judgments of the intentionality of a foreseen side effect that is either harmful or helpful. The theory is implemented as a computational model that integrates several previous hypotheses. It posits two basic forms of inference: a bottom-up inference from action to desire and a top-down inference from beliefs and desires to intention. The model uses a Bayesian network whose qualitative structure conforms to the relations among belief, desire, intention, and action (Malle & Knobe, 1997). Support for the theory comes from studies that have tested the model's prediction that bottom-up inference should occur only when the actor's primary objective is known. The model is fit to intentionality judgments with no free parameters.

8:40–8:55 (161)
Disentangling Computational Models of Choice RT. MARIUS USHER & ANDREI TEODORESCU, *Tel Aviv University*, KONSTANTINOS TSETSOS, *University College London*, & JAMES L. McCLELLAND, *Stanford University*—Although race and diffusion models for choice RT rely on different principles for integration of evidence and decision termination, both of them are able to account for typical data patterns. Here, we show that the models can be disentangled with a number of experimental manipulations. In particular, we examine the effects of cuing (assumed to affect the starting point) and of the time course of the evidence. The results indicate support for competition in the integration of evidence and decision making.

9:00–9:15 (162)
The Feasibility of Deriving Personality Information From the Statistical Regularities in Language. CURT BURGESS, STACEY ACEVEDO, KRYSTLE TRAN, MICHELLE MORRIS, & LANNAH HO, *University of California, Riverside* (sponsored by Curt Burgess)—Concept acquisition models such as HAL, LSA, and other similar models have been used to explore a very broad range of cognitive, psycholinguistic, and, more recently, social phenomena. The statistical regularities that define a word's context have proven to be a rich set of constraints. More recent results from our lab have included analyses of the personality characteristics of proper names, of the social biases inherent in occupation titles, of the extraction of meaning from dolphin communication, of the regional dialect in whale song, and of the differences in courtship songs of wild type and Fragile X mice. In the present research, a volume of the Twilight novel series (*Midnight Sun*) was used as the language sample. A set of personality descriptors (words that occurred in the text) was generated, and raters evaluated the relationship of the personality terms to several characters. We report an analysis using word vector elements and other variables as predictors of the human personality ratings.

9:20–9:35 (163)
Semantic Coherence in Conditional Probability Estimates: 2 × 2 Tables As Pedagogic Interventions. CHRISTOPHER R. WOLFE & CHRISTOPHER R. FISHER, *Miami University* (sponsored by Christopher R. Wolfe)—A constellation of conditional probability estimates is semantically coherent when quantitative estimates of $P(A)$, $P(B)$, $P(A|B)$, and $P(B|A)$ are consistent with the relationship among sets in the problem statement. Two experiments used 2 × 2 tables as pedagogic interventions. In both experiments, subsets and overlapping sets were the most difficult, and participants exhibited a moderate degree of semantic coherence. In Experiment 1, 2 × 2 table participants exhibited significantly greater semantic coherence on overlapping sets problems. In Experiment 2, a more elaborate intervention reduced inconsistent responses for subset and overlapping sets problems and increased semantic coherence for subsets. The intervention undermined performance on independent sets problems.

SYMPOSIUM III
Criteria, Confidence, and Recognition Memory
Illinois, Saturday Morning, 9:45–11:55

Chaired by Ian G. Dobbins, Washington University

9:45–10:00 (164)
Introduction. IAN G. DOBBINS, *Washington University*

10:05–10:20 (165)
Decision Noise in Recognition. AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—A tacit but fundamental assumption of the theory of signal detection is that criterion placement is a noise-free process. Yet maintaining and updating criteria would seem to pose a considerable burden on memory. This talk challenges that assumption on theoretical and empirical grounds and presents the noisy decision theory of signal detection (ND–TSD). I review recent empirical work that suggests the presence of criterion noise and discuss in detail the ensemble recognition paradigm, which provides a means of quantifying criterion variability. That experiment reveals that criterion noise is not trivial in magnitude and contributes substantially to variance in the slope of the isosensitivity function.

ND–TSD can help explain a number of current and historical puzzles in recognition memory and can provide a mechanism for rapprochement between theories of decision making that employ deterministic response rules and those that postulate probabilistic response rules.

10:25–10:40 (166)
Threshold and Graded Recollection in Recognition. COLLEEN M. PARKS, *University of Nevada, Las Vegas*—Recollection has been shown to operate according to two opposing models, threshold and signal detection models. Threshold models maintain that recollection can fail (fall below threshold), whereas signal detection models treat recollection as a continuous process. Recent research has revealed some influences on the nature of recollection, but general reasons why threshold patterns emerge in some conditions and graded patterns emerge in others are still unclear. One potential explanation is the number of contextual details; recollection of stimuli with few details may succeed or fail, whereas recollection of stimuli with many details may be graded. If true, manipulating amount of detail should produce threshold patterns for "few details" conditions but more graded patterns for "many details" conditions. The results, however, are mixed: Number of details affects the nature of recollection in some tasks, but not in others. Overall, results indicate that recollection can fail but can also be graded when successful.

10:45–11:00 (167)
Strong Memories Are Not Scalable. JOHN T. WIXTED, *University of California, San Diego*—People are generally skilled at using a confidence scale to rate the strength of their memories over a wide range. Specifically, low-confidence recognition decisions often yield close-to-chance accuracy, whereas high-confidence recognition decisions can be associated with close-to-perfect accuracy. However, using a 20-point rating scale, we found that the ability to scale memory strength had its limitations, in that a high proportion of list items received the highest rating of 20. Repeated and varied efforts to induce participants to differentiate between these strong memories were not successful. These results may indicate a special and qualitatively different state of strong memory, or they may suggest that the ability to differentiate between strong (and almost perfectly accurate) memories is absent because of the absence of differential error feedback for very strong memories in the past (the kind of differential error feedback that may account for the impressive memory-scaling expertise that participants otherwise exhibit).

11:05–11:20 (168)
Preparatory Cues and Recognition Accuracy and Confidence. IAN G. DOBBINS, *Washington University*—Recognition experiences outside the laboratory are heavily context related. For example, encountering a familiar face is more likely at a small, frequently attended conference than in the airport traveling to that conference. We have begun examining the ability of observers to incorporate contextual cues into recognition judgments, using a Posner-like paradigm where cues probabilistically forecast ("likely old" vs. "likely new") the status of each upcoming recognition probe. Initial findings suggest that although response rates are heavily dependent on cue validity, participants often fail to optimally integrate cues and evidence, even when fully informed about overall cue validity. Additionally, cue influence on confidence is often larger for new than for old materials. Thus, overall, observers do not increasingly use the cues on trials in which their internal evidence is most suspect, and they are more sensitive to contextual information when concluding that a stimulus is novel versus recognized.

11:25–11:40 (169)
The Pervasive Problem of Criterion Setting. SCOTT D. BROWN, *University of Newcastle*—As others in this symposium will discuss, there has been quite a lot of recent activity investigating how the decision threshold might be adjusted in models based on signal detection theory. This problem has been difficult to solve, because so many factors can influence criterion setting (stimulus manipulations, metacognitive strategy, payoffs, perceived accuracy, etc.), and there can even be situations in which a single decision threshold is insufficient to explain behavior. We take a different approach to the problem: removing the need for a decision threshold altogether. Instead, we develop a new nonparametric and dynamic model that describes how the underlying stimulus

representations develop. These representations themselves (the "signal" and "noise" distributions) are used to estimate likelihoods and make decisions without a threshold on the usual axis. We present simulations of the model to examine its behavior and several experiments that provide data to which we fit the model.

Selective Attention
Missouri, Saturday Morning, 10:20–11:55

Chaired by Steven Yantis, Johns Hopkins University

10:20–10:35 (170)
Reward-Driven Attentional Capture. BRIAN A. ANDERSON, PATRYK A. LAURENT, & STEVEN YANTIS, *Johns Hopkins University* (read by Steven Yantis)—Involuntary attentional capture has long been thought to depend on both physical stimulus salience and current perceptual goals. Recent evidence suggests that high attentional priority accrues to stimuli that predict reward, facilitating the voluntary deployment of attention. We examined whether stimuli previously associated with different amounts of reward differentially capture attention in a subsequent task when those stimuli are irrelevant and no longer predictive of reward. We found strong evidence for reward-driven attentional capture that cannot be attributed to physical salience or to voluntary search strategies. The effect lasted for hundreds of trials before extinguishing. Furthermore, we observed that individual differences in behavioral sensitivity to reward during learning were significantly correlated with differences in the magnitude and duration of reward-driven attentional capture. Our findings reveal a novel mode of attentional capture that is uniquely reward driven and offer an experimental model for investigating the involuntary influence of value-based salience.

10:40–10:55 (171)
There Can Be Only One: Emotion-Induced Blindness Reflects Competition for Representation in Time and Space. STEVEN B. MOST & LINGLING WANG, *University of Delaware*—Emotional stimuli impair awareness of immediately subsequent information, an effect known as "emotion-induced blindness." We present evidence that mechanisms driving emotion-induced blindness can be dissociated both from spatial attention (which emotional stimuli typically attract to their location) and from central bottlenecks, such as competition for access to visual working memory. Instead, evidence suggests that emotion-induced blindness stems from midlevel perceptual competition, whereby a target and emotional stimulus that might be linked by the perceptual system to a shared spatiotemporal position (due to rapid sequential presentation) jockey to become the "winning" episodic representation. In two experiments, targets and emotional or neutral distractors were embedded in one of two simultaneous rapid streams of items, and on each trial, the distractor and target could appear either in the same stream or in streams opposite from each other. Consistent with a spatiotemporal competition account, emotion-induced blindness was reliably localized to the location of an emotional stimulus.

11:00–11:15 (172)
Feature Binding in Auditory Spatial Memory: Evidence From Location and Identity Negative Priming. SUSANNE MAYR & AXEL BUCHNER, *Heinrich Heine University Düsseldorf*—Two experiments are reported with identical auditory stimulation in 3-D space. Participants localized a cued sound (Experiment 1) or identified a sound at a cued location (Experiment 2). A distractor sound had to be ignored. The prime distractor and the probe target were manipulated with respect to sound identity and location (repetition vs. change). The localization task revealed symmetric partial repetition costs: Participants were impaired in trials with identity–location mismatches between the prime distractor and probe target—that is, when the sound was repeated but not the location or vice versa. The identification task revealed asymmetric costs: Trials with prime-to-probe location changes of a sound identity were impaired; identity changes at a repeated location were not impaired. It is concluded that feature binding takes place regardless of the task. Instructions determine the kind of identity–location mismatch that is detected. Identity predominates over location information in auditory memory.

11:20–11:35 (173)
Who You Look At Is Related to How You Feel About Your Body. CHRISTINA JOSEPH, SARAH C. SAVOY, & MAGGIE SHIFFRAR, *Rutgers University, Newark* (read by Maggie Shiffrar)—How do observers distribute their visual attention across groups of people? Women with high body dissatisfaction (an eating disorder predictor) selectively attend to thin female bodies (Glauert et al., 2009). We examined whether this bias generalizes to objects and to male observers. Body dissatisfaction and body mass were measured in male and female participants. Participants then completed an arrow-probe attention task. Pairs of thin and fat bodies or buildings appeared, followed by an arrow probe located where a thin or fat body/building had been. Participants judged arrow direction. Reaction time differences indicated that female, but not male, observers spontaneously attended to thin bodies. High levels of body dissatisfaction, but not body mass, correlated with this attentional bias. Building observation showed no bias. These results support previous findings and suggest that there is a relationship between how one feels about one's own body and how one attends to the social world.

11:40–11:55 (174)
Attentional Setting Versus Spatial Attention in Artificial Grammar Learning. BARUCH EITAM, ARIT GLICKSOHN, RAN HASSIN, YAACOV SCHUL, & ASHER COHEN, *Hebrew University of Jerusalem* (read by Asher Cohen)—The involvement of different attentional systems in implicit learning has been a central issue in this domain. Here, we contrast the role of two attentional mechanisms, spatial attention and task-based selective attention, in the learning of artificial grammar. In all our experiments, participants were exposed during training simultaneously to a series of two distinct (either in space or in time) streams of colors and were required in various ways to monitor one of the streams. In most conditions, each stream was constructed by a distinct grammar. In different experiments, we used different but converging methods in which both streams of colors were presented within the attentional spotlight. The results of all the experiments were consistent: Participants learned the grammar of the relevant stream but did not learn the grammar of the irrelevant stream, even though both streams were within the attentional spotlight. We discuss the theoretical implications of our findings.

Discourse Processing
Mississippi, Saturday Morning, 10:20–11:55

Chaired by Rick Dale, University of Memphis

10:20–10:35 (175)
Nonlinear Dynamics of Perspective Taking. NICHOLAS D. DURAN, RICK DALE, & ROGER J. KREUZ, *University of Memphis* (read by Rick Dale)—This study explores how participants represent spatial layouts in communication and whether an egocentric or an allocentric (i.e., "other-centric") perspective is primary. This line of inquiry has contributed to many insights in the areas of pragmatics, embodiment, and social cognition. We provide a novel extension of this research by interpreting simple perspective-taking behavior as a nonlinear dynamical process. Central to our claim is that fundamental dynamical properties that exist throughout nature also exist at the level of high-level human cognition. By identifying and modeling these properties (e.g., attractors, hysteresis, control parameters), we can explain a comprehensive set of response patterns, including differences in consistently responding egocentrically or allocentrically, persistence in one type of response perspective, and modulation of responding based on inferences of another's mental state. In this straightforward application of dynamics, we also introduce a Flash-based online game that captures perspective-taking behavior with minimal task demands.

10:40–10:55 (176)
What is Retained in Common Ground? Distinct Effects of Linguistic Versus Physical Co-Presence. ALEXIA GALATI, *Stony Brook University and University of Cyprus*, & SUSAN E. BRENNAN, *Stony Brook University* (read by Susan E. Brennan)—Recent work has charted the time course by which common ground is used in language processing; however, less is known about exactly what is represented in common ground. Do speakers keep track of how information is shared with addressees? In

32 triads, directors arranged cards separately with two matchers, sharing some cards linguistically and physically, some only linguistically, some only physically, and others not at all. Subsequently, directors arranged all cards in separate rounds with each matcher. References to cards previously shared only physically included more words, details, reconceptualizations, and hedges than did those shared only linguistically, which, in turn, included more than did those shared both linguistically and physically. Moreover, expressions were pronounced more clearly for cards shared only physically than for those shared only linguistically. This suggests that the modality with which common ground is established is represented in episodic traces that shape speaking, for both inferential processes (utterance planning) and fast-acting ones (articulation).

11:00–11:15 (177)
Is It Real, or Is It Memorex? Examining the Influence of Communicative Context on Memory-Based Processing in Reference Resolution. WILLIAM S. HORTON & DANIEL G. SLATEN, *Northwestern University*—During conversation, passive cue-based memory mechanisms can facilitate access to partner-specific information. However, partner specificity may emerge most strongly when memory traces are established during genuine interactions. The present work examines this claim by comparing the influence of different communicative contexts on reference resolution. In a previous eyetracking experiment using prerecorded stimuli, we found that speaker-specific associations helped listeners anticipate possible targets of referring expressions. In the present study, we compared two new speaker conditions: a live condition in which listeners established speaker-specific associations with two real confederates, and a synthesized condition in which listeners established similar associations with two synthesized voices. Listeners in the live speaker condition looked more quickly to target items than did listeners in the synthesized speaker condition, but not more quickly than did listeners in a prerecorded human speaker condition. Memory-based processing may be sensitive to the social cues present in both interactive and noninteractive contexts.

11:20–11:35 (178)
Filling in the Gaps: Processing Ellipsis in Visually Presented Narratives. KRISTOPHER J. KOPP & JOSEPH P. MAGLIANO, *Northern Illinois University*, & DAVID N. RAPP, *Northwestern University* (read by Joseph P. Magliano)—Visually presented narratives cannot depict all of the information making up an action sequence. This study assessed the extent to which viewers infer different types of information left out of a picture story. Participants viewed illustrated stories containing event sequences consisting of three pictures: an initiating event, an action, and an outcome. Experimental versions of the stories removed one of the three pictures from the sequences. After viewing the stories, participants completed a recognition task for presented pictures, as well as for unviewed pictures that were left out of the sequences. Across two experiments, participants exhibited strong memory for explicit information at event boundaries and were more likely to falsely identify actions that could have occurred between event boundaries. These results support findings from previous work on event comprehension and, additionally, identify the particular types of inferences that readers of graphic narratives might construct to understand depicted events.

11:40–11:55 (179)
Reliability and Validity of the LISN Test of Comprehension of Spoken Passages. LINDSEY C. DAVIES, SANDRA HALE, JOEL MYERSON, MITCHELL S. SOMMERS, NANCY TYE-MURRAY, & BRENT SPEHAR, *Washington University* (read by Sandra Hale)—This study assessed the reliability and validity of multiple forms of the LISN test developed for longitudinal assessment of comprehension of extended spoken passages. The LISN has good ecological validity because it uses passages of lectures, interviews, and spoken narratives taken from transcripts of actual utterances. Each form consists of six passages, two of each type. Twenty-five undergraduates viewed video clips of all of the passages being read by professional actors. We now have five forms of six passages each that show good split-half reliability (rs < .70) and good alternate-form reliability (rs < .70). These forms also have good construct validity, as evidenced by the fact that, on average, they correlate .79 with an existing listening comprehension test, .64 with a reading comprehension test,

and .43 and .45 with tests of fluid and crystallized intelligence. These LISN forms provide a valuable tool for future studies, longitudinal and otherwise, involving within-subjects measurement designs.

Picture Processing
Meramec, Saturday Morning, 10:00–11:55

Chaired by Jeremy M. Wolfe
Brigham and Women's Hospital and Harvard Medical School

10:00–10:15 (180)
Does This Beach Make Me Look Like an Animal? Flexible Weighting of Evidence in Rapid Identification of Scene Properties. JEREMY M. WOLFE & KARLA K. EVANS, *Brigham and Women's Hospital and Harvard Medical School*—Observers detect categorical stimuli (e.g., "animal," "beach") in brief, masked scenes. Suppose that a scene contains two task-relevant properties ("animal on a beach"). If observers are looking for "animal" in this scene, the presence of the beach will interfere with the reportability of the presence of an animal. If the other category is not task relevant (e.g., "mountain"), it will not interfere. If the task is to report the presence of *either* animal *or* beach or to report the presence of *both* animal *and* beach, no interference is seen. Indeed, the *or* condition shows facilitation (animal on beach better than either animal or beach alone). We propose that observers accumulate information flexibly. When looking for just "animal," evidence for "beach" is taken as evidence against animal. In *or* and *and* conditions, the same beach is taken as positive evidence. Observers can rapidly extract information about multiple categories, using that evidence as needed.

10:20–10:35 (181)
Scene Memory With a Linguistic Secondary Task. ANSGAR D. ENDRESS & MARY C. POTTER, *MIT* (read by Mary C. Potter)—Can we make sense of our environment while processing verbal material, as when having a conversation while driving? Here, participants viewed a sequence of six pictured scenes at 200 msec per scene while simultaneously reading a centrally presented six-word RSVP sentence. Following this, we tested their memory for the sentence or the scenes. Scene memory was evaluated by presenting either actual scenes or mere verbal scene descriptions. Performance was substantially above chance for both scenes and sentences. Critically, scene memory was at least as good when participants simultaneously read a sentence, as compared with two control groups performing no secondary task at all or when there was a simple change detection task instead of reading the sentences. These results suggest that scenes can be interpreted by nonlinguistic mechanisms even when the memory probes of the scenes are verbal titles. Language perception and nonlinguistic perception of the world are, therefore, fundamentally independent.

10:40–10:55 (182)
Hemispheric Differences and Priming Effects in the Perception of Pictures and Environmental Sounds. PAULA GOOLKASIAN, SAMANTHA FINKELSTEIN, & ZHANNA DAVID, *University of North Carolina, Charlotte*—This experiment investigated whether pictures and environmental sounds, when presented in a lateralized manner, would be affected in similar ways by primes that varied in modality and in perceptual/linguistic format. Students responded to a same/difference task that required them to match prime–target pairs and determine, on item trials, whether the two successive events represented features drawn from the same item or, on category trials, whether the two events belonged to the same category. Both reaction times and error rates were found to be affected by the target's presentation location on either the right or the left side. However, the pattern of findings was specific to the target modality. Similarly, support for cross-modality priming was also mixed and modality specific. The findings are discussed within the context of the dual-subsystems theory (Gonzalez & McLennan, 2009; Marsolek, 1999; Marsolek & Burgund, 1997).

11:00–11:15 (183)
Masking Versus Searching: Similar Underlying Mechanisms? TSVI ACHLER, SHAWN BARR, MICHAEL I. HAM, JOHN S. GEORGE, GARRETT T. KENYON, & LUIS M. BETTENCOURT, *Los Alamos National Laboratory* (sponsored by Alejandro Lleras)—We investigated

the effects of various mask characteristics in a variety of object identification tasks at short SOAs (20 msec). We found a pattern of target–mask interactions similar to effects observed in search phenomena. Specifically, both sets of experiments displayed asymmetry and increased difficulty (masking efficiency) with similarity. Masks were more effective when they were more similar to the targets—for example, images of animals masked by natural scenes versus images of other animals. In addition, we tested these ideas in simpler image sets involving the interaction of low-level features in deformed closed contours versus their absence in cluttered backgrounds, using LED characters. We show that the common features of visual perception in these experiments can be accounted for by neural networks with top-down reentrant processing between objects and component features. Together, these findings indicate a higher level of interaction for masking beyond local blocking of low-level features.

11:20–11:35 (184)
Effects of Exposure Frequency and Expression Variation on Face Recognition and Generalization. GARY C.-W. SHYI, HUEI-MING HE, & GEORGE C.-C. WANG, *National Chung Cheng University*—We propose a model for classifying faces where familiarity varies along two continuous dimensions, frequency of contact and directness of contact, creating four possible types of familiarity. In two experiments, we explored the possibility of transforming familiarity type along the dimension of contact frequency by varying the number of exposures and the expression of unfamiliar faces. The results showed that the original face images were recognized better than those with altered expressions. Moreover, performance on faces with fewer exposures was impaired by variation in expression, especially when the targets were old; however, with sufficient exposures, performance was enhanced by variation in expression when the targets were new. We posited that variation in expression gives rise to generalization, whereas memory of the original image represents a consolidated trace of a specific expression, leading to image matching. Implications for how variation-induced generalization may affect the underlying configural, component, and holistic aspects of face processing are discussed.

11:40–11:55 (185)
Dehydroepiandrosterone (DHEA) Enhances Perceptual Identification, Fragment Completion, and Mental Rotation in Postmenopausal Women. BETHANY STANGL, *George Washington University*, ELLIOT HIRSHMAN, *University of Maryland, Baltimore County*, & JOSEPH G. VERBALIS, *Georgetown University* (read by Elliot Hirshman)—Although anecdotal reports and theoretical arguments suggest that administration of dehydroepiandrosterone (DHEA) should enhance cognition in the aged population, prior studies from our laboratory have failed to demonstrate beneficial effects of DHEA on multiple measures of short-term memory, long-term memory, and attention. Using the same methodology as in prior studies, the present results demonstrate that daily oral administration of 50 mg of DHEA for 4 weeks to postmenopausal women enhances performance in perceptual identification, fragment completion, same–different judgments, and mental rotation tasks. Attentional vigilance and visual search tasks do not demonstrate this enhancement, suggesting that the observed benefit is specific to visual object recognition tasks. Consistent with this interpretation, ancillary analyses of performance on motivational and affective measures do not demonstrate beneficial effects of DHEA. The present results represent the first demonstration of beneficial effects of DHEA on multiple, related cognitive tasks in a placebo-controlled double-blind experiment.

Bilingualism
Chouteau, Saturday Morning, 10:20–11:55

Chaired by Roberto R. Heredia, Texas A&M International University

10:20–10:35 (186)
Bilingual Sentence Processing: Multiple Language Activation. ROBERTO R. HEREDIA, ANNA B. CIEŚLICKA, & OMAR GARCIA, *Texas A&M International University*—This study explores cross-language homographs (words with competing meanings and orthographic overlap) and cognates (words with overlapping meaning and orthography). In Experiments 1 and 2, participants made lexical decisions to homographs and cognates in Spanish or English. In Experiment 3, bilinguals read English sentences that were either high or low constrained toward the meaning of the homograph. Experiment 4 used priming to measure language activation. In Experiments 1 and 2, cognates were recognized faster than their controls. The effect persisted irrespective of participants' expectations concerning English or Spanish monolingual modes. In Experiment 3, cognates in the low-constraining condition were processed faster than controls. However, homographs took longer to read than did their controls in the low-constrained context. Experiment 4 extended the results of Experiment 3, revealing negative priming for the English related target of the homograph, relative to its control. The results are discussed in terms of bilingual multiple activation (and nonselectivity) models of language processing.

10:40–10:55 (187)
Lexical Triggering in Bilingual Code Switching. GERRIT JAN KOOTSTRA, *Radboud University Nijmegen*, MARIJT J. WITTEMAN, *Max Planck Institute for Psycholinguistics*, TON DIJKSTRA, *Radboud University Nijmegen*, & JANET G. VAN HELL, *Radboud University Nijmegen and Pennsylvania State University* (read by Janet G. van Hell)—Code switching is the use of two languages within a single sentence. We tested the hypothesis that claims that language-ambiguous words, such as cognates or homophones, trigger a switch to the other language. Experiment 1 showed that Dutch–English bilinguals read code-switched words presented in sentences faster when the switch was preceded by a cognate trigger word than when preceded by a noncognate control word. Experiment 2 focused on lexical triggering and alignment with a dialogue partner in a discourse situation, using the confederate-scripting technique. Bilinguals were more likely to switch languages when the confederate had code switched, and this alignment effect was particularly large in the production of sentences containing language-ambiguous trigger words. Implications for theories of bilingual language production, code switching, and discourse alignment are discussed.

11:00–11:15 (188)
Does Task Constrain Cross-Language Phonetic Interactions? NATTALIA PATERSON & MATTHEW GOLDRICK, *Northwestern University* (read by Matthew Goldrick)—When performing a cued language-switching task (where an external cue indicates the language used for responses), bilinguals show less of a switch cost when the cue is linked to the response language (e.g., a language-specific word; Meuter, 2005). This suggests that certain contexts might help bilinguals inhibit the non-target language. We examine whether context helps bilinguals prevent phonetic interference from the first (L1) to the second language (L2). We compare Brazilian Portuguese (L1)–English (L2) bilinguals' productions (as well as native English controls) across picture naming and word reading. Whereas pictures can be associated with words in either language, for most words, the orthographic form is unique to each language. Bilinguals may therefore show less phonetic interference in word reading versus picture naming. We will be present results from acoustic analyses of initial consonants comparing the degree of cross-language interference in picture naming and word reading.

11:20–11:35 (189)
Does L2 Proficiency Modulate Noncognate Masked Translation-Priming Effects? MANUEL CARREIRAS, JON ANDONI DUÑABEITIA, & MARIA DIMITROPOULOU, *Basque Center on Cognition, Brain, and Language*— Noncognate masked translation-priming studies with unbalanced bilinguals performing lexical decisions show larger effects in the dominant (L1) to nondominant (L2) translation direction than vice versa. Importantly, this asymmetry is not present in early balanced bilinguals. The present study addressed whether gradual changes in L2 proficiency result in changes in the asymmetry by testing three groups of unbalanced Greek–English bilinguals with different levels of L2 proficiency. Participants performed lexical decisions on the same set of English and Greek targets primed by their noncognate translations. Even though participants' performance improved as a function of increased L2 proficiency, the pattern of masked translation-priming effects remained identical across the three levels of proficiency, always replicating the previously established asymmetry. These findings show that proficiency does not modulate

noncognate masked translation-priming effects. The data are discussed in relation to current models of bilingual word recognition and processing.

11:40–11:55 (190)
Learning to Read Hebrew As a Second Language: Acquiring "Semitic" Markers of Reading. RAM FROST, ALONA NARKISS, HADAS VELAN, & AVITAL DEUTSCH, *Hebrew University of Jerusalem*—How do proficient readers of European languages learn to read a Semitic language with an alphabetic orthography such as Hebrew? Do they implicitly develop "Semitic" markers of reading and, like native Hebrew speakers, develop reading procedures that fit with a lexical architecture that is based on root representations? We tracked the process of Hebrew-reading acquisition of young adults who were Russian, French, Spanish, and Italian native speakers. Specifically, we focused on the effects of cross-modal phonological, semantic, and morphological priming and compared them with parallel effects revealed during reading acquisition of Hebrew children. We found opposite trends: Whereas for Hebrew children, morphological-priming effects linearly decreased with increased reading proficiency, for readers of European languages, reading proficiency was consistently correlated with larger morphological-priming effects. These results demonstrate how morphological knowledge modulates and shapes reading strategies.

Reasoning and Problem Solving
Lewis and Clark, Saturday Morning, 10:00–11:55

Chaired by Mark H. Ashcraft, University of Nevada, Las Vegas

10:00–10:15 (191)
Spaced-Out Math: Order of Operations and Operand Spacing in Arithmetic Problems. NATHAN O. RUDIG & MARK H. ASHCRAFT, *University of Nevada, Las Vegas* (read by Mark H. Ashcraft)—The tendency to read left to right can conflict with the mathematical rules of order of operations. To overcome this conflict, people can use perceptual and mathematical cues to help guide their problem solving. In two experiments, we presented arithmetic problems that mixed addition and multiplication (e.g., $3 \times 4 + 5$), and we varied the order of operations and the spacing of digits around the operator signs. As compared with the equal-spacing condition, closer spacing for multiplication speeded performance, and distant spacing slowed performance. Likewise, presenting multiplication before addition led to faster performance than did the reverse order. The same was true when participants read the stimuli out loud without solving the problem. These effects were exaggerated if individuals were highly math anxious. The results speak to the syntax of mathematical expressions and the consequences of violating the rules of that syntax.

10:20–10:35 (192)
How Conceptual Distance and Problem Representation Affects the Creativity of Solutions Generated During Analogical Problem Solving. CYNTHIA M. SIFONIS, *Oakland University*—The present study examined how the creativity of solutions generated during analogical problem solving can be influenced by the interaction between problem representation and conceptual distance. In the study, students were taught how to use analogy to solve problems. They were then told to use analogy to solve the parking problem on campus and were given either (1) conceptually similar or conceptually distant source and target domains or (2) a specific or abstract representation of the parking problem. Analyses demonstrated that problem representation interacted with conceptual distance on problem-solving fluency and creativity. When conceptually distant source and target domains were used, more solutions were generated using an abstract representation of the problem, but the solutions were more creative when a specific representation of the problem was used. When conceptually similar source and target domains were used, more solutions were generated using a specific, rather than an abstract, representation of the problem.

10:40–10:55 (193)
Learning and Use of Memory-Based Versus Recognition-Based Methods in Interactive Skill Acquisition: A Cognitive Model. WEI DONG & WAI-TAT FU, *University of Illinois, Urbana-Champaign* (read by Wai-Tat Fu)—One critical step in interactive skill acquisition is to decide between methods that require memorization of steps versus methods that require recognition of environmental cues. Although memory-based methods often slow down performance during the initial stages of learning, once steps are memorized and, eventually, proceduralized, they are often more effective than recognition-based methods. Research has found that people tend to underutilize memory-based methods during early stages of learning, which often leads to suboptimal performance later. We studied the relations between choice of methods and learning in a computer-based environment. Participants could choose between shortcut keys or mouse clicks to execute a sequence of commands. We found that choice between methods was sensitive to their associated cost–benefit trade-offs. An ACT–R model was built to simulate the choice and learning processes. The model fit the human data well and also provided implications for additional factors that could influence this process.

11:00–11:15 (194)
Choosing Between Intuition and Reason: The Role of Metacognition and Fluency in Analytic Thinking. VALERIE A. THOMPSON, *University of Saskatchewan*, LINDEN J. BALL & HANNAH M. BRACK, *University of Lancaster*, & GORDON R. PENNYCOOK, *University of Saskatchewan*—A fundamental problem for dual-process theories of reasoning is to predict when deliberate Type 2 analyses are engaged to modify the intuitive judgments produced by automatic Type 1 processes. We investigated the hypothesis that a metacognitive judgment called the feeling of rightness (FOR) is mediated by fluency and cues Type 2 thinking; we were specifically interested in the role of processing (Alter et al., 2007) and retrieval (Thompson et al., under review) fluency. Using three separate reasoning tasks, we failed to replicate Alter et al.'s finding that difficult-to-process items (e.g., those presented in a difficult font) gave rise to increased accuracy, a proxy for Type 2 engagement; FORs also did not differ between conditions. However, in a fourth experiment, we demonstrated that regardless of ease of processing, fluently retrieved answers gave rise to a strong FOR, which, in turn, was associated with curtailed Type 2 processing.

11:20–11:35 (195)
Performance on Different Conditional-Reasoning Processes Is Not Always Positively Correlated. JOHN BEST, *Eastern Illinois University*—When people are asked to be logical and are then presented with decontextualized conditional-reasoning syllogisms, there are mean differences among the four conditional-reasoning processes, with the valid processes modus tollens and modus ponens being the hardest and easiest, respectively, and performance on the two invalid processes (denying the antecedent and affirming the consequent) generally in between. These differences have been explained by memory load or by syntactical biases, with researchers assuming that performance is always positively correlated. However, data from eight experiments involving more than 200 participants show (1) a stable pattern of correlations in which the between-experiment fluctuations in the magnitude of correlation for each process are generally smaller than the magnitude of the differences between reasoning processes and (2) significant positive correlations for only the two valid and the two invalid reasoning processes—both findings being difficult to reconcile with existing theories.

11:40–11:55 (196)
An Application of Muncaster's Computerized Logical Analysis, PropCalc, to Devine's Theory of Prejudice. SHELDON G. LEVY, *Wayne State University*—Functional scientific theory requires logical consistency. However, the limited ability of humans to employ ordinary language to verify this has led to symbolic languages. Nevertheless, the history of mathematics and of science identifies the difficulty in establishing consistency. In addition, theories should also be efficient; that is, the assumptions should not be redundant. Robert Muncaster's PropCalc is a computer program that provides a means by which verbal theories may be translated into symbolic statements. The program then allows an examination of the propositions to (1) verify their consistency, (2) determine whether some propositions are deducible from others (efficiency), and (3) provide the deductions that derive from the set of assumptions. This paper illustrates the application of the PropCalc analysis to Devine's theory of unconscious processes in the development of stereotypes and prejudice about African-Americans in the United States.

Concepts and Categories II
Illinois, Saturday Afternoon, 1:30–2:45

Chaired by Bradley C. Love, University of Texas, Austin

1:30–1:45 (197)
Looking to Learn, Learning to Look: Attention Emerges From Cost-Sensitive Information Sampling. BRADLEY C. LOVE, *University of Texas, Austin*—Given people's capacity limitations, one key aspect of learning is learning which stimulus aspects are goal relevant in the current context. Gathering unnecessary information can have costs in terms of time, effort, dollars, and so forth. Accordingly, many category-learning models employ selective attention mechanisms that learn which stimulus dimensions are most critical to performance. However, attention in category-learning models does not direct what is encoded but, instead, establishes decision weights on stimulus dimensions. According to existing models, all stimulus dimensions are encoded, which is not realistic or supported by basic research in attention. To address these shortcomings, I develop a model that selectively encodes information within a value of information framework. The value of a piece of information depends on the decision maker's goals, assumptions about (i.e., knowledge of) the world, and the cost of gathering the information. The model accounts for accuracy and eye movement data during category-learning tasks.

1:50–2:05 (198)
The Representation of Abstract Concepts: The Role of Affect. GABRIELLA VIGLIOCCO & DAVID P. VINSON, *University College London*, PASQUALE DELLA ROSA & STEFANO F. CAPPA, *Università San Raffaele*, & JOSEPH T. DEVLIN & STAVROULA T. KOUSTA, *University College London*—When both imageability and context availability of concrete and abstract words are controlled (along with a large number of other lexical dimensions), abstract words have a processing advantage over concrete words. In the studies presented, we provide behavioral and imaging evidence that such a processing advantage is linked to the fact that, on average, abstract words have greater affective associations than do concrete words.

2:10–2:25 (199)
A Fuzzy Category: What Is a Fact? MITCHELL RABINOWITZ, MARIA ACEVEDO, LINDSAY PORTNOY, SARA CASEN, MYRIAH ROSENGARTEN, & MARTHA KOWALCZYK, *Fordham University*—What do people mean when they say that something is a fact? Using two features—how much you think a statement is true and how likely you think it is that other people think the statement is true—our research has shown that people use the word *fact* is three ways. Within everyday general knowledge contexts, a fact is something that I think is true and expect that others will also think is true. Within academic contexts, a fact is something that I think is true but others might or might not think is true. Within political contexts, a fact is something that I think other people think is true but I do not. This research also shows that there is little consensus across people as to which statements should be considered to be facts. This work is interpreted in reference to research on fuzzy categories.

2:30–2:45 (200)
Localized Context Influences the Perceptual Judgment of Musical Tones. SHANNON M. HEALD, STEPHEN C. HEDGER, OLIVIER LESCOP, BERTHOLD HOECKNER, & HOWARD C. NUSBAUM, *University of Chicago* (read by Howard C. Nusbaum)—Perceptual judgments are influenced by the context in which stimuli are presented. There is a tendency for observers to show bias toward the central value of an experienced stimulus distribution. Such biases have been examined in a wide range of stimuli, but little research has examined biases using acoustic stimuli such as musical notes, to which listeners have prior exposure. Listeners perceptually matched probe tones to target notes when the range of target notes varied over trials. Individuals matched the frequency of target notes from memory by varying probe tone frequency. Systematic biases were found that depended on the distribution of the targets heard. Lower frequency notes were overestimated, and higher frequency notes were underestimated. However, biases for the same target changed in different distributions, indicating that judgments were based

on the context of the experiment, rather than on previous experience. Implications regarding distributional sensitivity for more complex acoustic stimuli are also discussed.

Visual Attention II
Missouri, Saturday Afternoon, 1:30–3:05

Chaired by Todd S. Horowitz, Harvard Medical School

1:30–1:45 (201)
Location and Identity Are Entangled in Multiple-Object Tracking. TODD S. HOROWITZ, *Harvard Medical School*, MICHAEL A. COHEN, *Harvard University*, YAÏR PINTO, *University of Amsterdam*, & PIERS D. L. HOWE, *University of Melbourne*—Multiple-object tracking is typically thought of as a purely spatial task. However, recent studies have demonstrated significant overlap among brain areas involved in tracking and visual short-term memory. Will this overlap show up in performance? Observers performed a multiple-identity-tracking task (Oksama & Hyönä, 2004) in which stimuli were unique objects (cartoon animals, Horowitz et al., 2007; disks with digits, Pylyshyn, 2004) that were masked during the response phase. Identities could be visible or masked during the tracking phase. Observers could be instructed to ignore identities and track only locations or to track both identity and location. We varied difficulty by manipulating duration, speed, and tracking load. We found that as difficulty increased, tracking identities reduced location performance. Furthermore, observers could trade location performance for identity performance, according to instructions. This provides the first behavioral evidence that spatial and identity information draw on a common resource in tracking.

1:50–2:05 (202)
Animate Motion Captures Visual Attention. JAY PRATT & PETRE V. RADULESCU, *University of Toronto*, RUO M. GUO, *University of Waterloo*, & RICHARD A. ABRAMS, *Washington University*—Across our evolutionary history, detecting animate entities in the visual field (such as prey and predators) has been critical for survival. One of the defining features of animals is their motion: self-propelled and self-directed. Does such animate motion capture visual attention? To answer this, we compared the time to detect targets in objects that were either moving predictably due to collisions with other objects (inanimate motion) or moving unpredictably with no such collisions (animate motion). Across several experiments, we consistently found that targets that occurred in objects that underwent animate motion were responded to more quickly than targets that occurred in objects that underwent inanimate motion. Moreover, these speeded responses appeared to be due to the perceived animacy of the objects, rather than to their uniqueness in the display or involvement of a top-down strategy. We conclude that animate motion does indeed capture visual attention.

2:10–2:25 (203)
Integration of Color and Shape in Object File Reviewing. JUN SAIKI, *Kyoto University*—To investigate whether object files play significant roles in integrating features, an object-reviewing paradigm was modified. First, to deal with multiple features, a matching task, instead of naming, was utilized. Second, a redundant signals paradigm was incorporated in order to evaluate whether a redundancy gain in RT reflected feature integration. Observers saw a preview display composed of two colored letters, followed by a target display with a single letter, and judged whether the target contained the color or shape of preview objects as quickly as possible. For match trials, features were either at the same object (SO) or at different objects (DOs), and type of match was color, shape, or color and shape. Mean RT revealed both a significant redundancy gain and an object-specific preview benefit (OSPB). Further analysis with a modified EZ diffusion model revealed that OSPB in nondecision time, which presumably includes encoding, was observed only when both shape and color shared the same location, providing evidence for object-based reviewing.

2:30–2:45 (204)
When Two Objects Are Easier Than One: Occlusion and Preview. W. TRAMMELL NEILL & YONGNA LI, *University at Albany*—Many studies have shown that subjects process two attributes of one object more

easily than two attributes of two different objects, even when the target attributes are equated for spatial separation. Such "within-object superiority" has led investigators to conclude that spatial attention is "object based," rather than "space based." However, when subjects must match two target features as the same or different, the opposite effect is often found—that is, "between-object superiority" (e.g., Davis & Holmes, 2005; Neill & Li, 2009). Although previous studies have reported within-object superiority for partially occluded objects, we demonstrate between-object superiority for such objects when particular confounds are eliminated. In addition, we find that between-object superiority is eliminated by a 250-msec object preview, prior to target appearance, supporting the conclusion that the effect depends on the degree to which the target features are integral to the overall object representation.

2:50–3:05 (205)

Organizational and Spatial Dynamics of Attentional Navigation Within and Between Hierarchically Structured Objects. MORRIS GOLDSMITH & MENAHEM YEARI, *University of Haifa*—Is the focusing (in addition to orienting) of visual attention object based, space based, or both? We used a new dynamic focusing task to examine attentional focusing latencies in hierarchically structured compound-letter objects, orthogonally manipulating global size (larger vs. smaller) and organizational complexity: two-level structure (global letter composed of local letters) versus three-level structure (global letter composed of squares composed of local letters). Participants identified both the global and local elements of these objects in one of two directions successively on a single trial: global–local (focusing) or local–global (defocusing). A longer overall RT was observed for both large versus small and three-level versus two-level objects, indicating that the time needed to focus or defocus attention depends both on the change in attentional aperture size and on the number of traversed structural levels. Shifting attention between levels of two different objects yields a similar pattern, supporting a generally hierarchical, object-based spatial model of attentional navigation.

Metamemory III
Mississippi, Saturday Afternoon, 1:30–2:45

Chaired by Philip A. Higham, University of Southampton

1:30–1:45 (206)

Regulating Accuracy With Grain Size: People Do Not Evaluate Correctly the Accuracy Benefits of Coarsening Answers. PHILIP A. HIGHAM, *University of Southampton*, KARLOS LUNA, *University of Minho*, & BEATRIZ MARTÍN-LUENGO, *University of the Basque Country*—Coarser answers tend to be more accurate, although they are less informative. We tested whether people fully appreciate the accuracy–grain-size relationship, a requirement if grain size is to optimally regulate performance. After viewing a slideshow of a crime scene, participants completed a five-alternative multiple-choice memory test. For each question, they were asked to choose and rate confidence in (1) a single favorite alternative (fine-grained answer) and (2) three plausible alternatives including the favorite alternative (coarse-grained answer). One answer was then selected for reporting. As was expected, accuracy was much higher for coarse- than for fine-grained answers. However, coarsening answers increased confidence only slightly and only if coarse-grained answers were selected for report. This pattern was attributable to over- and underconfidence for selected fine- and selected coarse-grained answers, respectively. These results suggest that there are notable limitations on people's ability to utilize grain size to regulate accuracy.

1:50–2:05 (207)

Auditory Hindsight Bias. DANIEL M. BERNSTEIN, ALEX WILSON, NICOLE PERNAT, & LOUISE MEILLEUR, *Kwantlen Polytechnic University*—Knowing the outcome to a problem can make someone believe that the outcome was predictable. This hindsight bias has been demonstrated for a variety of judgments, ranging from trivia questions and election outcomes to visual and gustatory judgments. Here, we report hindsight bias for auditory information. In several experiments, subjects had to identify words or phrases that had been degraded with noise. On other trials, subjects first heard the clear versions of these words or

phrases, then estimated the percentage of their peers who would be able to identify the degraded version had they not heard the clear version first. Subjects showed robust auditory hindsight bias by greatly overestimating their peers' ability to identify the degraded auditory information, even after they learned about the bias and were asked to avoid it. These results extend the generalizability of hindsight bias to auditory information and have implications for communication theory.

2:10–2:25 (208)

The Role of Idiomatic Language in Bilingual Source Monitoring. RUTHANNA GORDON, *Illinois Institute of Technology*, & KIEL CHRISTIANSON, *University of Illinois, Urbana-Champaign*—The source of information has important implications for how that information should be processed. For bilinguals, one useful piece of context is the language in which information was originally encountered. One possible cue for reconstructing this context is the use of figurative language. In this experiment, English/Spanish bilinguals read passages in both languages, each containing an idiom, each accompanied by a picture. All idioms were matched with an idiom in the other language that had the same figurative meaning. One third also had the same literal translation, whereas one third had similar literal translations and one third were entirely different. Participants then saw the pictures alone and attempted to identify the language in which the accompanying passage had been presented. Source-language attribution was best when literal meaning was identical across languages. This may increase the salience of each language's surface-level lexical characteristics, making those characteristics more powerful cues for source monitoring.

2:30–2:45 (209)

Association As Choice: What Metacognitive Judgments Tell Us About the Associative Processor. WILLIAM S. MAKI, *University of Arizona*, & ERIN M. BUCHANAN, *Missouri State University*—Economic decisions and free associations share properties of discrete choice models, so we begin by treating the free association (FA) task as a choice problem. Choice theory (Luce, 1959; Yellott, 1977) enables discovery of theoretical strengths for each associate in a large set of word association norms (Nelson et al., 2004). We mention several associative phenomena that follow from conceptualizing FA as analogous to economic choice, including FA test–retest reliability for individuals versus groups, a linear function relating metacognitive judgments of associative strength to FA probabilities, and the amplifying effect of backward association on associative judgments. Such judgments, aka "conditional predictions" (Koriat & Bjork, 2006), are often inflated and are resistant to experimental attempts to reduce the bias toward high ratings. We focus on recent debiasing experiments, the results of which indicate that some of the processes underlying associative judgments may be fast, mandatory, and cognitively impenetrable (cf. Fodor, 1983).

Text Comprehension
Meramec, Saturday Afternoon, 1:30–2:45

Chaired by David N. Rapp, Northwestern University

1:30–1:45 (210)

Proofreading Fosters Resistance to the Effects of Inaccurate Information. DAVID N. RAPP & RACHEL RYSKIN, *Northwestern University*—People rely on what they read, which is commendable when text content is accurate. However people also rely on content when it is inaccurate, suggesting that evaluative processing is not the default during comprehension (and more generally, during encoding). We examined whether proofreading, which necessitates careful evaluation of text content, reduces reliance on false information. In two experiments, participants read text containing information that was, on the basis of norming, obviously accurate or inaccurate. Following their reading, participants judged the validity of a series of facts, with critical items derived from the information in the texts. Participants in Experiment 1, who merely read the text, were less accurate on the judgment task after reading false, as compared with true, information. Participants in Experiment 2, tasked with proofreading, were more accurate regardless of the content of what they read. These results demonstrate that evaluative tasks during reading can enhance readers' resistance to inaccurate information.

1:50–2:05 (211)

Levels of Comprehension During Letter Detection: The Roles of Reading Ability and Text Comprehensibility. JOANNA C. BOVEE & GARY E. RANEY, *University of Illinois, Chicago*, & FRANCES DANIEL, *Indiana University Northwest* (read by Gary E. Raney) (sponsored by Gary E. Raney)—Researchers use letter detection tasks to study word processing during reading. Letter detection is assumed to focus attention on word-level processing at the expense of meaning, but how this affects comprehension, relative to normal reading, has not been precisely measured. We examined how letter detection affects memory and comprehension of the surface form, textbase, and situation model and how comprehension changes as a function of reading ability and text comprehensibility. Performing letter detection reduced overall comprehension. Furthermore, performing letter detection reduced situation-level comprehension more than it did textbase or surface-level comprehension, but this effect was smaller for better readers when passages were easier to understand. This suggests that using the letter detection task is an effective way of focusing readers' attention at the word level. However, the extent to which this redirecting of attention influences comprehension depends on the difficulty of the text, as well as on the participants' reading ability.

2:10–2:25 (212)

Explicitness and Implicitness in Text Comprehension and Memory. MURRAY SINGER, ANJUM FAZALUDDIN, & KATHY N. ANDREW, *University of Manitoba*—It has been at least tacitly acknowledged that the explicitness and implicitness of text ideas vary independently. Ideas supported by gist are frequently unstated (implications), and conversely, explicit ideas may not be congruent with the gist. Three experiments inspected the ramifications of this circumstance for text recognition. They defined idea implicitness in terms of the case-filling suitability of a concept, plausibility in a story context, and congruence with causal antecedents, respectively. Target ideas were either stated or not and implied or not in stimulus messages. All three experiments showed that, in recognition testing following reading, stated versus unstated ideas were more discriminable when unimplied than when implied by their message. The implications of these findings for the multilevel representation of discourse is explored.

2:30–2:45 (213)

The Comprehension of Multiword Units: Does Constituent Predictability Save the Day for Schizophrenic Patients? CRISTINA CACCIARI & FRANCESCA PESCIARELLI, *University of Modena*, CHIARA REALI, *University of Heidelberg*, & TANIA GAMBERONI, *ASL Modena, Italy*—Traditionally, schizophrenic patients were considered to be impaired in comprehending linguistic units with an abstract meaning (e.g., proverbs). Since then, several studies have investigated figurative language comprehension, but with rather inconsistent results: Some studies showed impaired idiom comprehension, whereas others showed impairment only in some types of idiom. The role of constituent predictability has been investigated less, despite the well-acknowledged role of anticipation mechanisms in language comprehension. Idioms and antonymous pairs provide two different cases of bound context (at a sentence vs. word level) in which constituent predictability can be manipulated. We tested the comprehension of idioms inserted in sentential contexts (Experiment 1) and of antonymous word pairs (Experiment 2) in Italian paranoid schizophrenic patients (and matched controls). In both experiments, the final constituent was highly predictable. At odds with previous results, idiom comprehension was preserved in young adult schizophrenics, but not antonymous word pair comprehension.

Modeling RT
Chouteau, Saturday Afternoon, 1:30–3:25

Chaired by Andrew Heathcote, University of Newcastle

1:30–1:45 (214)

Evidence Accumulation in Task Switching. ANDREW HEATHCOTE & FRINI KARAYANIDIS, *University of Newcastle*—We extended an evidence accumulation model of decision processes in single-task paradigms to provide a unified account of speed and accuracy in a cued-trials task-switching experiment. We applied the model to an experiment examining four phenomena that have been the main focus of interest in task-switching research: switch cost, the preparation effect, residual switch cost, and the mixing effect. The model was descriptively accurate and provided a revealing picture of the psychological mechanisms underlying the four phenomena.

1:50–2:05 (215)

A Diffusion Model Decomposition of Practice. ERIC-JAN WAGENMAKERS, ANGELOS KRYPOTOS, & GILLES DUTILH, *University of Amsterdam*—When people repeatedly perform the same cognitive task, their mean response times invariably decrease. To account for this decrease, most theories of practice assume that the practice effect is driven by changes in a single psychological process. In our first study, a diffusion model analysis of data from a 10,000-trial lexical decision task demonstrated that practice not only affects speed of information processing, but also affects response caution, response bias, and peripheral processing. In a second experiment, we replicated our results and also disentangled the effects into stimulus-specific and task-specific components. We conclude that a diffusion model decomposition provides a perspective on practice that is more detailed and more informative than the traditional analysis of mean response times.

2:10–2:25 (216)

Diffusion Model Analysis of Priming and Associative Recognition. ROGER RATCLIFF & GAIL McKOON, *Ohio State University*—We present an application of the diffusion model to an experiment that tested associative recognition and priming in item recognition. Subjects studied pairs of words and then were tested with either single words for item recognition or pairs of words for associative recognition. In the item recognition test, there was a large priming effect for words from the same study pair presented consecutively. We tested college age students and 60- to 74-year-olds with a range of IQs. We fit the diffusion model to the data from both tasks and examined whether the size of the item recognition priming effect was related to the accuracy of associative recognition. The diffusion model allowed us to separate the effects of decision criterion settings and nondecision processes from drift rates, allowing direct comparisons between young and old for priming and associative recognition.

2:30–2:45 (217)

Using Response Time to Advance Recognition Memory Models: A Diffusion Model Analysis. JEFFREY J. STARNS, *University of Massachusetts*, & ROGER RATCLIFF & GAIL McKOON, *Ohio State University* (read by Gail McKoon)—Recognition theorists have primarily compared models using z-transformed receiver operating characteristics (zROCs), with no attempt to accommodate response time (RT) data. We used the diffusion model to fit zROC functions and RT distributions across a target probability manipulation. The model was able to fit the data with both speed- and accuracy-emphasis instructions. The model matched zROC slopes <1 by proposing more variability in memory evidence for targets versus lures, but the ratio did not equal the zROC slope, as is assumed by the unequal variance signal detection (UVSD) model. The dual-process signal detection (DPSD) model required a substantial recollection component to fit zROC slopes in the speed condition, even though almost all responses were made in less than 600 msec. The diffusion model provided a more complete account than did either the UVSD or the DPSD model. Accommodating RTs reveals that zROC interpretations made on the basis of accuracy-only models are invalid.

2:50–3:05 (218)

Dissociable Perceptual-Learning Mechanisms Revealed by Diffusion Model Analysis. ALEXANDER A. PETROV, NICHOLAS M. VAN HORN, & ROGER RATCLIFF, *Ohio State University*—Performance on perceptual tasks improves with practice. Most theories address only accuracy (or, conversely, threshold) data and tacitly assume that perceptual learning is a monolithic phenomenon. Our method was to measure the stimulus specificity of perceptual learning of motion direction discrimination. Twenty-seven observers trained to discriminate small deviations from a fixed reference direction for four sessions with feedback, accuracy-contingent bonuses, and "slow down" messages. Session 5

tested the orthogonal direction. The results showed that specificity indices were SI = 0.60 ± 0.10 for d' and 0.31 ± 0.07 for mean RT (group-level data ± 80% bootstrap CIs). The diffusion model achieved good fits to the individual RT distributions from each session. SI = 0.70 ± 0.10 for drift rate and 0.12 ± 0.08 for the maximum nondecision time, T_{max}. The boundary separation and minimum nondecision time did not change significantly with practice. We conclude that this suggests two dissociable perceptual-learning mechanisms: a stimulus-specific increase of drift rate and a stimulus-general decrease of T_{max}. The traditional d' analysis confounds these effects.

3:10–3:25 (219)

Modeling RT in Guided Visual Search. CHRIS DONKIN, *Indiana University, Bloomington*, DENIS COUSINEAU, *University of Montreal*, & RICHARD M. SHIFFRIN, *Indiana University, Bloomington* (read by Richard M. Shiffrin)—In the experimental conditions in Cousineau and Shiffrin (2004), the display objects were presented successively, at speeds such that the displays appeared to be simultaneous. The distributions of response times were fit with a guided visual search model (e.g., Wolfe, 1994) based on the linear ballistic accumulator (Brown & Heathcote, 2008). The study used consistent mapping for up to 60 training sessions, but the targets were defined conjunctively, hindering the learning of pure "popout." The guided search model assumes that a serial search occurs, but a parallel process roughly identifies display positions with a likely target, and the serial search is guided to those positions. In addition, for target-absent displays, as the serial search continues without a target identification, so that the probability that a target is in (one of) the remaining display objects becomes low, the parallel process sometimes terminates the serial search early with a negative response.

Reasoning and Problem Solving II
Lewis and Clark, Saturday Afternoon, 1:30–3:05

Chaired by James A. Dixon, University of Connecticut

1:30–1:45 (220)

A Physical Account of Cognitive Change. REBECCA BONCODDO, JASON ANASTAS, & JAMES A. DIXON, *University of Connecticut* (read by James A. Dixon)—Theories of cognition have long grappled with how a person is able to create, and alter, rules and strategies. The present work addresses these phenomena from the perspective of a physical account of cognition. We report a series of studies in which the discovery and resetting of cognitive structures (e.g., rules, strategies) are explained by the flow of energy across multiple scales in the system. Changes in energy and matter at different levels, as indexed by local diffusion rates, provide information about energy consumption at that scale. We propose that the interactions across scales are the source of a new structure.

1:50–2:05 (221)

Avatar Visibility As a Potential Detrimental Factor in Virtual Brainstorming. THOMAS B. WARD, MATTHEW G. GUERDAT, & BEVERLY ROSKOS, *University of Alabama*—This research focuses on group brainstorming in virtual environments. The model tested assumes that cues in the situation influence group members' sense of presence in the virtual environment, which, in turn, influences their task involvement and performance. On the basis of prior research, it was expected that visible 3-D avatars would lead to a greater sense of presence, but a preliminary study using Wonderland resulted in just the opposite effect. Participants found the environment less compelling and were less involved when avatars were visible than when the only indicator of the other group members was their comments in text chat. A second study used Second Life, because of the greater realism of the avatars in that environment, but also showed indicators of a lowered sense of presence, in comparison with a text-only condition. Avatar realism, other environmental cues, and participants' prior experiences with text chat modes of communication are discussed.

2:10–2:25 (222)

Strategies for Imitation and Innovation in Networked Groups. ROBERT L. GOLDSTONE & THOMAS WISDOM, *Indiana University,*

Bloomington—Using an Internet-based experimental platform that allowed groups of 2–200 people to interact with each other in real time on networked computers, we studied how people search high-dimensional problem spaces by randomly exploring, building on their own past innovations, or imitating other people's solutions. Participants were tasked with assembling high-scoring teams of players, with players and interactions between players having unknown but stable contributions to their teams' scores. Imitation increased and innovation decreased with increasing group size, and both strategies decreased over rounds of play. Participants tended to imitate solutions that were similar to their own, were popular, and were increasing in popularity. Imitation was the most successful strategy, and participants' scores improved as the rate of other participants' imitation in their group increased. The last effect stems from "imitation reciprocity," by which imitators extend and improve solutions and then are imitated by the individuals they originally imitated.

2:30–2:45 (223)

Belief Bias in Judgments of Sample-Size Adequacy in Statistical Reasoning. RICHARD B. ANDERSON, LEISHA A. COLYN, & BETH M. HARTZLER, *Bowling Green State University*—Research on syllogistic reasoning indicates that people are more likely to judge an argument as valid when they believe the argument's conclusion to be true. The present research assessed whether belief bias would also occur in intuitive statistical judgments. Participants saw either Version A or B of a scenario involving either handedness or sexual orientation. Version A described an observer who, on the basis of 100 observations, drew a conclusion that was consistent with the observations but was not believable (e.g., a conclusion that "most Americans are left-handed"). In Version B, the conclusion was believable (e.g., that "most Americans are right-handed"). Participants' task was to assess the degree to which 100 is a sufficiently large sample to support a confident conclusion on the part of the observer. As was expected, the sample size was judged to be more adequate when the conclusion was believable than when it was not believable.

2:50–3:05 (224)

Analogical Transfer in Spanish–English Bilinguals. ERI FUKUMINE & SHELIA M. KENNISON, *Oklahoma State University* (read by Shelia M. Kennison)—The research investigated analogical transfer in a problem-solving task. Forty-seven Spanish–English bilinguals attempted to solve the ray problem (Francis, 1999, adapted from Duncker, 1945) after first attempting to solve one of four versions of the lightbulb problem (Francis, 1999, adapted from Holyoak & Koh, 1987). All participants received the ray problem in their first language but received the lightbulb problem in their second language. The English and Spanish versions of the lightbulb problem differed in difficulty. All participants answered five comprehension questions over the content of the lightbulb problem before viewing the ray problem. The results showed that participants' success in solving the ray problem was influenced by their comprehension of a key structural feature of the lightbulb problem. The results support Francis's (1999) view that higher order processes, such as analogical transfer, are not language specific.

SYMPOSIUM IV
Aesthetic Science: Psychophysical and Neuroscientific Approaches
Illinois, Saturday Afternoon, 3:15–5:25

Chaired by Stephen E. Palmer, University of California, Berkeley

3:15–3:30 (225)

Introduction. STEPHEN E. PALMER, *University of California, Berkeley*

3:35–3:50 (226)

Aesthetic Preferences for Colors: An Ecological Approach. STEPHEN E. PALMER & KAREN B. SCHLOSS, *University of California, Berkeley*—Average color preference ratings of U.S. participants yielded systematic functions, with broad peaks around saturated blue and a deep trough at dark yellow (olive). These functions are best predicted by the ecological valence theory (EVT), which states that color preferences are

largely determined by people's affective response to the objects that are that color. Various tests of the EVT are reported, including its ability to account for cross-cultural differences, individual differences, institutional affiliations, and short-term preference changes. The results thus far are highly promising.

3:55–4:10 (227)
Aesthetic Preferences in Spatial Composition: The Role of Representational Fit. JONATHAN S. GARDNER & STEPHEN E. PALMER, *University of California, Berkeley* (sponsored by Stephen E. Palmer)—Aesthetic responses to simple, single-object pictures were studied using two-alternative forced choice psychophysical tasks. The results show systematic "default" biases in the preferred position, size, and perspective of the object, including center, inward-facing, and various kind of ecological biases. Similar results are evident in analyses of a database of stock photographs. These default expectations can be violated advantageously, however, when the violation fits the intended message (as indicated by the image's title). The results of our experiments are consistent with a "representational fit" account of the aesthetics of spatial composition.

4:15–4:30 (228)
The Aesthetics of Musical Expression: Evidence From Psychophysics. DANIEL J. LEVITIN, *McGill University*, ANJALI K. BHATARA, *UCLA*, ANNA K. TIROVOLAS, *McGill University*, MARIE LILU DUAN, *University of Nevada*, & BIANCA LEVY, *Boston College*—Expression in musical performance is largely communicated by the manner in which a piece is played, beyond the notes written on the page. Participants rated the emotional expressivity of performances by an expert pianist and various manipulated versions of them. Aesthetic judgments decreased monotonically with performance variability but formed an S-shaped (sigmoidal) function, in which greater sensitivity to expression was seen for musical manipulations in the middle of the range, rather than at the extremes. This implies a form of the perceptual magnet effect, in which versions close to the prototypical extremes are perceptually assimilated to those prototypes.

4:35–4:50 (229)
Dissecting Neuroaesthetics. EDWARD A. VESSEL, G. GABRIELLE STARR, & NAVA RUBIN, *New York University* (sponsored by Irving Biederman)—The neural basis of aesthetic experience and judgment results from the integration of multiple informational sources: stimulus-triggered preferences, emotional reactions, and context. We studied neural responses to a range of visual artworks and found differentiated networks involved in stimulus-triggered preference versus aesthetic reaction. Highly aesthetically moving images also engaged the default-mode network. Both aesthetic judgments and emotional reactions were highly individual, such that aesthetic reactions could be triggered by nonpositive emotional experiences, as reflected in subnetworks of the overall brain response.

4:55–5:10 (230)
Aesthetics and the Brain. IRVING BIEDERMAN, *University of Southern California*—A gradient of cortical opioid receptors—sparse in sensory areas and dense in association areas—may subserve our tendency to maximize the rate at which we acquire new but interpretable information. Behavioral and neuroimaging experiments suggest that aesthetic motivation derives from this system that originally evolved to render us infovores.

Task Switching
Missouri, Saturday Afternoon, 3:30–5:25

Chaired by Catherine M. Arrington, Lehigh University

3:30–3:45 (231)
Tracking the Influences of Preparation, Congruency, and Task Switching on Task Performance During Explicit Task Cuing. CATHERINE M. ARRINGTON & STARLA M. WEAVER, *Lehigh University*—Task-switching paradigms used to examine executive control in multitask environments typically measure reaction time and errors from keypress responses. The punctuate nature of such responses may limit the ability to capture variability in behavior that unfolds over time in complex environments. In the present series of experiments, subjects performed two simple categorization tasks by making mouse movements to onscreen response category labels. Continuous recordings of *x*- and *y*-coordinates were acquired. Using the explicit-task-cuing paradigm, we considered the effects of preparation time and stimulus congruency on cue and target processing. Deviations in movement trajectories provide insight into the time course of responding, during which specific factors influence task performance. Deviations were larger on task switches than on task repetitions and on incongruent than on congruent trials. These factors interacted with preparation interval.

3:50–4:05 (232)
Task Switch Costs on Concurrent Timing: An Apparent Dissociation Between Voluntary and Involuntary Task Switching. CHARLES VIAU-QUESNEL & CLAUDETTE FORTIN, *University of Laval*, & RICHARD SCHWEICKERT, *Purdue University* (read by Richard Schweickert)—In a dual-task paradigm, timing is disrupted by concurrent tasks requiring cognitive control, attention, or manipulating information in memory. Consistent with this previous body of research, timing and concurrent task switching are expected to interfere in dual-task designs, especially if task switching requires cognitive control. However, there was no interference in previous experiments using a cued task-switching paradigm with concurrent timing. In the present study, time intervals were reproduced concurrently to task switching, using either a cued task-switching paradigm in pure and mixed lists (Experiment 1) or a voluntary task-switching paradigm (Experiment 2). The results suggest that whereas involuntary (i.e., cued) task switching does not interfere with concurrent timing, voluntary task switching does. This might indicate that voluntary task switching uses different resources than does cued task switching, possibly top-down cognitive control. Further research is discussed, along with the implications of using timing as a mean to identify cognitive control tasks.

4:10–4:25 (233)
Task Set Formation: Switching to a Completely Novel Task Enhances Task-Switching Costs. MICHAEL W. COLE & TODD S. BRAVER, *Washington University*—A hallmark of human cognition is the ability to rapidly learn new tasks from instruction. Surprisingly little is known, however, about how rapid instructed task learning (RITL) differs from general task switching. We hypothesized that RITL involves a unique task set formation process that would be reflected in enhanced task-switching costs for novel, relative to practiced, tasks. To test this hypothesis, we used a novel paradigm in which three task components with four levels each were factorially recombined to produce 64 unique tasks. Four of the 64 tasks (counterbalanced) were practiced in a prior session. We verified enhanced task-switching costs when switching between novel tasks, relative to switching between practiced tasks. Furthermore, novel task performance was already at practiced task performance levels after only a single exposure. This suggests that task set formation very rapidly translates instructions into task sets for later retrieval from instruction cues.

4:30–4:45 (234)
Executive Functions and Task Switching. MICHELLE ELLEFSON, *University of Cambridge*, ELISABETH BLAGROVE, *University of Warwick*, & NICK CHATER, *University College London*—The relative contribution of executive function (EF) abilities across development remains unclear with respect to the contemporary task-switching paradigm. Scores from EF tasks, along with accuracy and task-switching RT, were subjected to a path analysis to examine the role of individual differences in EF in task switching. The results indicate that the ability to switch between tasks is important for producing a correct response and that both inhibition and switching are essential for a quick and accurate response. This model highlights theoretical debates persisting in the task-switching literature, because both processes seem to contribute to RT performance—that is, the main measure used in task-switching studies. Therefore, performance decrements in task-switching studies should be decomposed into RT and accuracy costs to clarify their roles in EFs, exploring the development of switching and the origins of switch costs.

4:50–5:05 (235)
Supertaskers: An fMRI Investigation of Extraordinary Multitaskers. JASON M. WATSON, NATHAN MEDEIROS-WARD, JANELLE K. SEEGMILLER, STEFAN PULST, & DAVID L. STRAYER, *University of Utah*—Using a high-fidelity driving simulator and an auditory operation span task (OSPAN), Watson and Strayer (*Psychonomic Bulletin & Review*, **17**, 479-485) identified rare participants (2.5%) who showed no dual-task costs while driving and talking on a hands-free cell phone. In this follow-up study, we further evaluated these extraordinary multitaskers, or "supertaskers," along with two different control groups (i.e., matched high spans on OSPAN, as well as low spans). Specifically, while lying in an MR scanner, participants completed an especially challenging dual version of the *N*-back task that included both visual and auditory modalities (Jaeggi et al., 2007). Supertaskers were more accurate than both control groups at the highest levels of cognitive load, and the fMRI data revealed differential activation across the three groups in several brain regions, including subregions of the prefrontal cortex (PFC). The results are discussed in light of theories of individual differences in executive attention and PFC-mediated cognitive control.

5:10–5:25 (236)
Dimension-Specific Sequential Modulation of Congruency Effects in Cross-Task Context. JAEYONG LEE & YANG SEOK CHO, *Korea University* (read by Yang Seok Cho)—A larger congruency effect is obtained when the previous trial is congruent than when it is incongruent. This congruency sequence effect was examined in cross-task contexts in three experiments. In Experiment 1, in an alternating sequence, participants performed a horizontal Simon task with a horizontal response set and a vertical Simon task with a vertical response set. In Experiment 2, horizontal and vertical spatial Stroop tasks were performed in an alternating sequence. In both experiments, the congruency effects were modulated by the previous trial congruency when the two trials shared the same spatial dimension, but not when they had different spatial dimensions. However, when participants performed horizontal Simon and spatial Stroop tasks in Experiment 3, the congruency effects were modulated by the previous trial congruency, although both tasks were preceded by the other task. These results suggest that the cognitive control mechanism biases performance in a distractor-specific fashion.

Action and Perception
Mississippi, Saturday Afternoon, 3:10–5:25

Chaired by Martina Rieger
Max Planck Institute for Human Cognitive and Brain Sciences

3:10–3:25 (237)
Motor Imagery in Typing: Expertise, Familiarity, and Errors. MARTINA RIEGER, *Max Planck Institute for Human Cognitive and Brain Sciences*—In two experiments, motor imagery in typing was studied. In Experiment 1, typing expertise (10-finger typists vs. hunt-and-peck typists) and action familiarity (typing with 2 vs. 10 fingers—i.e., in the own system or another system) were studied. Participants executed and imagined typing short texts. The results indicate that expertise (10-finger typists were more accurate in the timing of the imagined action) and action familiarity (correlations between imagination and execution were higher for the familiar than for the unfamiliar action in 10-finger typists) play an important role in the accuracy of motor imagery. In Experiment 2, participants imagined and executed typing "the way they usually type" and were allowed to correct errors. Imagination was faster than execution. Most important, the execution–imagination time difference and the number of additional keystrokes in the execution condition (as a measure of error/error correction) were correlated. This indicates that errors and their correction are not spontaneously imagined during motor imagery.

3:30–3:45 (238)
Priming of Reach and Grasp Actions by Irrelevant Objects. MICHAEL E. J. MASSON, DANIEL N. BUB, & ANDREAS T. BREUER, *University of Victoria*—An influential view of the neural mechanisms determining actions to manipulable objects is that they are part of a visuomotor network (the dorsal stream) that is functionally distinct from the ventral system that determines the identity of objects. On this account, grasping objects is based on a dorsal representation that depends solely on parameters of the object directly determined by vision. In other words, the dorsal stream has no memory. This view of action predicts that priming of visuomotor actions should be absent when responding is mediated by the dorsal stream, a prediction confirmed in a number of reports. Using a new methodology, we show robust visuomotor priming effects under conditions that ensure involvement of the dorsal stream in reach and grasp responses. These priming effects are short-lived (an outcome that explains the null effects in previous reports) and include information about the functional goal typically afforded by the object.

3:50–4:05 (239)
Speed–Accuracy Trade-Offs in Specialized Keyboards. GREGORY FRANCIS & ELIZABETH JOHNSON, *Purdue University*—Patients with locked-in syndrome are perceptually and cognitively aware of their environment but are unable to speak and have very limited motor capabilities. Many patients communicate with a virtual keyboard by triggering a binary action when a cursor moves over a desired item. For text entry, such a method is excruciatingly slow. We show how keyboards can be optimally designed to maximize text entry speed, while simultaneously controlling the entry error rate. The method quantifies how different factors in keyboard design influence both entry speed and accuracy and demonstrates that different keyboard designs can alter the capabilities of keyboard use. For a given text corpus and allowable average entry error proportion, the method identifies the cursor duration and character layout that minimizes average entry time. The method can be adapted to a variety of keyboard designs and selection devices and, thereby, improve the communication of locked-in syndrome patients.

4:10–4:25 (240)
Target-Directed Vision in Action-Specific Perception. ROUWEN CAÑAL-BRULAND & JOHN van der KAMP, *VU University Amsterdam*, & FRANK F. ZHU & RICH S. W. MASTERS, *University of Hong Kong*—Golf players who hit with more success judge the hole to be bigger than do their less successful counterparts. This phenomenon, labeled *action-specific perception*, is consistent with one of the main tenets of embodied perception—that performance capabilities moderate an actor's perception of the environment. However, the processes that mediate action-specific effects are largely unknown. We present two studies in which we show that target-directed vision is a prerequisite for action-specific perception. In the first study, we used a throwing-and-catching task paradigm and showed that action-specific effects emerge only for primary action targets, but not for intermediate targets. In the second study, we replicated previously reported action-specific effects on perception in golf putting, but when vision toward the target was diverted or withheld, no action-specific effects emerged. Our results provide evidence to suggest that vision toward the action target is crucial for the emergence of action-specific effects.

4:30–4:45 (241)
Culture Affects Visual Distance Estimation. TAMER SOLIMAN, ALISON E. GIBSON, & ARTHUR M. GLENBERG, *Arizona State University* (read by Arthur M. Glenberg)—Can culture affect basic perceptual processes? Perceiving affordances reveals available actions and their difficulty; affordances depend on the body, the environment, and, we propose, on one's culture. In collectivist cultures, a premium is placed on considering and acting in regard to others, whereas individualists more often act for themselves. We reasoned that because individualists do not strongly perceive a connection to others, symbolic barriers (e.g., a yellow highway stripe) are sufficient to create a perceptible barrier to action, whereas this would be less true for collectivists. Participants stood behind a symbolic (yellow caution tape), a physical (fence), or no barrier and estimated distances to targets 8–24 yards away. Later, interpersonal attitudes were assessed by an implicit cognitive task. Relative to no barrier, when estimating across the symbolic barrier, strong individualists overestimated short distances; at the longest distance, there were no differences. Hence, culture affects perception by changing affordances.

4:50–5:05 (242)

Transfer from a Color-Mapping Task to a Simon Task for Shapes. GIULIA BARONI, *University of Bologna,* & MOTONORI YAMAGU-CHI & ROBERT W. PROCTOR, *Purdue University* (sponsored by Dan L. Chiappe)—The Simon effect refers to reaction time being shorter when the response location on a trial corresponds to the irrelevant location of the stimulus than when it does not. The effect can be reversed when the Simon task is preceded by or intermixed with an incompatibly mapped location-relevant task. This reversal is typically attributed to acquisition of incompatible stimulus–response associations. Treccani et al. (in press) found that an incompatible mapping used for a color discrimination task reversed the Simon effect when that task was intermixed with a Simon task for which shape was relevant. We tested whether the Simon effect is modulated similarly when participants practice with the color discrimination and then transfer to the Simon task. The Simon effect was uninfluenced by whether the prior color mapping was compatible or incompatible, but it was eliminated for both mappings when the practice stimuli shared an irrelevant spatial dimension with the transfer stimuli.

5:10–5:25 (243)

Does Stimulus Uncertainty or Response Uncertainty Produce the Hick/Hyman Law? RICHARD E. HAZELTINE, TIMOTHY WIFALL, & J. TOBY MORDKOFF, *University of Iowa*—The Hick/Hyman law (Hick, 1952; Hyman, 1953) holds that reaction time increases linearly with the log of the number of stimulus–response alternatives when they are equally likely. Here, we examined the relative contributions of stimulus uncertainty and response uncertainty to this increase. Participants practiced responding vocally to eight equally likely visual stimuli with eight, four, or two responses and then transferred to sessions in which either only four or only two stimuli were presented. Thus, we could compare, for example, the reductions associated with going from 8 stimuli:2 responses to 4 stimuli:2 responses or from 8:8 to 4:4. Our analyses focused on trials in which the response (and stimulus) differed from that of the previous trial. Reducing the number of responses consistently had a much larger effect on reaction time than did reducing the number of stimuli. We discuss the implications of these findings for models of response selection.

Associative Learning
Meramec, Saturday Afternoon, 3:10–5:25

Chaired by Timothy C. Rickard, University of California, San Diego

3:10–3:25 (244)

Addition, Subtraction, Identical Elements, and Semantic Quantity. TIMOTHY C. RICKARD, JUNG KWAK, & DANIEL BAJIC, *University of California, San Diego*—The results of multiple practice-transfer experiments support the identical-elements account of the memorial organization of facts following retrieval practice. In the case of arithmetic, that model predicts that performance improvements will transfer neither to complementary operations (e.g., 4×7 to 28/4) nor to complementary division or subtraction problems (e.g., $11-3$ to $11-8$). Recently, however, cross-operation transfer for addition and subtraction has been demonstrated, raising a challenge to the model. Candidate accounts are that addition/subtraction memory may have a more holistic character than does multiplication/division memory or may be partly dependent on semantic quantity (e.g., mental number line) representations that support transfer. We conducted addition/subtraction transfer experiments to investigate these possibilities. The results speak both to the role that semantic quantity representations play in addition/subtraction and to the viability of the identical-elements model as a global account of the memorial organization of practiced facts.

3:30–3:45 (245)

Guided Cognition Homework Efficiently Improves Mathematics Problem-Solving Performance. WILLIAM B. WHITTEN II & MITCHELL RABINOWITZ, *Fordham University*—Guided cognition (GC) improves learning from homework by structuring study tasks to engage students in specific, observable cognitive events that elicit underlying cognitive processes. We identified cognitive events that commonly occur in classrooms and that have correlates in the experimental literature and then designed some into homework. Last year, we evaluated GC effectiveness for learning mathematics and reported that GC homework improved students' abilities to interpret and work story problems and also to execute calculations for nonstory problems. In the present experiments, we assessed GC efficiency. During equal time intervals, seventh-grade students either worked 12 story problems (Condition T) or worked 4 story problems and performed four noncalculation cognitive events (Condition GC) for each of two topics (multiplying and dividing fractions). Surprise quizzes after 1–3 days and after 14 weeks showed that GC students, who had worked only 8 problems, performed as well as T students, who had worked 24 problems.

3:50–4:05 (246)

Learning in Late Adulthood: The Role of Binding and Domain. ELAINE TAMEZ, JOEL MYERSON, & SANDRA HALE, *Washington University* (read by Joel Myerson)—Age-related differences in learning are hypothesized to result from associative-binding deficits. In this study, older adults completed three types of learning tasks that differed in the number of associations that needed to be formed: list learning (e.g., day, men, win, etc.), paired-associate learning (e.g., set–zip), and complex associative learning (e.g., lie: A–rim, lie: B–rim, lie: C–dry). In each of two domains (verbal and spatial), participants completed four learning blocks for each task. With verbal learning, performance on the first two blocks decreased across tasks as the number of associations required increased. Surprisingly, paired-associate learning was equivalent to list learning on subsequent blocks. With spatial learning, performance decreased as the number of associations required increased. This decrease was greater than in the verbal domain, and this pattern was maintained across blocks. Thus, learning appears to be influenced by associative deficits that are greater in the spatial than in the verbal domain.

4:10–4:25 (247)

Age-Related Changes in Implicit Learning Across Human Life Span. DEZSO NEMETH & KAROLINA JANACSEK, *University of Szeged* (sponsored by Alan D. Baddeley)—Implicit skill learning underlies not only motor, but also cognitive and social skills. We investigated such learning across the life span, between 4 and 85 years of age. The participants performed a probabilistic implicit sequence-learning task (alternating serial reaction time task), which measured "pure" sequence-specific learning that is distinct from general motor skill learning. We found that the difference in implicitly learning high- versus low-probability events exhibits a characteristic and rapid decrement at around the age of 12. These results suggest that due to developmental changes in early adolescence, implicit-learning processes undergo a marked shift in weighting raw probabilities versus more complex interpretations of events.

4:30–4:45 (248)

Adaptation to the Temporal Statistics of Spatial Cuing. CORY A. RIETH & DAVID E. HUBER, *University of California, San Diego* (read by David E. Huber)—Spatial cuing produces facilitation for short (<150 msec) cue–target SOAs but deficits for long (>300 msec) SOAs. These deficits are termed "inhibition of return" (IOR). We tested whether this reflects environmental regularity by training participants that the SOA determined target location. Following training that targets would appear on the cued side only for long SOAs, the IOR was reversed. In contrast, the IOR was enhanced after training that targets would appear on the uncued side only for long SOAs. However, no training effects were observed for short SOAs. A subsequent experiment used only short SOA training to avoid the ambiguities of training with both short and long SOAs. With this change, training modulated spatial cuing even at short SOAs. These results are compatible with the claim that spatial cuing is a learned behavior that incorporates not only expectations of location, but also expectations of time.

4:50–5:05 (249)

Attention and the Inverse Base Rate Effect: Evidence From Event-Related Potentials. ANDY J. WILLS & AURELIU LAVRIC, *University of Exeter* (sponsored by Stephen Monsell)—In the inverse base rate effect, participants are trained that cue compound AB predicts a commonly occurring outcome, whereas cue compound AC predicts a rarer

outcome. Participants subsequently state that compound BC predicts the rarer outcome—a response opposite to what one might expect, given the relative frequency of the outcomes and the fact that both B and C are perfect predictors of their respective outcomes. We report an electrophysiological investigation of the inverse base rate effect that supports an explanation in terms of early attentional differentiation driven by differences in prediction error.

5:10–5:25 (250)

Enhanced Old–New Recognition and Source Memory for Faces of Cooperators and Defectors in a Social-Dilemma Game. RAOUL BELL, AXEL BUCHNER, & JOCHEN MUSCH, *Heinrich Heine University Düsseldorf*—A popular assumption in evolutionary psychology is that the human mind comprises specialized cognitive modules for social exchange, including a module that serves to enhance memory for the faces of cheaters. In the present study, participants played a trust game with computerized opponents, who either defected or cooperated. In a control condition, no interaction took place. A multinomial model was used to assess old–new discrimination, source memory, and guessing biases separately. Inconsistent with the assumption of a memory mechanism that focuses exclusively on cheating, the present study showed enhanced old–new discrimination and source memory for both defectors and cooperators, for which memory was equally good. When the differences in base rates were extreme, memory for the rare opponent type was enhanced. The fact that the present results are inconsistent with those of previous studies using verbal descriptions of cheating, trustworthy, and irrelevant behaviors suggests that the relative significance of cheating and cooperation may change depending on whether one reads about interactions between third parties or is directly involved in social exchange. The findings can be attributed to a mechanism that focuses on exchange-relevant information and flexibly adapts to take into account the relative significance of this information in the encoding context, which may be more beneficial than focusing exclusively on cheaters.

Concepts and Categories III
Chouteau, Saturday Afternoon, 3:50–5:25

Chaired by Eva Dreikurs Ferguson
Southern Illinois University, Edwardsville

3:50–4:05 (251)

Do Culture and Parenting Styles Influence Transitivity of Simple Choices? EVA DREIKURS FERGUSON, *Southern Illinois University, Edwardsville*, & JOEL A. HAGAMAN, *University of the Ozarks*—Several studies examined the impact of culture on parenting style and on cognitive style, as evidenced by transitivity of choices among simple alternatives. Adlerian theory and the work of Kurt Lewin would predict that parenting styles will influence transitivity of choices (Ferguson, Hagaman, Grice, & Peng, 2006), and the conceptualization of Peng and Nisbett (1999) would suggest that since Asian dialectic thinking often accepts opposites as equally valid, Asians can be expected to be more intransitive than Caucasians in simple personal choices. Asian American, Caucasian American, and university students in India reported different parenting styles, and they differed in transitivity of choices. Regression analyses revealed that culture affects both parenting style and transitivity of choices.

4:10–4:25 (252)

The Academic Experiences Survey: Assessing the Impact of Liberal Education. KATHLEEN M. GALOTTI & LACEY DORMAN, *Carleton College*—First-year undergraduate students ($N = 101$) participated in a short-term longitudinal study of goal setting, decision making, and epistemological changes, as they pertained to their academic experiences. We created the Academic Experiences Survey to assess students' reactions to their academic experiences. This instrument has five scales: understanding of liberal arts, attitude toward interdisciplinary study, self-reported academic skills, level of comfort at college, and future planning or orientation. Preliminary analyses indicate acceptable to excellent levels of internal reliability for most of the scales (median coefficient alpha of .801). We found several correlates of scale scores with other

well-known measures of cognitive functioning, including need for cognition and connected knowing, as well as with the kinds of personal goals students set themselves for the year. We explore the potential uses of this new instrument.

4:30–4:45 (253)

Polarization and Political Categorization. EVAN HEIT & STEPHEN P. NICHOLSON, *University of California, Merced*—Two experiments examined the typicality structure of contrasting political categories. In Experiment 1, two separate groups of subjects rated the typicality of 15 individuals, including political figures and media personalities, with respect to the categories Democrat or Republican. The relation between the two sets of ratings was negative, linear, and extremely strong ($r = -.9957$). Essentially, one category was treated as a mirror image of the other. Experiment 2 replicated this result and showed some boundary conditions. The same method was applied to two other pairs of contrasting categories: healthy and junk foods, and male and female jobs. For those categories, the relation between contrasting pairs was weaker, and there was less of a direct trade-off between typicality in one category versus typicality in its opposite. The results are discussed in terms of implications for political reasoning and decision making and for conceptual representation.

4:50–5:05 (254)

Causal Precipitants and Expert Judgments of Psychological Normality. NANCY S. KIM, DANIEL J. PAULUS, & DANIELLE KHALIFE, *Northeastern University*—Understanding bizarre behaviors makes them seem more psychologically normal (Ahn, Novick, & Kim, 2003; Kim & LoSavio, 2009; Meehl, 1973). We asked whether, more broadly, the perceived normality of a behavior is influenced by the degree of mismatch between the extremity of the behavior and the severity of its cause (cf. Einhorn & Hogarth, 1986; Medin, 1989). Practicing clinical psychologists ($N = 73$) read case vignettes in which either traumatic or mildly negative events preceded hypothetical people's behaviors (DSM symptoms, mildly distressed behaviors, or calm behaviors). Calm behaviors following a traumatic event were judged to be of comparable normality to full-fledged, DSM-disordered behaviors following the same event. Furthermore, contented behaviors following a traumatic event were judged to be more abnormal than were identical behaviors following a mildly negative event. Explicit DSM recommendations moderated the strength of the effect, but clinicians' theoretical orientations did not. Implications for categorization and reasoning are discussed.

5:10–5:25 (255)

Mood, Cognitive Flexibility, and Category Learning. JOHN PAUL MINDA & RUBY T. NADLER, *University of Western Ontario*—Theories of mood and its effects on cognition suggest that positive mood may increase cognitive flexibility. This increased flexibility is associated with areas in the prefrontal cortex and the anterior cingulate cortex, both of which play crucial roles in hypothesis testing and rule selection. As such, cognitive tasks that rely on these behaviors may benefit from positive mood, whereas tasks that do not rely on these behaviors should not benefit from cognitive flexibility and/or positive mood. We explored this idea within a category-learning framework. Happy, neutral, and sad moods were induced in our subjects, and they learned either a rule-described or a non-rule-described category set. Subjects in the happy mood condition performed significantly better than subjects in the neutral or sad mood conditions when learning the rule-described categories. Mood had little effect on the learning of non-rule-described categories.

Working Memory III
Lewis and Clark, Saturday Afternoon, 3:30–5:25

Chaired by Klaus Oberauer
University of Zurich and University of Bristol

3:30–3:45 (256)

Interference Between Processing and Storage in Working Memory: Testing a Prediction of the SOB Model. KLAUS OBERAUER, *University of Zurich and University of Bristol*, & SIMON

FARRELL, CHRISTOPHER JARROLD, MARTIN GREAVES, & KAZ PASIECZNIK, *University of Bristol*—In complex-span working memory tasks, processing of distractors impairs memory. Interference-based theories explain this impairment by distractors' interfering with items. We tested predictions from a new interference-based computational model of complex span, C-SOB (Lewandowsky & Farrell, 2008). The model predicts that item–distractor similarity affects memory, the effect depending on the relative placement of similar items and distractors. When each item is followed by similar distractors, higher item–distractor similarity should improve memory, because distractors are associated to the same position as the preceding items, so that similar distractors reinforce the item's memory trace. Additionally, the encoding strength of distractors following similar items is reduced by novelty-gated encoding, a core principle of C-SOB. The beneficial effect of item–distractor similarity disappears when items are preceded, rather than followed, by similar distractors. We confirmed these predictions in three experiments using nonwords, manipulating the phonological similarity between items and distractors preceding or following them.

3:50–4:05 (257)

Adaptive Choice in Strategies of Maintenance in Verbal Working Memory. VALÉRIE CAMOS, *Université de Bourgogne and Institut Universitaire de France*, GÉRÔME MORA, *Université de Bourgogne*, & KLAUS OBERAUER, *University of Zurich and University of Bristol*—Because both articulatory rehearsal and attentional refreshing aid the maintenance of verbal information at the short term, the present study evaluated the adaptive use of these mechanisms, using a complex span paradigm. In Experiment 1, phonological similarity of memory-list words and attentional demand of concurrent processing were manipulated. As was predicted, a phonological similarity effect (PSE) appeared only when the concurrent task was attention demanding, thus impairing the use of refreshing and encouraging rehearsal. To verify that PSE indicates the use of rehearsal, participants were instructed to use one of the two mechanisms in Experiments 2 and 3. In accordance with Experiment 1, the PSE was observed only under rehearsal. Thus, adults could adaptively choose between the two mechanisms. When remembering phonologically confusable materials, they prefer refreshing to reduce the impact of phonological characteristics. When available attention is reduced, they favor a less attention-demanding mechanism, rehearsal.

4:10–4:25 (258)

Forgetting From Visual Working Memory: Time and Attention Both Matter. TIMOTHY J. RICKER, *University of Missouri, Columbia*, CANDICE C. MOREY, *University of Groningen*, & NELSON COWAN, *University of Missouri, Columbia* (read by Nelson Cowan)—Unlike recent studies using easily labeled verbal materials, we find that memory for arrays of unconventional, novel characters drops dramatically during an unfilled 6-sec retention interval. We also find, however, that the level of responding depends on attention and that this level can be reduced with distracting tasks that have few visual features. These distracting tasks have been based on spoken stimuli and have included covert retrieval from long-term memory, digit repetition, subtraction, and parity judgment. We propose that there are two sets of visual features, only some of which can be refreshed using attention. There appears to be an equilibrium between forgetting and refreshing of these features, given that retention interval and distraction type do not interact. Any attentional distraction, regardless of its specific features, appears to disrupt the refreshment process. The data show that both forgetting over time and the use of attention are important for visual working memory.

4:30–4:45 (259)

Affective Memory Bias in Working Memory: Content and Context. AMANDA R. RABINOWITZ & RICHARD A. CARLSON, *Pennsylvania State University* (read by Richard A. Carlson)—Affective memory bias refers to the tendency to better remember information with a certain emotional valence, but such effects are often not found in working memory tasks (Gotoh, 2008). Bruce and Arnett (2005) demonstrated affective bias in working memory, using a reading span task. We explored this effect, using a reading span task in which sentences, target words, or both had affective content (positive or negative). The results suggest that both the content of the memory target and the context of encoding influence the accuracy of subsequent retrieval. Recall accuracy was better when the target words had a negative valence than when the target words were positive. Furthermore, recall was better when the sentences proceeding target words had a positive valence than when the sentences were negative. Affect was also related to sentence reading times, with subjects spending more time reading negative sentences. The theoretical implications of these findings are discussed.

4:50–5:05 (260)

Cortical Representation of Tactile Short-Term Memory in the Human Brain Revealed by Magnetoencephalography. ULYSSE FORTIER-GAUTHIER & STEPHAN GRIMAULT, *University of Montreal*, DOUGLAS CHEYNE, *Neuromagnetic Imaging Laboratory, Hospital for Sick Children, Toronto, Canada*, & PIERRE JOLICŒUR, *University of Montreal* (read by Pierre Jolicœur)—Brain activity specifically related to the retention of information held in tactile short-term memory (TSTM) was isolated using whole-head magnetoencephalography. We simultaneously stimulated two, four, or eight locations (out of eight) on one hand (hand alternated across blocks). The tactile stimulation pattern was held in memory for 1,800 msec before being compared with a test pattern that was either the same or different by one location (except when all eight locations were stimulated), yielding effective memory loads of zero, two, and four. Analyses focused on regions in the brain that showed a monotonic increase of sustained activity during the retention interval with an increasing tactile memory load. Preliminary analysis showed the right cingulate gyrus, left precuneus, medial frontal gyrus, right precentral gyrus, and right supramarginal gyrus as increasing with load. These regions are likely to participate in the active maintenance of the information held in TSTM.

5:10–5:25 (261)

Auditory-Verbal Hebbian Sequence Learning: The Legacy of Perceptual–Gestural Mapping? ROBERT W. HUGHES & JOHN E. MARSH, *Cardiff University*—Auditory–verbal short-term serial recall improves when a list is intermittently repeated across a block of otherwise nonrepeated lists, thereby demonstrating long-term sequence learning (Hebb, 1961). We examined the role of passive perceptual organization in such learning. We found that if the lists (including the repeating list) were presented in alternating female–male voices, such that nonadjacent items were likely to form a coherent stream, learning was observed for the within-voice subsequences: Repetition-learning for a list (e.g., 46913528) generalized to a transfer list made up of the concatenation of nonadjacent items in the original list (i.e., 49326158; no such transfer was found with single-voice lists). However, the lists also had to be mapped onto a gestural sequence; no learning was found if the lists had merely to be monitored passively. Auditory–verbal sequence learning may reflect the legacy of a process of mapping one (perceptually derived) form of organization onto another (gestural) form.

Perception
Illinois, Sunday Morning, 8:00–9:55

Chaired by J. Devin McAuley, Michigan State University

8:00–8:15 (262)
Regulatory Focus Theory and Auditory Perceptual Classification: A Motivation Perspective on Musician Advantages in Listening Tests. J. DEVIN McAULEY, *Michigan State University*, MOLLY J. HENRY, *Bowling Green State University*, ALAN WEDD, *Michigan State University*, & SAMANTHA TUFT & BRYAN T. GRUSHCOW, *Bowling Green State University*—The present study extends research bridging regulatory focus theory and visual perceptual classification to the auditory domain in order to consider the contribution of motivation to musician advantages in listening tests. In two experiments, participants heard tones that varied in frequency and duration according to an initially unknown disjunctive rule and assigned them to one of two categories, either gaining points for correct responses or losing points for incorrect responses. In Experiment 1, musicians learned the rule more quickly than did non-musicians in the gains condition. In Experiment 2, the same pattern of results was observed for individuals primed with a promotion focus, as compared with those primed with a prevention focus. No musicianship/regulatory focus effects were observed in the losses conditions. These findings are consistent with a regulatory fit hypothesis and the view that musicians adopt a promotion focus when faced with listening tests that require mastery.

8:20–8:35 (263)
Sound Affects the Speed of Visual Spatial Orienting. JEAN VROOMEN & MIRJAM KEETELS, *Tilburg University*—We examined the effects of a task-irrelevant sound on visual processing time. Participants were presented with revolving clocks at or around central fixation and reported the hand position of a target clock at the time an exogenous cue (one clock turning red) or an endogenous cue (a line pointing toward one of the clocks) was presented. A spatially irrelevant sound presented 100 msec before the cue speeded up visual latency, if compared with a sound presented 100 msec after the cue. The effect of the sound was larger the farther the target was from fixation, and it was larger for endogenous than for exogenous cues. A visual temporal warning signal had different effects on latency. These results demonstrate that an asynchronous sound can (1) shift the perceived time of occurrence of a visual cue (temporal ventriloquism) and (2) speed up the velocity of the attentional shift toward the target. Sounds thus have multiple effects on visual perception.

8:40–8:55 (264)
Enhanced Visuospatial Learning and Memory Effects in Time–Space Synesthesia. URSINA TEUSCHER, DAVID BRANG, VILAYANUR S. RAMACHANDRAN, & SEANA COULSON, *University of California, San Diego*—Time–space synesthetes report that they consistently experience time events, such as the months of the year, as having a specific spatial layout. Two studies compared 11 synesthetes' and 41 nonsynesthetic controls' ability to memorize novel spatial calendars. Both studies revealed better memory performance (quicker reaction times and higher consistency) for synesthetes than for controls, even if the memorized calendar was specifically designed to conflict with synesthetes' own involuntarily experienced calendar. The findings suggest that time–space synesthetes' enhanced visuospatial memory abilities may underlie the emergence of time–space synesthesia, since people with a greater capacity to learn mappings between spatial forms and temporal sequences might be more likely to think of months of the year in terms of idiosyncratic shapes, whereas others might be more reliant on culturally established mapping schemes.

9:00–9:15 (265)
Familiar Configuration Effects on Figure–Ground Perception Are Impaired in Medial Temporal Lobe Amnesia. MARY A. PETERSON, *University of Arizona*, & MORGAN D. BARENSE, *University of Toronto*—Amnesia from medial temporal lobe (MTL) lesions has traditionally been considered a selective deficit in declarative memory, yet recent studies suggest that the perirhinal cortex of the MTL is involved in high-level perceptual processing. The evidence for this alternative view derives primarily from tasks with a substantial memory component, leaving open the question of whether memory or perception is impaired. We tested whether two patients with MTL lesions would show normal effects of familiar configuration on figure–ground perception, a quintessentially perceptual task. The patients showed effects of familiar parts, rather than familiar configuration, on figure assignment, whereas control subjects showed the converse pattern. We interpret our results as evidence that perirhinal cortex damage impairs discrimination of novel versus familiar configurations, consequently releasing lower level part familiarity responses; part-familiarity responses are reduced in the intact brain when novel configurations are perceived. Thus, the MTL plays a role in the perceptual processing of familiar configurations.

9:20–9:35 (266)
New Configural Superiority Effects in the Temporal and Spatial Domains. JAMES R. POMERANTZ, *Rice University*, SHAIYAN KESHVARI, *Baylor College of Medicine*, MARY C. PORTILLO, *University of Houston, Downtown*, ANNA I. STUPINA, *Rice University*, & DOLAPO SOKUNBI, *Baylor College of Medicine*—Can adding noninformative context improve the discriminability of stimuli? When the identical context C is added to two target stimuli A and B, AC and BC are usually harder to discriminate from each other than are A and B—because of increased similarity, noise (masking, crowding), and attentional load. In special cases, the reverse occurs, a result called a *configural superiority effect* (CSE), which we believe arises from emergent features. We introduce new CSEs involving apparent motion in which the context is offset from the targets in time, and we show how these effects can be made arbitrarily large. We distinguish these CSEs from mere anchor effects in absolute judgment tasks. We consider whether CSEs can arise from the creation of both accidental and nonaccidental properties, and we discuss whether further CSEs could be identified were there some way to correct for the adverse effects of context, such as crowding.

9:40–9:55 (267)
Failure of Perceptual Separability in Judgments of Distance But Not Position. STEPHEN DOPKINS & HYOUN PYOUN, *George Washington University*—When subjects indicate whether pairs of points belong to the same column of a two-dimensional array, their performance does not depend on the vertical distance between the points. When subjects indicate whether pairs of points are zero columns apart in a two-dimensional array, in a task in which the criterion number of columns varies from trial to trial, their performance depends on the vertical, as well as the horizontal, distance between the points. The pattern of data is well accommodated under the assumption that subjects can directly access the horizontal positions for pairs of points but cannot directly access the horizontal distances for pairs of points and must, therefore, make judgments of horizontal distance on the basis of the aggregate distances between the points, with the horizontal dimension weighted more heavily than the vertical dimension. These results suggest revisions in current ideas about perceptual separability and its failure.

Explicit Memory IV
Missouri, Sunday Morning, 8:00–9:35

Chaired by Michael P. Toglia, University of North Florida

8:00–8:15 (268)
Veridical and False Memory for Survival and Nonsurvival DRM Lists. MICHAEL P. TOGLIA & AARON D. LEEDY, *University of North Florida*, CATHERINE M. BAKER, *Auburn University,* & ARTHUR H. CHENG, *University of North Florida*—Evolutionary perspectives regarding cognitive functioning recently have guided research on survival's role in developing an adaptive memory. We examined recall of DRM lists related and unrelated to survival, with participants rating words for pleasantness or survivability. Survival lists were rated higher for survivability and pleasantness, as compared with nonsurvival lists. Participants who processed words for survival with a grasslands scenario had lower correct recall than did both those processing for generic

survivability and those processing for pleasantness. Additionally, survival lists produced better veridical memory than did those with low survival relevance. Survival grasslands processing led to greater false memory than did pleasantness processing and to illusory recall equal to that for generic survivability encoding. Survival lists led to somewhat more false memory than did nonsurvival lists. Overall, survival processing and list type showed little advantage in accurate recall, although leading to greater inaccurate memory. The results are discussed with regard to their practical significance to adaptive memory and to theories of false memory.

8:20–8:35 (269)

Who's Memory Is That? Source Confusion Following Collaborative Remembering. IRA E. HYMAN, JR., *Western Washington University*— When engaged in collaborative remembering, people adopt information from their partner's memory. We looked at whether people are able to recall which memories are their own and which came from their partner. We presented people with partially overlapping lists of words. We found that people make frequent errors in source monitoring by claiming their partner's memories as their own. In collaborative remembering, people work to construct an agreed-upon version of the past.

8:40–8:55 (270)

To Tell the Truth: Destination Memory Varies With Truthfulness. DONALD J. TELLINGHUISEN & ZIG A. INGRAFFIA, *Calvin College*—Destination memory is the ability to remember to whom particular information has been told. We replicated portions of Gopie and MacLeod's (2009) destination memory procedure, in which participants were asked to give information to pictures of famous persons and then complete an associative memory test. As in that study, we found that increasing self-focus by having participants give personal information yielded decreased destination memory accuracy when compared with instances where general information was told. In addition, we examined destination memory for telling true versus false information. We expected that accurate destination memory would have utility for keeping lies straight and hypothesized better destination memory for lies than for truth. However, we found that personal lies were associated with significantly worse destination memory performance than were general facts or general falsehoods. Processing involved in constructing a lie may negatively influence the ability to remember to whom false information has been given.

9:00–9:15 (271)

Elimination of the Own-Race Bias for Out-Group Faces. CHRISTINA N. STANFORD, JEFFREY S. ANASTASI, & MATTHEW R. HUGHES, *Sam Houston State University* (read by Jeffrey S. Anastasi)— The purpose of the present study was to determine whether the own-race bias could be eliminated under conditions where one is focusing on an in-group/out-group affiliation that does not involve race. In Experiment 1, black and white college students were presented with photographs of black and white individuals who were labeled as fellow students or professors. In Experiment 2, black and white college students were presented with photographs of black and white faces that were labeled as fellow students from their university or as police officers. Overall, results indicated an own-race bias. However, this own-race bias was primarily observed for student faces. The own-race bias was eliminated for the professor and police officer faces. The results indicated that the own-race bias can be reduced or eliminated for faces that are categorized into an out-group affiliation other than race. The results are discussed with regard to Sporer's (2001) in-group/out-group model.

9:20–9:35 (272)

There Is More to Judgments of Learning Than Prediction: They Improve Memory. TETSUYA FUJITA, *Hosei University*—In the present study, I examined the effect of making judgments of learning (JOLs) on remembering words. In Experiment 1, I compared the memory performance of participants when they made JOLs with that when they made semantic and physical judgments on the levels of processing. The results revealed that participants who made JOLs showed better performance for free recall than did those who made physical judgments and that their

preference was also equal to that of participants who made semantic judgments. In Experiment 2, I examined the extent to which JOL was effective, as compared with self-reference processing, and whether judgment for memory of the self was critical. The results showed that JOL had the same effect as memory performance as a whole, regardless of the object (the self or others). In Experiment 3, I examined the effect of intentionality of learning on JOL, but there was no effect. These findings showed that making JOLs is beneficial for memory.

Speech Perception II
Mississippi, Sunday Morning, 8:00–9:35

Chaired by Laura C. Dilley, Michigan State University

8:00–8:15 (273)

Exploring the Role of Exposure Frequency in Recognizing Pronunciation Variants. LAURA C. DILLEY, *Michigan State University* & MARK A. PITT, *Ohio State University*—This study sought evidence for the proposal that the efficiency of recognition of pronunciation variants of spoken words (*counter* vs. *couner*) is a function of the frequency with which they are produced by talkers. Talkers' productions and listeners' perceptions of words with medial /t/ were examined across 16 conditions in which /t/ was realized in one of four possible ways (as a canonical, glottal, flapped, or deleted variant) in four phonological contexts, each of which favored one of the realizations. The results from the production experiment showed that talkers primarily produce contextually predictable realizations of /t/. The results of a lexical decision experiment showed that listeners displayed similar selectivity in their classification responses, except when responding to the canonical pronunciation. These results indicate that perception efficiency largely mirrors production frequency, with an important caveat associated with canonical /t/ pronunciation.

8:20–8:35 (274)

Seeing the Talker Hinders Semantic Processing by Preschool-Aged Children. SUSAN JERGER, *University of Texas, Dallas*, MARKUS F. DAMIAN, *University of Bristol*, CANDICE M. MILLS & JAMES C. BARTLETT, *University of Texas, Dallas*, & NANCY TYE-MURRAY, *Central Institute for the Deaf of Washington University School of Medicine*—The interference in picture naming produced by semantically related distractors presented auditorily or audiovisually was studied with our multimodal (MM) picture–word task. Unlike children 6–14 years of age, the results for 4- to 5-year-olds did not show semantic interference. This finding contrasts with our research showing phonological interference from 4 to 14 years on the MM task (Jerger et al., 2009). A second experiment compared MM with cross-modal (CM, no face) results for the same semantic items in a different pool of children. CM results for 4- to 5-year-olds showed semantic interference. Differing results for the MM versus CM tasks is consistent with a limited capacity hypothesis. The attended information of the MM task consumed the younger children's limited resources, hindering processing of the semantic content of the distractors and reducing interference. Both the type of knowledge and the perceptual load influence picture–word performance in younger children.

8:40–8:55 (275)

Segmental Versus Suprasegmental Information in the Perception of Foreign-Accented Speech. JOAN A. SERENO, LYNNE LAMMERS, & ALLARD JONGMAN, *University of Kansas*—Both segmentals (individual speech sounds) and suprasegmentals (pitch and speech rate) have been found to influence the perception of foreign accents. The present study examines the relative impact of segmentals and suprasegmentals on intelligibility, accentedness, and comprehensibility. Forty sentences recorded by two English and two Korean speakers were manipulated by combining the segmentals from one speaker with the suprasegmentals of another speaker. Four versions of each sentence were created: one English control, one Korean control, and two Korean–English combinations (one with Korean suprasegmentals and English segmentals, the other with English suprasegmentals and Korean segmentals). Forty native English speakers transcribed the sentences for intelligibility and rated their accentedness and comprehensibility. The study found that

segmentals have a significant effect on intelligibility, accentedness, and comprehensibility, whereas suprasegmentals had a significant effect only on intelligibility. Therefore, it seems that native speakers rely on segmentals when determining how accented and comprehensible non-native speech is.

9:00–9:15 (276)

On the Locus of Cognitive Load in Models of Spoken-Word Recognition. SVEN L. MATTYS & LUKAS WIGET, *University of Bristol*—The effect of cognitive load (CL) on spoken-word recognition has received little attention, despite the prevalence of CL in everyday listening conditions (e.g., divided attention). To assess the effect of CL on the relative contribution of lexically versus acoustically mediated processes, we measured the magnitude of the "Ganong effect" (lexical bias on phoneme categorization) under CL and no CL. Under CL, participants saw a visual array while performing phoneme identification (/g/ vs. /k/) on *gi–ki* (baseline), *gift–kift*, and *giss–kiss* continua. Detection of a prespecified target in the visual array was checked at the end of each trial. The no-CL condition excluded the visual task. CL led to a larger Ganong effect. However, performance on the *gi–ki* (baseline) continuum was unaffected by CL. This pattern remained strong under various time constraints. The results suggest that CL boosts lexically mediated processes, with no reduction in phonetic acuity. Implications for spoken-word recognition models are discussed.

9:20–9:35 (277)

Speech and Word Recognition Are Continuous: Evidence From Granger Causality Analysis of MEG/EEG Movies. DAVID W. GOW, JR. & RICKY D. SACHDEVA, *Massachusetts General Hospital*—For much of the last 50 years, evidence for the categorical perception of speech sounds has defined an implicit boundary between speech perception and spoken word recognition, with speech perception encompassing the realm between acoustics and categorization and word recognition covering the mapping between phonemic and lexical representation. This view has been challenged by evidence that phonetic variability influences lexical processes and lexical representations influence speech categorization. In this paper, we present evidence from a Granger causality analysis of MRI-constrained MEG/EEG activation movies to explore the relationship between acoustic-phonetic processing in the superior temporal gyrus (STG) and abstract representations of lexical form associated with the supramarginal gyrus (SMG) during the perception of CV voicing and place continua. Granger analysis shows direct top-down SMG influences on STG activation for category boundary tokens, consistent with interactive accounts of speech categorization.

Letters and Word Processing III
Meramec, Sunday Morning, 8:00–9:35

Chaired by Johanna Kissler, University of Konstanz

8:00–8:15 (278)

When and How Does Reading of Emotional Words Differ From Reading Neutral Words, Pseudowords, or Letter Strings? JOHANNA KISSLER, *University of Konstanz*, CORNELIA HERBERT, *University of Würzburg*, & ANNE HAUSWALD, *University of Konstanz* (sponsored by Joseph Dien)—During reading, event-related brain potentials to emotional words were shown to differ from neutral ones. Here, we investigate the functional stage of this effect. Letter strings, pseudowords, and neutral, pleasant, and unpleasant words were presented while participants' event-related brain potentials were recorded. Differences between letter strings, on the one hand, and pseudowords and words, on the other hand, were found between 100 and 200 msec, indicating formal stimulus classification. From about 200 msec, words differed from pseudowords and letter strings, suggesting a lexicality effect. The largest effect of emotion peaked at 285 msec, supporting a postlexical stage of the effect. However, pleasant words evoked larger amplitudes than did unpleasant and neutral words already at 130 msec, coinciding with the differentiation between words and pseudowords. This suggests a dynamic influence of emotional content on word processing. Data are complemented by intracranial recordings from two presurgically implanted patients.

8:20–8:35 (279)

A Dual-Route Theory of Orthographic Processing. JONATHAN GRAINGER, *CNRS and Aix-Marseille University*—I present a theory of orthographic processing that draws a key distinction between a coarse-grained and a fine-grained route that involve two fundamentally different types of orthographic code. Processing along the coarse-grained route optimizes fast access to semantics by using minimal subsets of letters that are determined by the constraints imposed by letter visibility, on the one hand, and by the relative diagnosticity of letter combinations, on the other. These minimal sets of letter identities code for approximate within-word letter position independently of letter contiguity. Processing along the fined-grained route, on the other hand, is sensitive to the precise ordering of letters, as well as to position with respect to word beginnings and endings. This enables the chunking of frequently occurring contiguous letter combinations that form relevant units for morpho-orthographic processing (prefixes and suffixes) and for the prelexical translation of print to sound (multiletter graphemes).

8:40–8:55 (280)

Learning to Spell From Reading: General Knowledge About Spelling Patterns Can Distort Memory for Specific Words. MICHEL FAYOL, *Université Blaise Pascal and CNRS*, REBECCA TREIMAN, *Washington University*, BERNARD LÉTÉ, *University Lumiere Lyon 2*, & SÉBASTIEN PACTON, *Université Paris Descartes and CNRS* (read by Rebecca Treiman)—Adults often learn to spell words during the course of reading for meaning, without intending to do so. We developed an incidental learning task in order to study this process. Spellings that contained double *m*, *n*, and *r*, letters that often double in French, were learned more readily by French university students than were spellings that contained less common but still legal doublets. When recalling the latter, the students sometimes made transposition errors, applying the abstract feature of doubling to a consonant that often doubles in the language, rather than to the consonant on which the feature originally appeared (e.g., *tiddunar* recalled as *tidunnar*). The results show that people use general knowledge about the graphotactic patterns of a writing system, together with word-specific knowledge, to reconstruct spellings. These processes contribute to failures and successes in memory for spellings, as in other memory domains.

9:00–9:15 (281)

Transposed Letters and the Change Detection Task. JAY G. RUECKL, *University of Connecticut and Haskins Laboratories*, & SAMANTHA K. HENRY, *University of Connecticut*—We investigated transposed-letter effects using a novel paradigm—the change detection task. In this task, a series of letter strings is presented on each trial. On some trials, the same letter string is presented each time, whereas on others, one of the letter strings differs from the others. Across a series of experiments, we observed that (1) letter replacements were easier to detect than letter transpositions, (2) stimulus duration had a more pronounced effect on the detection of replacements than of transpositions, and (3) changes were easier to detect in real words than in pseudowords, but this lexicality effect was independent of both stimulus duration and type of change. These results provide insights about the time course of the accumulation of letter identity and letter position information. The methodological similarities and differences between the change detection task and other paradigms used to study transposed-letter effects are also discussed.

9:20–9:35 (282)

Tale of Two Links: Association in Mediated Priming. LARA L. JONES, *Wayne State University*—Mediated priming refers to the increased accessibility of a target (SUN) by a prime (CRATER) that is related indirectly via a connecting mediator (*moon*). Such activation can occur via spreading activation from prime to mediator to target (McNamara & Altarriba, 1988) or via a postlexical semantic-matching process, which entails a successful search for a plausible mediator linking the prime and target (Jones, 2010). Mediated priming effects were compared for items having a strong forward association between mediator and target (DOG–*cat*–MOUSE) versus items having only a weak mediator–target association (PLOW–*field*–MOUSE). Priming obtained for both mediator–target association conditions in strategic lexical decision tasks (LDTs),

in which prime–target pairings were evident. However, in an automatic continuous (sequential) LDT, priming obtained for only the items having a strong mediator–target association. Thus, a strong mediator–target association is likely necessary in order for mediated priming to occur via spreading activation.

Motor Control
Chouteau, Sunday Morning, 8:00–9:55

Chaired by Jonathan Vaughan, Hamilton College

8:00–8:15 (283)

Dexterity and Reaching Around Obstacles With a Tool. JONATHAN VAUGHAN, HILLARY KEATING, & DEBORAH A. BARANY, *Hamilton College*, & DAVID A. ROSENBAUM, *Pennsylvania State University*—Dexterity denotes both right-handedness and skill in executing movements usually associated with the preferred hand. Twelve right-handers moved a tool, held in the right or left hand, between spherical targets separated by 20 or 81 cm, while an obstacle intruded up to 12 cm on the direct path of movement. As was expected, movement times to more distant targets and/or around more intrusive obstacles were longer, and distance interacted with obstacle intrusion ($ps < .001$ in each case). The posture-based motion model's extension of Fitts's law to account for movements around obstacles (Vaughan et al., submitted) fit these movement times very well ($R^2 > .95$ for right and left hands separately or combined). However, movement times were unaffected by which hand executed the move ($p > .22$ for all main effects and interactions involving the hand). We address the implications of these results for models of movement planning.

8:20–8:35 (284)

Intermanual Transfer of Proprioceptive Shift in Left-Handers. GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Left-handed subjects used their left or right hand in target pointing during exposure to prismatic displacement with concurrent visual and proprioceptive feedback to produce proprioceptive aftereffects. Both hands were tested after exposure in order to assess transfer from the exposed to the unexposed hand. Transfer was symmetric, occurring from the exposed left hand to the unexposed right hand and from the exposed right hand to the unexposed left hand, but only when the exposed hand was tested first after the exposure period. These results suggest that transfer occurs in postexposure testing by means of secondary sensory–motor connections for both hands. Differences between left- and right-handers are discussed.

8:40–8:55 (285)

Sequential Dependencies in Semi-Real-World Motor Tasks. ANUP DOSHI, *University of California, San Diego*, MATTHEW WILDER, *University of Colorado, Boulder*, CUONG TRAN, *University of California, San Diego*, ALAA A. AHMED, *University of Colorado, Boulder*, MOHAN M. TRIVEDI, *University of California, San Diego*, & MICHAEL C. MOZER, *University of Colorado, Boulder* (read by Michael C. Mozer)—Recency effects have been studied extensively in simple 2AFC tasks. We explored recency effects in two relatively complex, naturalistic tasks: (1) driving in a simulator that required sequences of environment-initiated braking and acceleration actions, and (2) reaching to a target with a robotic manipulandum that applied perturbing forces perpendicular to the desired movement, either to the left or to the right. We found robust sequential effects in both tasks that depended on the stimulus identities, but not—in contrast to the 2AFC literature—on their repetition and alternation pattern per se. One possible explanation for the difference is the long intertrial intervals in our tasks (on the order of 5 sec). We also found long lag effects (eight trials back in the manipulandum study), possibly due to significant motor adaptation taking place as the task was learned. We explore various memory trace models to explain the data.

9:00–9:15 (286)

Bimanual Versus Dyadic Coordination in Finger Oscillation. PETER DIXON, *University of Alberta*, & SCOTT GLOVER, *Royal Holloway, University of London*—Subjects performed coordinated left–right finger movements either bimanually or with a partner. In keeping with previous research, bimanual coordination was easier with instructions to perform mirror-image oscillations than with instructions to perform parallel oscillations (in which both fingers move right at the same time and then left at the same time). However, the reverse was true for dyadic coordination: When subjects moved one finger in coordination with a partner's finger, parallel oscillation was substantially easier than symmetric oscillation. This result undermines the view that the relative difficulty of bimanual parallel and symmetric oscillations is a function of perceptual processes (e.g., Mechsner, Kerzel, Knoblich, & Prinz, 2001). Instead, we hypothesize that the coordination effects depend on the how movement targets are coded in terms of the dynamic spatial environment.

9:20–9:35 (287)

The Continuous Endstate Comfort Effect: The Impact of Contextual, Motor, and Cognitive Factors. OLIVER HERBORT & MARTIN V. BUTZ, *University of Würzburg*—How humans grasp an object often reflects subsequent manipulations of the object (endstate comfort effect). We explored such anticipatory grasp selection in a continuous task space. In four experiments, participants had to grasp a box by a circular handle and rotate it. Experiment 1 revealed that the direction of the box rotation mostly determined participants' grasp orientations and that the extent of the box rotation had only a minor impact. Experiment 2 showed that the range of required box rotations did not affect anticipatory grasp selection. Experiments 3 and 4 revealed that the cognitive representation of the task and task-irrelevant motor factors bias grasp selection only for short box rotations. In sum, the experiments suggest that anticipatory grasp selection is mostly determined by the category of the anticipated object manipulation and that participants shield the grasp selection process against task-irrelevant factors if the difficulty of the required movement is high.

9:40–9:55 (288)

Social Inhibition of Return Is Not Goal Based. GEOFF G. COLE, *University of Essex*, PAUL A. SKARRATT, *University of Hull*, & REBECCAH-CLAIRE BILLING, *University of Essex*—Social inhibition of return (SIOR) is the effect whereby an individual will inhibit a reaching response to a location that has just been responded to by another individual. The present study describes a series of experiments that examine whether this phenomenon is "goal based." Pairs of participants sat adjacent to each other and performed a variation of a standard SIOR experiment in which each took turns to reach out for a cued object presented on a table top. Importantly, the two participants performed either the same action on the object or a different action. Although results showed SIOR, the size of the effect was not modulated according to whether each participant had the same goal or not. We conclude that the mechanism giving rise to SIOR does not represent the goal of an action.

Human Learning II
Lewis and Clark, Sunday Morning, 8:00–10:15

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

8:00–8:15 (289)

A Deeper Analysis of "Deep" Encoding in the Spacing and List-Strength Effects. PETER F. DELANEY & ARIE S. SPIRGEL, *University of North Carolina, Greensboro*, & THOMAS C. TOPPINO, *Villanova University*—When people are instructed to study a list of words for a later memory test, the second most frequently used strategy they report is the story mnemonic. Participants used the story mnemonic to study three lists of words—one pure-massed, one pure-spaced, and one mixed—with a test after each. Study was done aloud and recorded. We obtained (1) significant spacing effects on pure lists, replicating earlier work; (2) larger spacing effects for people who recalled more words; and (3) a list-strength effect such that mixed lists produced higher spaced recall than did pure lists and lower massed recall than did pure lists. We next transcribed the study-aloud protocols and extracted a variety of metrics about rehearsal rates, story quality, word characteristics, and mediator type to predict subsequent recall rates. The magnitude of spacing effects depends on a number of different encoding factors.

8:20–8:35 (290)

Semantic Transparency and Contextual Strength in Incidental Vocabulary Acquisition of Novel Compounds: Evidence From Eye Movements and Recall. STEPHEN M. BRUSNIGHAN & JOCELYN R. FOLK, *Kent State University* (read by Jocelyn R. Folk)—Previous reading studies have revealed little evidence for semantic transparency effects in the processing of familiar English compounds (Frisson, Niswander-Klement, & Pollatsek, 2008). Evidence is mixed for benefits of combining contextual and word cues in word learning; some studies have shown that readers most successfully interpret novel Kanji compounds using both sources of information (Mori & Nagy, 1999), whereas others have shown no benefit from combining sources after direct instruction of novel English words (Wysocki & Jenkins, 1987). In our study, participants read sentence pairs containing novel and known English compounds that were either semantically opaque or transparent (e.g., *milkshake*, *cocktail*, *drinkblend*, *deskdoor*) in neutral and strong sentence contexts. Readers showed processing and retention advantages for novel transparent compounds in strong contexts and disadvantages for novel opaque compounds in strong contexts. This suggests that readers' success in deriving word meanings for novel English compounds benefits from pooling sources of contextual and morphemic information.

8:40–8:55 (291)

Learning New Vocabulary in German: The Beneficial Effects of Inferring the Meanings of Unknown Words. SHANA K. CARPENTER, RIEBANA E. BIEGEL, BETH MARTIN, MARK LOONEY, & KRISTIAN SCHMIDT, *Iowa State University*—Some research suggests that reading in a foreign language is a good way to acquire new vocabulary (e.g., Krashen, 1993). On the basis of past research using incidental-learning paradigms, however, it is impossible to know whether this learning is due to inferring the meanings of unknown words while reading, versus looking them up in a dictionary. In the present study, introductory-level German students read a simplified story and learned new German words through either inferring their meanings from context, or reading an English translation that was already provided. Later tests of recognition and recall demonstrated superior memory for meanings that were inferred, as compared with read, and exposure to the story also led to considerable gains in vocabulary knowledge of familiar words that participants were initially unable to recall. Theoretical and practical implications of these results are discussed.

9:00–9:15 (292)

Multimedia Learning and the Testing Effect: Comparing Enhanced Encoding With Repeated Retrieval. AIMEE A. CALLENDER & ANA M. FRANCO-WATKINS, *Auburn University*—The testing effect (repeated retrieval) and multimedia learning (enriched encoding) both lead to improved performance on memory tests, as compared with read-only controls, but they have not been directly compared. This comparison is critical to determining whether instructors or learners should focus on enhancing encoding or retrieval processes during learning. Eighty-six participants were assigned to one of four conditions: MultimediaPre (animation and video, then text), MultimediaPost (text, then animation and video), testing, or reread. A final free-recall test was taken immediately or after a 1-week delay. Performance in each of the conditions was analyzed as a function of delay and reading ability. Consistent with previous research, high-ability readers benefit equally from all strategies. Low-ability readers need either enriched encoding or enhanced retrieval. The order of the multimedia material may affect performance for both high- and low-ability readers.

9:20–9:35 (293)

Dynamics of Emotions During Complex Learning. ARTHUR C. GRAESSER & SIDNEY K. D'MELLO, *University of Memphis*—We propose a model for explaining the dynamics of students' cognitive–affective states during deep learning activities. The model predicts that learners in a state of flow/engagement will experience cognitive disequilibrium and confusion when they face contradictions, incongruities, anomalies, and other impasses. Learners revert into the flow/engaged state if equilibrium is restored by thought, reflection, and problem solving. However, failure to restore equilibrium and obstacles that block goals trigger frustration, which, if unresolved, will lead to boredom. The

hypotheses of the model were supported in two studies in which participants completed a 32- to 35-min tutoring session with a computer tutor (AutoTutor). Their cognitive–affective states were tracked at several points in their tutoring sessions via a retrospective affect judgment protocol. Time series analyses confirmed the presence of confusion–flow/engagement and boredom–frustration oscillations, as well as confusion-to-frustration transitions. We discuss enhancements, implications, and applications of the model to pedagogical strategies.

9:40–9:55 (294)

Training the Brain to Learn. CHRISTOPHER M. CONWAY, *Saint Louis University*, & MICHELLE GREMP, *Washington University*—Language acquisition is based in part on fundamental domain-general learning abilities. For instance, visual sequential learning is correlated with language processing in healthy adults (Conway et al., 2010). Furthermore, disturbances to nonlinguistic sequential learning have been found in populations with language delays or communication disorders, including children with dyslexia (Howard et al., 2006), children with specific language impairment (Evans et al., 2009), and deaf children with cochlear implants (Conway et al., in press). In order to enhance learning and cognition in such populations, we designed a novel adaptive training task that targets nonlinguistic, visual sequential-learning abilities. The preliminary results reveal that 10 days of training leads to improvements for nontrained tasks of learning, memory, and executive functions in adults, hearing children, and children who are deaf or hard of hearing and, thus, shows promise for helping to enhance basic learning and language functions in both typical and impaired populations.

10:00–10:15 (295)

University Students Learn a New Long Division Algorithm. PATRICIA BAGGETT, *New Mexico State University*, & ANDRZEJ EHRENFEUCHT, *University of Colorado, Boulder*—Long division is the most difficult of the four arithmetic algorithms that are taught in elementary schools. We designed another division algorithm, called "marked division," that requires only addition, subtraction, and doubling, along with a small amount of writing, and we taught it to a group of prospective elementary teachers in a university mathematics class in the southwestern United States. We present the algorithm and report data showing the levels of skill and understanding that students attained, together with their comments about its difficulty and usefulness. General comments about working memory requirements and the arithmetic knowledge needed for algorithms that are currently taught in schools and a comparison of the "standard" and the new algorithm are included.

Cognitive Control III
Illinois, Sunday Morning, 10:20–11:55

Chaired by Lisa R. Fournier, Washington State University

10:20–10:35 (296)

Variations in Action Sequence Overlap and Their Effects on Reaction Time. KEVIN R. FEISZLI & LISA R. FOURNIER, *Washington State University* (read by Lisa R. Fournier)—Planning and withholding an action to one visual stimulus (A) can delay a response to a later occurring, second visual stimulus (B) if the action features associated with A and B partly overlap. We examined whether this compatibility interference (CI) occurs only when the action for B overlaps with the first, as opposed to the second, action feature required for A. Participants planned and withheld a two-part joystick movement (e.g., left–up or up–left) on the basis of the identity of A and then executed a joystick movement to B on the basis of its identity. The results showed that CI occurred regardless of whether Movement B was the same as the first or the second action required for A but was limited to left/right versus up/down movements. This suggests that CI is not due to priming and subsequent inhibition of Action A when B is presented. Moreover, CI may be limited to actions requiring cognitive oversight.

10:40–10:55 (297)

Dynamic Constraints on Verbal Control of Sequential Action. ULRICH MAYR & KILLIAN KLEFFNER, *University of Oregon*—It

is almost a truism that language aids serial-order control by allowing people to verbally cue upcoming sequential elements. We asked subjects to perform hierarchically organized task sequences while "thinking aloud" each task label. Surprisingly, response times (RTs) showed marked effects of online retrieval, despite ample preparatory time between sequential elements. Furthermore, speech onsets and RTs were almost perfectly synchronized, both within individuals and across conditions. In an additional experiment, we confirmed that when instructed to do so, participants were able to speak task labels prior to presentation of response-relevant stimuli and that this completely eliminated RT signatures of retrieval—however, at the cost of an increase in errors. Thus, although preparatory self-cuing is possible in principle, in natural situations, it seems to be prevented through a strong, "gestalt-like" tendency to synchronize speech and action. This tendency may support context updating, rather than preparation.

11:00–11:15 (298)
Activation Dynamics of Creative Intuition. KRISTIN GRUNEWALD, JARED M. NOVICK, & HENK J. HAARMANN, *University of Maryland, College Park* (read by Henk J. Haarmann)—Making fast intuitive judgments about whether creative verbal problems are solvable requires mental access to the answer in the face of semantic distractors, even if the answer is not consciously known. We therefore predicted that the ability to resolve lexical–semantic competition would correlate with such intuitions. Fifty healthy participants completed a picture-naming task that measured the ability to cope with lexical–semantic competition and a task requiring fast judgments about whether three cue words (e.g., *crab*, *tree*, *pine*) have a common weak semantic associate. When participants intuited a solution, they then tried to generate it (here, *apple*). The ability to resolve lexical–semantic competition correlated positively with correct intuitive judgments but negatively with the proportion of actual solutions. These findings suggest that creative cognition relies on the control of activation dynamics—namely, enhancement of the activation of the answer but dampening of the activation of the overall semantic space.

11:20–11:35 (299)
Processing Fluency As a Signal for Effort Adjustments. GESINE DREISBACH, *University of Regensburg*, & RICO FISCHER, *Technical University Dresden* (sponsored by Rico Fischer)—Experiencing difficulties during information processing can be used either as an avoidance signal for future action selection ("avoid and switch") or as a signal for increased need of cognitive effort ("try harder"). These alternative ideas are currently reflected in two seemingly opposing theories of anterior cingulate cortex function—namely, the outcome evaluation versus the conflict-monitoring accounts. Botvinick (2007) recently suggested that both positions might converge on the detection of aversive signals. Here, we show that low perceptual fluency, which is known to evoke negative affective reactions, triggers the mobilization of cognitive effort even in the absence of response conflicts. More precisely, in two experiments, processing adjustments in reaction to fluency manipulations as indicated by significant interactions of fluency $N \times$ fluency $N-1$ were found after practice. It follows that an aversive signal (here, low fluency) is used not only for effort prediction (Song & Schwarz, 2008), but also for effort adjustments.

11:40–11:55 (300)
Conflict Adaptation in Time: Foreperiods As Contextual Cues for Attentional Adjustment. ANDREA KIESEL, *University of Würzburg*, & MIKE WENDT, *Helmut Schmidt University/University of the Federal Armed Forces Hamburg*—Interference evoked by a nominally irrelevant stimulus dimension, such as flankers in the Eriksen task, is reduced when the proportion of conflicting stimuli is increased (Gratton, Coles, & Donchin, 1992). This modulation is sensitive to contextual cues such as stimulus location or color, suggesting attentional adjustment to conflict contingencies on the basis of context information. In the present study, we explored whether conflict adjustment occurs depending on temporal variation of conflict likelihood. We associated low and high proportions of conflict stimuli with foreperiods of different lengths. Flanker interference was higher with foreperiods associated with low conflict proportions, suggesting that participants use the foreperiod as a contextual cue for attentional adjustment. We conjecture that participants initially adopt the

strategy useful for conflict contingencies associated with short foreperiods and readjust, in the absence of any additional exogenous cue, when the imperative stimulus has not occurred during a certain time interval.

Event Cognition
Missouri, Sunday Morning, 10:00–11:55

Chaired by Stephen R. Schmidt, Middle Tennessee State University

10:00–10:15 (301)
Delayed Disengagement From Emotional Pictures As Measured by Automatic and Controlled Processing Tasks. CRISTIE GOAD, DARREN M. HALL, & STEPHEN R. SCHMIDT, *Middle Tennessee State University* (read by Stephen R. Schmidt)—Several researchers have suggested that emotional stimuli capture and hold attention to the detriment of processing and remembering surrounding stimuli. To directly investigate this delayed disengagement, participants viewed a series of emotional and neutral pictures, with each picture immediately followed by a reaction time task. Experiment 1 demonstrated that negative affect pictures slowed simple numeric addition, relative to both positive and neutral pictures, but had no impact on alphabet arithmetic. Experiment 2 demonstrated that ambiguous arousing pictures slowed numeric addition, relative to positive and neutral pictures. Experiment 3 extended these findings to a choice reaction time task. We concluded that delayed disengagement is not determined by level of arousal. Rather, the emotional appraisal of a stimulus postpones processing of surrounding stimuli.

10:20–10:35 (302)
Visual Target Detection Is Impaired at Event Boundaries. MARKUS HUFF, *Knowledge Media Research Center, Tübingen*, & JEFFREY M. ZACKS, *Washington University* (read by Jeffrey M. Zacks)—Perception is predictive, and when prediction becomes difficult perceptual systems may devote extra resources to cope. When a stream of events is perceived, this may lead to a transient focus on the event's contents at the expense of other information and also may lead to the subjective impression that one event has ended and another has begun. We tested whether visual detection was impaired at those moments likely to be judged boundaries between events. Short animated soccer clips were used as stimulus material, and event boundaries were imposed by having the ball change possession. Participants were asked to keep track of 4 of 10 players and to watch for 200-msec probes appearing either at an event boundary or at a nonboundary. Probe detection was less accurate at event boundaries. This result suggests that the structure of events in ongoing activity into events corresponds with the regulation of attention over time.

10:40–10:55 (303)
Effects of Static and Moving Lineups on Eyewitness Memory for Events. JULIE L. EARLES & ALAN W. KERSTEN, *Florida Atlantic University*—This research tested whether seeing lineup members in motion, rather than static, pictures influences one's later ability to remember the perpetrator of an action. Participants viewed video clips involving different actors performing different actions. Participants then viewed a series of lineups, each asking whether one of the lineup members had performed a particular action. Some lineups involved static frontal and profile views of each lineup member. Others involved a video of each lineup member simply turning to one side and then to the other. In a later recognition test, an actor was sometimes seen performing an action that had been performed by somebody else, but the face of the actor had appeared in the lineup testing for memory of the perpetrator of that action. Participants were more likely to falsely recognize these test items when the actor's face had appeared in a static photo lineup, rather than in a moving, video lineup.

11:00–11:15 (304)
Eventful Experience Speeds Up Time. ASHLEY S. BANGERT, CHRISTOPHER A. KURBY, JEFFREY M. ZACKS, ALBERT DENG, & JAMES E. BRYANT, *Washington University*—Timing is a ubiquitous feature of everyday experience. Although we live in a world in which time is continuous, people tend to segment their experiences into temporally discrete events. During an everyday experience, an observer's perception of how much time has passed may depend on the number of events that

the observer perceived to occur. The present study tested this hypothesis in two experiments where participants made prospective temporal judgments while watching movies of people engaged in everyday activities. Participants were trained to reproduce a 30-sec interval, after which they reproduced this interval during eventful and uneventful portions of the movies. Participants made shorter reproductions during eventful than during uneventful movie segments. This suggests that time passed more quickly when the experiences were more eventful, a result that challenges predictions from prominent theories of prospective timing.

11:20–11:35 (305)
The Role of Modality in Recall of Misleading Postevent Information. KATINKA DIJKSTRA & EELCO M. MOERMAN, *Erasmus University Rotterdam*—The effect of misleading postevent information on correct recall for an event is well documented (Loftus, Miller, & Burns, 1978). The superiority of recall for enacted stimuli over verbally encoded stimuli has been demonstrated as well (Dijkstra & Kaschak, 2008; Dijkstra, MacMahon, & Misirlisoy, 2008). The present study examined the effect of modality on immediate and long-term recall of misleading postevent information. Participants answered questions about a sequence of events they listened to, watched, or acted out. Half of them were exposed to misinformation afterward. The results demonstrated a smaller effect of misinformation in the auditory than in the embodied condition, whereas recall of events without misinformation was highest in the embodied condition. After 2 weeks, recall was generally lower than before, except for the misinformed group when answering questions including misinformation. Apparently, effects of misinformation fade over time, but embodied cues do not provide protection for these effects.

11:40–11:55 (306)
From Eyewitness Memory to Law Enforcement Training: A Unified Cognitive Approach. MATTHEW J. SHARPS, *California State University, Fresno*—Recent research in eyewitness memory has made it possible to identify typical classes of error that occur in the processing of violent scenes and to provide a theoretically coherent account and taxonomy of these error types. This theoretical approach has now been applied experimentally to training in law enforcement. The method involves the identification of specific types of cognitive errors likely to occur in the given task context, followed by the development of specific feature-intensive cognitive skill sets to enhance performance. In experiments on training for the detection of improvised explosive devices and on training for deadly force encounters, this approach has yielded experimental results far superior to those derived from traditional training approaches. The cognitive approach, based in explicable psychological science, also attains high approval ratings from law enforcement experts. The results demonstrate the great utility and practicality of applied cognitive principles in modern law enforcement and forensic environments.

Recognition Memory
Mississippi, Sunday Morning, 10:00–11:55

Chaired by Kenneth J. Malmberg, University of South Florida

10:00–10:15 (307)
Item Similarity Effects on Sequential Dependencies Observed in Recognition Memory Testing. KENNETH J. MALMBERG, JEFFREY ANNIS, & DONALD HAYWARD, *University of South Florida*—Models of recognition memory have traditionally assumed that decisions are made independently. This assumption was recently disconfirmed by the discovery of assimilation in yes–no testing and judgments of frequency (Malmberg, Hayward, & Annis, 2009). Some models assume that assimilation reflects short-term variability in bias (Treisman & Williams, 1984), whereas other models assume that it is the result of a carryover across trials of information used to make decisions (Brown et al., 2008; Petrov & Anderson, 2005). We recently examined whether stimulus similarity affected assimilation in order to constrain these models. Implications of our results are discussed.

10:20–10:35 (308)
A Nonparametric Definition and Test of Single Process in Recognition Memory. JEFFREY N. ROUDER, *University of Missouri,*

Columbia—Analysis of receiver operating characteristic (ROC) curves has been useful in assessing whether recognition memory is mediated by one or multiple processes. Unfortunately, extant models are critically based on parametric assumptions that have little psychological justification. For example, both Yonelinas (1994) and Wixted (2007) posit that familiarity and strength, respectively, follow a normal distribution. Although the normal is without strong psychological justification, this parametric assumption is critical for inferences about processing. To avoid unjustified parametric assumptions, I provide a novel axiomatic definition of single process in ROC curves that allows researchers to assess whether one or more processes underlie recognition decisions. The notion is that a family of ROC curves are from a single process if they change in one way or there is a single parameter that describes the changes across the family. Statistical tests of single process are developed, and they may be applied broadly wherever ROCs are drawn.

10:40–10:55 (309)
Only When It's Tough: Feedback Improves Old/New Recognition When Lures are Difficult to Discriminate. KATHLEEN M. VIEIRA, LESLIE A. BUTLER, SEAN M. LANE, TANYA KARAM, & STEPHANIE GROFT, *Louisiana State University* (read by Sean M. Lane)—Although correct feedback about memory decisions on a subset of items improves subsequent accuracy on source-monitoring tests (e.g., Lane, et al., 2007), it typically has no effect or affects only response criterion on old/new recognition tests (Kantner & Lindsay, 2010). One possible explanation for these findings is that people typically rely heavily on familiarity when making old/new decisions and it is difficult to adjust this unidimensional type of evidence. In contrast, feedback may help when people make more fine-grained decisions that allow for adjustment to the features they rely upon. In two experiments, we manipulated the similarity of lures to studied items. Participants studied a set of pictures, completed an old/new recognition test, received feedback, and completed a second test. In both experiments, feedback improved old/new discrimination between old items and highly similar lures but only changed response criterion between old items and low-similarity lures.

11:00–11:15 (310)
Unrelated Bilateral Eye Movements Enhance Recognition of Faces. MARIANNE E. LLOYD & MEGAN M. MILLS, *Seton Hall University*—Research using a 30-sec eye movement procedure between the encoding and retrieval phases of a memory test has shown that horizontal, as opposed to vertical, eye movements can improve memory performance. To date, these demonstrations have been limited to verbal domains including associative recognition (Parker et al., 2008), autobiographical memory (Christman et al., 2003), and false alarms to semantic associates (Christman et al., 2004). The present research investigated the effect of the eye movement task on recognition of faces. Horizontal eye movements improved memory performance, but only if the faces were encoded for 10 sec each. When the encoding time was shortened to 3 sec, the eye movement procedure had no effect. In addition, inverted face recognition was not improved by horizontal eye movements. The results are discussed in terms of dual-process theories of recognition memory and the role of unrelated tasks in memory performance.

11:20–11:35 (311)
Nonepisodic Retrieval Practice (ELE_A_ _ _ Cuing ELEVATOR) Facilitates Episodic Recall of ELEPHANT (Cued by E_ _PH_NT or GIRAFFE). KIT CHO & JAMES H. NEELY, *University at Albany* (read by James H. Neely)—During retrieval practice (RP), each subject received 0, 1, 5 or 10 RP trials with word fragments that sometimes cued a nonstudied word orthographically similar to a studied word (study, ELEPHANT; RP, ELE_A_ _ _ [ELEVATOR]). RP performance was worse for fragments orthographically similar to a studied word than for fragments totally unrelated to any studied word. Thus, studied words were being retrieved and blocking retrieval of the correct solution and, presumably, were being suppressed when the correct solution was retrieved. However, in both semantic (*giraffe*) and orthographic (E_ _PH_NT) final cued recall tests, recall of the studied words (e.g., ELEPHANT) increased linearly with the number of prior RP trials. Thus, with totally independent cues, RP produced a positive testing effect even when the target itself was not directly cued during

RP and whether or not the domains of the RP test (orthographic) and final test (orthographic, semantic) were the same or different.

11:40–11:55 (312)

Revelation Effects on Recognition Memory for Words and Pseudo-words. ROBERT L. GREENE, *Case Western Reserve University*—The revelation effect is the tendency to call an item on a recognition test old if it is immediately preceded by a different task interpolated between test items. One approach to this phenomenon emphasizes the misattribution of familiarity: Activation of information during the interpolated task influences the calculation of familiarity during the recognition process. Such an account can be used to explain many of the findings in the revelation effect literature, including apparent differences between yes–no and forced choice testing. However, this approach has difficulty explaining results involving recognition testing of pseudowords (pronounceable nonwords), where revelation may lead to a decreased tendency to call items old.

Letters and Word Processing IV
Meramec, Sunday Morning, 10:00–11:55

Chaired by Joseph Dien, University of Maryland

10:00–10:15 (313)

Combined ERP/fMRI Evidence for Lexical Effects in the Language Formulation Area. JOSEPH DIEN, *University of Maryland, College Park*, ERIC BRIAN & DENNIS L. MOLFESE, *University of Louisville*, & BRIAN T. GOLD, *University of Kentucky*—The recognition potential (Rudell, 1991), a left-lateralized negativity that peaks at about 200–250 msec, is one of the most interesting of the early latency ERP reading components. It is the first to consistently display lexicality effects (larger for words vs. nonwords) and, possibly, semantic effects. It has therefore been suggested that it reflects an early confluence of lexical and semantic processing (Martín-Loeches, 2007). In this experiment, 23 participants underwent the task while having high-density 129-channel ERP data collected, and a separate sample of 15 participants underwent the task while having fMRI data collected in a 3T scanner. Examination of the ERP data confirmed that a standard recognition potential effect was produced. The only corresponding effect in the fMRI data was in the language formulation area, confirming it as a more likely source for the recognition potential.

10:20–10:35 (314)

Eye Movements and Pupil Dilations Reveal Fast, Voice-Specific Priming. MEGAN H. PAPESH, MICHAEL C. HOUT, & STEPHEN D. GOLDINGER, *Arizona State University* (read by Stephen D. Goldinger)—We examined voice-specific priming, lexicality effects, and word frequency effects, all using a novel eyetracking, lexical decision task. Participants made speeded "word/nonword" decisions to items spoken in one of four randomly selected voices. Responses required participants to click a red "x" or a blue "+" located randomly within separate visual half-fields, necessitating trial-by-trial visual search with consistent half-field response mapping. After a break, participants completed a second block with new and repeated items, half of which were spoken in different voices. Contrary to recent findings that voice effects emerge in late, postaccess processing (McLennan & Luce, 2005), we observed oculomotor evidence that voice-specific priming emerges early, within the first few hundred milliseconds of perception. Classic frequency and lexicality effects were observed in saccade initiation times and pupil diameters. These measures also revealed fast voice-specific priming. The results illustrate the time course of voice effects and support episodic theories of lexical access.

10:40–10:55 (315)

The English Disease in Finnish Compound Processing: Evidence From Eye Movements. RAYMOND BERTRAM, *University of Turku*, PETAR MILIN, *University of Novi Sad*, & VICTOR KUPERMAN, *Stanford University*—According to Finnish spelling regulations, compounds are to be written in either concatenated format (*syntymapaiva = birthday*) or hyphenated format (*vaihto-ohjelma = exchange program*). However, more and more often Finnish compound words are written incorrectly in spaced format (*syntyma paiva, vaihto ohjelma*). It is speculated that this

phenomenon—coined the English disease—occurs under the influence of English, where many compounds appear in spaced format. This would mean that many Finnish bilinguals would apply strategies of L2 in their L1, an instance of backward transfer. In this eye movement study, we examined whether illegally spaced Finnish compounds were easier to process when their English translation equivalent was also spaced (*ostos kassi = shopping bag*) than when this was not the case (*syntyma paiva*). The results showed that the presentation format of English translation equivalents indeed affected the processing of illegally spaced Finnish compounds as well as the participants' proficiency in English did.

11:00–11:15 (316)

Eliciting Meaning: If the Meaning You Do Not Achieve, Prime–Prime Again! DAVID S. GORFEIN, *University of Texas, Dallas*, & VINCENT R. BROWN, *Hofstra University*—Lexically ambiguous words (homographs) were selected on the basis of one meaning belonging to a specific semantic category (e.g., *edible things*), while the other meaning fell outside the category. The role of multiple exposures of homographs is examined in a transfer task paradigm, with the critical task requiring participants to decide whether a word belongs to the specific semantic category. Prior to the category test, homographs were tested in such a manner that those that had, in a normative study, been found to be weakly associated with the category were primed for the category meaning, whereas homographs that were strongly associated with the category were primed for their alternative meaning. The results are discussed in relation to models of meaning selection.

11:20–11:35 (317)

Second-Language Phonology Is Active When Using Your First Language. NIELS O. SCHILLER & KALINKA TIMMER, *Leiden University*—The masked onset priming effect has previously been reported in speakers' first languages (L1s). In the present study, bilingual Dutch (L1)/English (L2) participants read aloud L1 target words primed with L2 words. The onset of the primes was manipulated to separate the contributions of orthographic and phonological activations in reading aloud. Orthographically related primes did not lead to faster response times, but event-related brain potentials (ERPs) revealed orthographic priming. Phonologically related L2 primes decreased the response times. ERPs partly supported these phonological priming effects. The results demonstrate that English phonology is also activated in Dutch participants, even when they are in their native monolingual environment and are less familiar with the orthography of the L2.

11:40–11:55 (318)

Interactive Effect of Semantic Transparency and Word Frequency on Lexical Decision for Chinese Compound Words. CHI-SHING TSE, *Chinese University of Hong Kong*—With native Chinese speakers as participants and two-character Chinese compound words as experimental stimuli, the effects of whole-word frequency and semantic transparency on visual lexical decisions were investigated, with other lexical characteristics (e.g., character frequency and number of strokes) being statistically controlled. Both the mean level and distributional level of reaction time measures were examined. The semantic transparency effect occurred for low-frequency words, but not for high-frequency words. This interactive effect of semantic transparency and word frequency was mediated by both modal and tail portions of the reaction time distribution, with the semantic transparency effect for low-frequency words being increased as a function of reaction time bins. The implications of these findings for the roles of direct access to the whole-word representation and morphological decomposition in the compound-word processing are discussed.

Bilingualism II
Chouteau, Sunday Morning, 10:20–11:55

Chaired by Kenneth R. Paap, San Francisco State University

10:20–10:35 (319)

I Left My Bilingual Advantage in San Francisco. KENNETH R. PAAP, ZACK GREENBERG, DAVID GUERRERO, & BRENDA MEJIA, *San*

Francisco State University—Students from San Francisco University participated in a category fluency task, three nonverbal tasks reflecting aspects of executive control (antisaccade, Simon, and switching), and a lexical decision task (LDT) with blocks of either category primes or antonym primes. The subgroup of bilinguals showed less category fluency, but no advantage in attentional control. In the LDT, bilinguals were slower, generated more priming, and, unlike the monolingual subgroup, showed no costs in relation to a neutral prime condition in the blocks using category–instance relationships.

10:40–10:55 (320)

Bilingualism → Selective Attention → Creativity: Exploring Cognitive Mechanisms Underlying Bilingual Creative Potential. ANATOLIY V. KHARKHURIN, *American University of Sharjah*—This study explores the hypothesis that bilingualism encourages selective attention that facilitates an individual's creative capacity. Ninety American University of Sharjah bilingual college students participated in the study. Their language proficiency was assessed using a picture-naming task. Creative abilities were assessed with the Abbreviated Torrance Test for Adults, a standard test of divergent thinking, which provided generative and innovative capacity scores, and with the Invented Alien Creatures task, a standard test of structured imagination that provided an invariants violation score. The selective attention was assessed by the Stroop test, and the fluid intelligence was assessed by Culture Fair Intelligence Test. A series of ANOVAs revealed that participants with higher proficiency in English significantly outperformed their less proficient counterparts on the Stroop condition, innovative capacity, invariants violation scores and, marginally significantly, on the IQ. The findings show that practice with two languages may facilitate selective attention, which, in turn, encourages creative potential.

11:00–11:15 (321)

Advantages of Bilingualism in Priming TOT Resolution. SABRA D. PELHAM & LISE ABRAMS, *University of Florida* (read by Lise Abrams)—This study examined the effect of grammatical class on phonological priming of tip-of-the-tongue (TOT) resolution in monolingual English speakers and bilingual Spanish–English speakers. Participants read questions whose answers corresponded to low-frequency target words. When having TOTs, participants rated the spelling and pronunciation difficulty of five words, one of which was a phonologically related prime or an unrelated control word. Primes contained the target's first syllable and either shared a part of speech with the target or differed from it. Questions were presented again, and resolution of TOTs was recorded. For bilinguals, different part-of-speech primes increased TOT resolution, as compared with unrelated controls, whereas same part-of-speech primes did not, consistent with previous findings in young adults. For monolinguals, primes did not significantly facilitate TOT resolution, irrespective of the prime's part of speech. Contrary to deficits typically observed in language production tasks, bilinguals demonstrated greater success in using phonology to activate weakened connections that cause TOTs.

11:20–11:35 (322)

Bilinguals Reveal Blocking Mechanisms Underlying Tip-of-the-Tongue States. TAMAR H. GOLLAN, VICTOR S. FERREIRA, & CYNTHIA CERA, *University of California, San Diego*, & SUSANNA FLETT, *University College London*—When speakers get stuck in a tip-of-the-tongue (TOT) state, it sometimes seems that related words are blocking retrieval. However, experimental evidence for blocking effects is limited. In two translation-priming experiments, bilinguals were given three Spanish primes and produced either semantically (Experiment 1) or phonologically (Experiment 2) related Spanish words to each. They then named a picture in English. On critical trials, one of the primes was the Spanish translation of the English picture name. With the semantic task, translation primes marginally increased TOTs but also speeded correct retrievals. With the phonological task, translation primes still significantly increased TOTs, but without speeding correct retrievals. In both experiments, translation-primed TOTs were significantly more likely to resolve spontaneously. These results imply that joint activation of translations speeds concept selection but slows lexical selection, that the nondominant language can compete with the dominant language, and that TOTs can arise during lexical selection.

11:40–11:55 (323)

Top-Down Processing in Spoken Word Recognition: Evidence From Bimodal Bilinguals. VIORICA MARIAN & ANTHONY J. SHOOK, *Northwestern University*—The present study explores the role of top-down information in language processing by investigating parallel language activation in bimodal bilinguals, who are fluent users of a spoken and a signed language. Interactive accounts argue for language systems in which higher levels of processing (e.g., word meaning) are capable of activating lower levels (e.g., word form) via top-down feedback connections. In contrast, discrete feedforward accounts propose that the language system does not employ top-down mechanisms during processing. The present study tests these two accounts and demonstrates that top-down feedback mechanisms can drive language activation. In an eyetracking study, bimodal bilinguals showed activation of their signed language while receiving input in English only. Since spoken and signed languages do not share input structure, the results suggest that parallel language activation can be driven by top-down mechanisms, providing support for interactive accounts of language processing.

Metamemory IV
Lewis and Clark, Sunday Morning, 10:40–11:55

Chaired by Christopher Hertzog, Georgia Institute of Technology

10:40–10:55 (324)

Age Differences in Strategic Choice During Skill Acquisition. JARROD C. HINES & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*, & DAYNA R. TOURON, *University of North Carolina, Greensboro* (read by Christopher Hertzog)—Older adults are slower to shift to memory-based strategies during skill acquisition (Touron & Hertzog, 2004). We used prelearning to manipulate this retrieval reluctance in the noun-pair (NP) learning task; 100%, 50%, or 0% of the items were learned to criterion before NP task trials were administered. Prelearning all items led to a faster and more complete strategic shift from visual scanning to retrieval for both age groups, but older adults' retrieval use for prelearned items was delayed and asymptoted at a lower level in the 50% condition (prelearned items mixed with new items). This retrieval reluctance was greatly reduced when participants were administered interspersed recognition memory probes during the NP task, indicating that experiencing retrieval success alters use of the retrieval strategy. Lower retrieval strategy use in the 50% condition is influenced by a general strategic set, rather than by item-specific learning, inflating estimated age deficits in associative learning.

11:00–11:15 (325)

The Effect of Semantic and Phonological Similarity on Long-Term and Working Memory for Paired Associates. MICHAEL D. PATTERSON & WANTING LOW, *Nanyang Technological University*—Previous researchers have claimed that working memory (WM) for verbal information is generally maintained in a phonological form and long-term memory (LTM) in a predominantly semantic form. However, studies using paired associates have not systematically varied phonological and semantic similarity at both stimulus and response levels. Recently, we reported that semantic-grouping expectations in LTM predict binding errors when recalling paired associates in WM tasks (*Abstracts of the Psychonomic Society*, 2009). In new experiments, we examined how semantic and phonological similarity affect LTM tasks. Participants viewed three paired-associates for 1.5 sec each and then, after a 15-sec intervening arithmetic task, selected responses linked with stimuli earlier in the trial. Surprisingly, accuracy significantly decreased as either phonological or semantic similarity increased, particularly at the stimulus level. These results contrast with stronger semantic effects for WM tasks. The results call for revaluation of separate phonological and semantic representations used for WM and LTM tasks, respectively.

11:20–11:35 (326)

Response Latency As a Diagnostic Cue for the Accuracy of Children's Reports. RAKEFET ACKERMAN, *Technion–Israel Institute of Technology*, & ASHER KORIAT, *University of Haifa*—How can the forensic system predict the accuracy of information provided by child eyewitnesses? A previous study with general knowledge questions (Koriat & Ackerman, 2010) showed a developmental trend in the accuracy

of children's confidence ratings, which was partly due to increased reliance on answer latency as a cue for confidence. In the present study, 2nd- and 5th-graders were presented with picture–event pairs or with a slideshow presenting a story. They then answered multiple-choice questions about various details. Both response latency and confidence predicted accuracy reliably. No age differences were observed when the task was easy, but a developmental trend was found when the task was harder. Importantly, even young children relied on choice latency as a cue for confidence. The results suggest that latency can help in predicting the accuracy of answers provided by young witnesses, either directly or through its contribution to the predictive value of confidence ratings.

11:40–11:55 (327)
Total and Partial Recall and Their Related States of Awareness in Schizophrenia Patients. ELISABETH BACON, *INSERM*, & MARIE IZAUTE, *CNRS*—When healthy people cannot retrieve a solicited memory target, they can usually provide some partial information about it and make accurate metamemory judgments. We examined the nature of the semantic information that schizophrenia patients can access about words that they failed to retrieve and the related states of awareness (autonoetic/noetic awareness). Patients and their matched healthy control participants had to learn words of a putative "Somali" language (Koriat et al., 2003). When they failed to retrieve the target answer, they were asked to judge the meaning of the Somali word with respect to one of three semantic dimensions—evaluation (good–bad), potency (strong–weak), and activity (active–passive)—and to assess their states of awareness related to total or partial recall. The results show that in cases of target failures, schizophrenia patients knew even less that the healthy matched controls and that their states of awareness were imprecise, suggesting a failure in error detection.

• MUSIC PERCEPTION AND COGNITION •

(1001)

Effect of Tune Repetition on the Preference for Nontonal Music. MUSTAFA T. BILGE, ESRA MUNGAN, & AYŞECAN BODUROĞLU, *Boğaziçi University*, & HASAN G. TEKMAN, *Uludağ University*— Previous studies have demonstrated mere exposure effects (MEEs) with unfamiliar tonal music. Our goal was to investigate whether an MEE could be obtained with nontonal tunes. In Experiment 1, nonmusicians gave familiarity ratings to repeated presentation of unfamiliar (tonal), semirandom (nontonal), or fully random (nontonal) tunes during the exposure phase. A subsequent forced choice liking task measured their preference for old versus new tunes. The second experiment was identical, except that the way tunes were repeated during exposure was varied (repeated in the beginning, at the end, or throughout the list). Our results showed MEEs for fully random and unfamiliar tunes in Experiment 1 and for semirandom and unfamiliar melodies in Experiment 2. The discrepant findings of Experiments 1 and 2 depending on type of repetition during exposure are discussed using the fluency misattribution (Bornstein, 1989) and affective precedence (Zajonc, 1980) hypotheses.

(1002)

Semantic Priming of Song Lyrics: Within Modality But Not Cross Modality. SARAH K. JOHNSON, *Moravian College*, & ANDREA R. HALPERN, *Bucknell University*—Research exploring the semantic memory properties of music is relatively rare. Previously, we found within-modality priming (tune to tune) but not cross-modality priming (semantic category to tune) of familiar melodies. Here, we explore the priming of song lyrics. In Experiment 1, we primed lyrics (e.g., "Dashing through the snow . . .") using a semantic category label that either matched ("Christmas") or did not match ("patriotic") the target lyrics. On a true/false lyric verification task, we found significantly faster responses for related than for unrelated primes on false-lyric trials ("Dashing through the frost . . ."). In Experiment 2, the primes were melodies either from the same semantic category (related primes) or from different semantic categories (unrelated primes). In this case, no significant priming emerged. Taken together with our previous findings, these results present a consistent picture of within-modality semantic priming but not cross-modality priming for the components of familiar songs.

(1003)

Keeping an Eye on Guitar Skill: Visual Representations of Guitar Chords. MATTHEW J. C. CRUMP, GORDON D. LOGAN, & JERRY KIMBROUGH, *Vanderbilt University*—We investigate a role for vision in skilled guitar, focusing specifically on visual contributions to the representation of basic chords (e.g., C, A, G, E, D). Experiment 1 involved naming or playing guitar chords displayed in different visual formats (e.g., letter, picture, chart) and orientations. Experiment 2 employed a Stroop-like design, involving identification of the visual or auditory dimension for pairs of chord pictures and sounds. Our results demonstrate that visual representations of guitar chords are orientation sensitive and are associated with their corresponding actions and sounds. We discuss how visual input derived from observing oneself play an instrument can contribute to the representation of musical structures and suggest that such visual contributions may be especially important for spatially complex performance domains such as the guitar.

(1004)

Parietal Activation in Two Types of Mental Musical Transformation. NICHOLAS E. FOSTER, *McGill University*, ANDREA R. HALPERN, *Bucknell University*, & ROBERT J. ZATORRE, *McGill University*— In previous studies in separate groups, we found similar activation in the anterior intraparietal sulcus (IPS) during two mental musical transformation tasks: temporal reversal of pitches and transposition from one pitch level to another. Here, we sought to determine whether both auditory transformations recruit overlapping subregions of the IPS in individual subjects. Musicians underwent fMRI while performing same/ different judgments on short melody pairs, where the second melody was untransformed, reversed in time, or transposed in pitch. We found common bilateral activation in the anterior IPS, which covaried with task difficulty as defined by error rate in the reversal task and greater transformation difficulty in the transposition task. This finding supports the hypothesis that the IPS performs transformations in both time and frequency. Since the IPS is implicated in mental visual rotation tasks, this suggests common processing in complex mental transformation tasks across domains.

• SPEECH PERCEPTION •

(1005)

Bilinguals Generalize From Known Phonological Contrasts in Perception of a Novel Language. BOŻENA M. PAJĄK, *University of California, San Diego* (sponsored by Tamar H. Gollan)—Bi-/multilingual speakers are often believed to be better at learning additional languages than are monolinguals. One explanation is that bi-/multilinguals use previously acquired linguistic knowledge to make better guesses about possible features of the new language they are learning. For the auditory modality, we hypothesize that learners use their knowledge about the distribution and structure of phonological categories across the languages they speak in order to estimate the relevance of acoustic–phonetic dimensions for the novel language categories. If a given dimension (e.g., segment duration) is phonologically relevant in at least one previously acquired language, a learner is predicted to attend to this dimension in a new language and, crucially, generalize it beyond the segments it was applied to in the learner's other languages. We report results that support this hypothesis by showing that English–Cantonese bilinguals generalize from vowel duration contrasts in Cantonese to consonant duration contrasts in a novel language.

(1006)

Phonetic Convergence As a Function of Linguistic and Social Distance. MIDAM KIM & ANN R. BRADLOW, *Northwestern University* (sponsored by Ann R. Bradlow)—We explore phonetic convergence by native English speakers after exposure to speech by a native or Korean speaker of English. Participants read two word sets, were exposed to one of the word sets through either auditory (experimental groups) or visual (control groups) inputs, and read both word sets again. They also participated in an Implicit Association Test, which measured their attitude toward native and foreign speakers of English. The speech materials were English consonant–vowel–consonant words that consisted of consonants and vowels that might be hard to distinguish by Korean speakers of English because of their native language influence. Recorded productions were acoustically analyzed and compared with the model productions. Preliminary results illustrate that convergence was greater toward natives than toward nonnatives, convergence was negatively correlated with the degree of negative attitude toward foreign people, and convergence generalized to the word set participants did not hear during the exposure phase.

(1007)

Discriminating Information Presented at Accelerated Rates. CHRISTINA V. WASYLYSHYN & GREGORY O. GIBSON, *Naval Research Laboratory*—Accelerated speech is marked by an increased word rate, so that more information can be transmitted per unit of time. Even when the pitch and prosody of the original speech is preserved, loss of information occurs, most notably from the loss of processing time that the listener would typically use to integrate the auditory information. The present study examined comprehension performance of short auditory narratives at seven accelerated speech rates (ranging in 15% increments from 50% to 140% faster than normal). Participants were asked to discriminate between three different types of information: true, false, and distractor. The results indicate that overall comprehension declined as speech rate increased, and participants' abilities to discriminate between true, false, and distractor information also declined across increasing speeds. The results are discussed in terms of performers' abilities

to discriminate between different types of information at accelerated speech rates and the underlying neurophysiology.

(1008)

Examining Variation in Emotional Tone of Voice on Listeners' Perception of Spoken Words. MAURA L. WILSON & CONOR T. McLENNAN, *Cleveland State University*—Previous studies demonstrated that listeners are faster to recognize words recently spoken by the same talker, relative to a different talker, when processing is relatively slow. The purpose of the present study was to examine intratalker variation in emotional tone of voice on listeners' online perception of spoken words. On the basis of previous work, we predicted reduced priming in the mismatch condition, in which words are repeated in a different emotional tone of voice (e.g., sad and frightened), relative to the match condition, in which words are repeated in the same emotional tone of voice (e.g., frightened), when processing is relatively slow (Experiment 2, hard lexical decision) and equivalent priming in the match and mismatch conditions when processing is relatively fast (Experiment 1, easy lexical decision). The present study should provide a greater understanding of the role that variation in emotional tone of voice plays in listeners' online perception of spoken words.

(1009)

A Cost to Bilingualism: Weaker Automatic Processes With Late Language Acquisition. CARSON DANCE, *University of California, San Diego, and Stony Brook University*, & ARTHUR G. SAMUEL, *Stony Brook University and Basque Center on Cognition, Brain, and Language (IKERBASQUE)* (sponsored by Arthur G. Samuel)—Phonemic restoration is a phenomenon in which listeners are caused to perceive phonemes that have been replaced by noise. We investigated whether this automatic process operates in a bilingual's second language (L2) and the extent to which this depends on early acquisition of L2. The strength of restoration was assessed in bilinguals' native (Spanish) and second (English) languages. Native Spanish speakers were separated into early (English learned before age 7) and late bilinguals. Restoration by English monolinguals was used as a baseline, in addition to a comparison of L2 restoration as a function of age of English acquisition. Initial results suggest that for English stimuli, late bilinguals restore less (in their L2) than English monolinguals do, and that late L2 learners restore less in English than do early L2 learners. This pattern suggests that automatic processes in an L2 provide less support for speech perception, with early L2 acquisition reducing this cost.

• VISION •

(1010)

Items Near the Hands Affect Later Stages of Visual Attention. GREG L. WEST, SAM QIAN, & NASEEM AL-AIDROOS, *University of Toronto*, RICHARD A. ABRAMS, *Washington University*, & JAY PRATT, *University of Toronto* (sponsored by Jay Pratt)—Recent research has indicated that the presence of hands in the visual field can enhance performance on classic visual attention tasks (Abrams, Davoli, Du, Knapp, & Paull, 2008; Davoli & Abrams, 2009). It is, however, not known at what stage of visual processing the presence of hands in the visual field begins to have an effect on perceptual and attentional functioning. In the present study, we measured visual evoked potentials (VEPs) while participants had their hands either in their visual field (hands-up condition) or lowered (hands-down condition). Participants indicated whether a cross at fixation changed color while passively viewing a black-and-white checkerboard reversal pattern (1.5 Hz). Time-locked VEPs to checkerboard reversals revealed a significant decrease in positivity from 200 to 400 msec for the hands-up, relative to the hands-down, condition, suggesting that the presence of hands affects later stages of attentional orienting associated with disengagement.

(1011)

Metacontrast Masking With Texture-Defined Second-Order Stimuli. EVELINA TAPIA, *University of Illinois, Urbana-Champaign*, & BRUNO G. BREITMEYER & JANE JACOB, *University of Houston*—We examine metacontrast masking with texture-defined second-order stimuli. Our results reveal that (1) both the monotonic Type A and the nonmonotonic

(U-shaped) Type B metacontrast effects, which have been extensively examined with first-order luminance-defined stimuli, can be obtained with texture-defined second-order stimuli, and (2) neither the size nor the orientation contrast between texture elements defining the stimuli has a significant impact on the magnitude or shape of metacontrast, unlike analogous contrasts with first-order stimuli. In light of previous findings, evidence suggests that the metacontrast suppression mechanism can be activated not only by first- but also by second-order (cyclopean and texture-defined) features and objects. Additionally, this indicates that contours of first- and second-order objects are processed in a similar manner—hence, possibly, by a similar neural mechanism. However, there also may be processing of second-order contour and surface features that is distinct from processing of first-order contours and surfaces.

(1012)

Illusory Control Affects the Subjective Duration of Emotional Events. STEFANIA MEREU & ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign*—The feeling of control, even when illusory, is important in preserving mental health and may be an adaptive response to anxiety. In fact, patients with high levels of anxiety display higher levels of illusory control as a means to control stressful events. The present study aims to identify the mechanism responsible for reducing anxiety through illusory control. We hypothesized that perceived control may shrink the subjective duration of unpleasant events—usually perceived as being longer than they are—to fit reality to one's desire. We asked participants to judge the duration of positive and negative images while manipulating the amount of control they experienced over the content of the image. As expected, participants who experienced no control judged negative images as being longer than positive images, but, critically, participants who experienced control did not. These results suggest that illusory control affects time perception to reduce anxiety related to distressing events.

(1013)

Color Filling In in Afterimages. JIHYUN KIM & GREGORY FRANCIS, *Purdue University* (sponsored by Gregory Francis)—Van Lier, Vergeer, and Anstis (2009) reported that afterimage color was constrained by a drawn contour. In their report, the afterimage color was visible only when the color was within the borders of a contour drawn while the afterimage was viewed. Francis (2010) hypothesized that the contour was responsible for both triggering and trapping the spreading afterimage color. He described model simulations that explained the afterimage percept by showing how neural representations of the contour defined a surface that trapped the afterimage color during a filling-in process. In this study, we tested the model's explanation by varying the size of the drawn contour, relative to the inducing stimulus. Although the model simulation predicted the spreading of the afterimage color across the entire region inside the contour boundary, subjects reported that the afterimage color boundary matched the boundary of the inducing stimulus, rather than the contour boundary.

(1014)

The Visual Recognition and Detection of Emotional Body Postures. ASHLEY BLANCHARD & MAGGIE SHIFFRAR, *Rutgers University, Newark* (sponsored by Maggie Shiffrar)—Observers frequently demonstrate enhanced visual sensitivity to angry faces. Although few studies have examined sensitivity to emotional body postures, these studies often have not included normed stimuli. In a series of psychophysical studies, we developed a normed set of emotional body posture stimuli and used them to investigate whether emotion modulates the visual recognition and detection of emotional body postures. First, naive observers sequentially viewed computer-generated body postures and reported the emotional state depicted in each posture (e.g., angry, fearful, happy, sad, neutral). Stimuli were then selected such that body postures were equated for recognition speed, recognition accuracy, and perceived intensity across emotions. Visual search arrays were constructed from these normed stimuli, and observers reported whether or not all of the emotions in each array were the same. Fearful and angry body postures were detected most quickly. Enhanced sensitivity to these body postures would promote threat detection.

• PICTURE PROCESSING •

(1015)

Do the Eyes Speak As Much As the Mouth? ANNIE ROY-CHARLAND & MÉLANIE PERRON, *Laurentian University*—Emotional facial expressions are generally well recognized. However, analyses repeatedly have shown varying accuracy rates as a function of the emotion: happiness being the best recognized, and fear the worst. Regardless of recognition, these emotions also tend to attract attention differently. Recent work revealed that certain parts of the face are more efficient in attracting attention (e.g., the mouth more than the eyes). It remains to be seen whether these regions affect recognition in the same way. Participants viewed facial expressions of the basic emotions of different intensity levels and identified the emotion while eye movements were recorded. Recognition rates were consistent with previous research: Happiness was highest, and fear was lowest. Most important, in line with attention research, participants showed a different use of the mouth and eye regions, the eyes being fixated for longer periods than the mouth. These results are discussed in terms of the perceptual-processing hypothesis.

(1016)

Age and Instruction Effects on the Relationship Between Encoding and Memory for Objects and Their Locations. KATIE L. MEADMORE, SHUI-I SHIH, & SIMON P. LIVERSEDGE, *University of Southampton* (sponsored by Simon P. Liversedge)—Can differences in encoding behaviors partly account for age effects on object location memory? We recorded eye movements of younger and older adults while they viewed a photograph depicting 12 household objects in a cubicle. After encoding, participants completed incidental or intentional object identity and object location memory tests. Under incidental instructions, younger adults outperformed older adults on memory for objects and their locations. However, under intentional instructions, memory performance was equivalent in younger and older adults; the younger adults' advantage on memory was reduced. Critically, instructional manipulations affected encoding behaviors and subsequent memory performance in the older, but not the younger, adults. Relative to the incidental condition, older adults under intentional instructions exhibited greater object-oriented viewing (they fixated more targets and for longer) and more accurate object and object location memory. Our results suggest that eye-movement-based encoding strategies can partly explain age-related decline in memory for objects and their locations.

(1017)

Independent Effects of Verbalization and the Own-Race Advantage on Face Recognition. KAZUYO NAKABAYASHI, *University of Hull*, TOBY J. LLOYD-JONES, *Swansea University*, NATALIE BUTCHER, *University of Teesside*, & CHANG HONG LIU, *University of Hull* (sponsored by Toby J. Lloyd-Jones)—Language can influence cognition: Describing a face in words can either facilitate or interfere with subsequent visual recognition. Here, we focus on verbal facilitation of face recognition and examine the relationship between verbally describing a series of faces and the own-race advantage (ORA), whereby people are better at recognizing faces from their own race, as compared with those of other races. Using converging evidence from behavioral and eye movement performance, we answer four theoretical questions. (1) Do verbalization and the ORA benefit face recognition independently? (2) Are the benefits of verbalization and the ORA on face learning or recognition? (3) Do verbalization and the ORA provide a general visual-processing benefit, or are they tied to configural or featural processing in particular? (4) Which facial features mediate effects of verbalization and provide diagnostic cues for race-specific identification, and are such features important at learning or recognition?

(1018)

Dual-Coding Theory: Revisited. OMAR GARCIA, JESSICA MORALES, ROBERTO R. HEREDIA, & ANNA B. CIEŚLICKA, *Texas A&M International University* (sponsored by Roberto R. Heredia)—We revisit Paivio's (2007; Paivio & Csapo, 1969, 1973) dual-coding theory. In Experiment 1, for the encoding phase, bilinguals studied pictures, abstract words, and concrete words and were asked to press a button as soon as they understood each stimulus. Stimuli presentation was either 189 or 500 msec per item. In Experiment 2, for the encoding condition, participants were asked to classify word and picture label onset (i.e., first letter) as a consonant or a vowel as quickly as possible. Recall for Experiment 1 replicated the picture superiority effect; however, the concreteness effect failed to materialize. The results for Experiment 2 again replicated the picture superiority effect. Unlike in Experiment 1, the concreteness effect was obtained. Although stimuli presentation (189 vs. 500 msec) was not reliable, there was a trend showing better retrieval for the 500-msec time condition. The results are discussed in terms of dual-coding theory and levels of processing.

• LETTERS/WORD PROCESSING •

(1019)

The Effect of Referent Similarity on Word Learning and Its Elimination. LIBO ZHAO, STEPHANIE PACKARD, & PRAHLAD GUPTA, *University of Iowa* (sponsored by Prahlad Gupta)—Learning of a word involves learning of a phonological word form, its meaning (or referent), and the mapping between them. We examined the effect of referent similarity on word learning. Experiment 1 found that word-learning performance, as measured by naming accuracy, was lowest for the high-similarity condition (highly similar referents used), highest for the low-similarity condition (dissimilar referents used), and in between for the medium-similarity condition (moderately similar referents used). Importantly, the naming errors in the high-similarity and medium-similarity conditions were mostly due to confusions in mapping between the word forms and the referents. Experiment 2 further demonstrated that prior discrimination experiences between the highly similar referents led to improvement in word learning, eliminating the detrimental effect of referent similarity. These findings suggest that mapping a word form to a referent that is similar to others involves identifying information in that referent that distinguishes it from the others.

(1020)

Effects of Exogenous Spatial Cuing on Repetition Priming Depends on Stimulus Size. YOUSRI MARZOUKI, *University of Provence and CNRS*—An experiment combined exogenous spatial cuing with masked repetition priming. Participants performed a lexical decision task (word vs. pseudoword classification) with central targets and horizontal peripheral primes that were cued or not by an exogenous abrupt onset. In the present study, word length was manipulated (three-letter words vs. five-letter words). The results showed a significant facilitation of prime processing by an exogenous valid cue only with three-letter words, whereas with five-letter words, an inhibitory effect was observed. These data indicate that an exogenous spatial cue boosts the prime at the location of the cue, explaining the higher gain for repetition-priming effects. This gain cannot be obtained with longer peripheral primes, which indicates the crucial role that the physical size of the parafoveal stimulus plays in priming efficiently a centrally located target.

(1021)

Assessing the Influence of Letter Position in Reading Connected Texts Using a Letter Detection Task. JEAN SAINT-AUBIN & KATHERINE GUÉRARD, *University of Moncton*, & MARIE POIRIER & CONSTANTINA DEMETRIOU, *City University London*—One of the most basic processes involved in reading continuous texts is the recognition of the words' constituent letters. Although some studies have suggested that the initial and final letters of a word have a privileged status, there is no consensus with regard to the time course of letter recognition and to the importance of the different letter positions when connected texts are read. In the present experiments, we used a letter search task to examine the impact of letter position on word identification in connected text, using the classical paper-and-pencil procedure (Experiment 1) and an eye-movement-monitoring procedure (Experiment 2). In Experiment 3, a condition with transposed letters was included. Our results show that the first letter—but not the last letter—of words benefits from better processing and that an advantage for the final letter occurs when the visual configuration of words is altered.

50

(1022)

The Scope of Meaning Activation During Lexical Ambiguity Resolution in the Cerebral Hemispheres. HOANG VU & MICHAEL HAJI, *Saint Mary's College*, & GEORGE KELLAS, *University of Kansas*— The present research examined the scope of meaning activation in the cerebral hemispheres following the central presentation of sentences that were biased toward the subordinate meaning of an ambiguous word. Immediately (0-msec ISI) after each sentence was presented, a target word was presented to either the left or the right visual field to await a lexical decision. Target words were related to either the dominant or the subordinate meaning of the lexical ambiguity, and each target word was either highly salient to the expressed meaning or less salient. Lexical decision times showed that in the left hemisphere (LH), only target words related to the subordinate meaning of the subordinate biased sentences were activated regardless of salience; however, high-salient target words were activated to a greater degree than low-salient targets. In contrast, in the right hemisphere (RH), lexical decision times showed a more complicated pattern of activation. Targets related to both dominant and subordinate meanings were activated, with different magnitudes of activation for high- and low-salient targets. The results are discussed within Beeman's (1998) proposal of fine semantic coding in the LH and coarse coding in the RH.

(1023)

The Role of Subsyllabic Units in Visual Word Processing of Korean Monosyllabic Words: A Masked Priming Study. SAY YOUNG KIM & DONALD J. BOLGER, *University of Maryland, College Park* (sponsored by Carol Whitney)—A putative left-branching syllable structure has been proposed for Korean (i.e., body–coda) in contrast to English (i.e., right-branching), on the basis of such tasks as sound similarity judgments (e.g., Yoon, Bolger, Kwon, & Perfetti, 2001). The present study examined whether or not Korean speakers favor a body–coda structure over an onset–rime structure within a monosyllabic word during a masked prime lexical decision task (SOA = 47 msec). Korean participants were given CVC structured monosyllabic words as targets, preceded by one of four different types of primes: body (CV_), rime (_VC), identical (CVC), and nonmatch as control. The main effect of prime type was significant. Identical primes induced the largest facilitation effect on the targets, but it was not different from that of body primes. The lack of a priming effect with the rime unit supports the proposed body unit (left-branching) preference in the nonlinear orthographic syllable package (kulja) of Korean.

(1024)

The Development of Italian Pseudohomophone Reading. FRANCESCA PERESSOTTI & LUCIA COLOMBO, *University of Padua*— Italian pseudohomophones (*storya*) are read faster than orthographically matched nonwords (*stofya*) because they benefit from activation of phonological units in the lexicon. They show no advantage as compared with unmatched nonwords (*stofia*; Peressotti & Colombo, 2008), since the latter receive activation from the orthographic lexicon. Due to their unusual spelling, pseudohomophones do not benefit from lexical orthographic activation, since they can be read only via phonological recoding. In the present study, we investigated the development of these effects. First-, second-, and third-grade children were presented pseudohomophones, matched nonwords, and unmatched control nonwords in a mixed list. Accuracy and RTs were measured. The results are discussed in light of the development of relative contribution of lexical and sublexical knowledge, on the one hand, and orthographical versus phonological information, on the other hand.

(1025)

Orthography and Morphology in the Recognition of Compound Words. UN-SO PARK-DIENER & GREG B. SIMPSON, *University of Kansas*—Rastle (2004) used a masked-priming visual lexical decision task in three different priming conditions and found priming when the prime and the target had a morphological relationship (e.g., *cleaner*–CLEAN) and also when the prime and the target only looked as if they had a morphological relationship (e.g., *corner*–CORN), but not when the prime and target shared only the form, such as in *brothel*–BROTH. This

result suggests that people decompose words by their morphological structure. In the present study, we used a similar design with words composed of free morphemes. We also used three types of priming conditions: actual compound words (*doghouse*–DOG), pseudocompound words (*mushroom*–MUSH), and orthographic controls (*spinach*–SPIN). Reaction time results showed priming in the compound word condition, but not in the pseudocompound word condition. Apparent morphological relationship may not be enough for decomposing compound words.

• PSYCHOLINGUISTICS •

(1026)

Behavioral Correlates of "Deep" and "Surface" Anaphora. REBECCA R. WOODBURY, *Harvard University and MIT*, & DAVID N. CAPLAN, *Massachusetts General Hospital and Harvard University* (sponsored by David N. Caplan)—Two self-paced reading time experiments were conducted using two sets of materials that differed in whether they contained a "surface" or a "deep" anaphor. "Distance" materials were used to examine the effect of placing an intervening sentence between the antecedent and anaphor, and "particle shift" materials were used to examine the effect of repeated matching or mismatching word order following the antecedent and anaphor. For distance materials, no difference in reading time at the anaphoric region was found between short and long conditions for either surface or deep anaphors, but comprehension question accuracy was lower and comprehension question response time was higher in long conditions than in short conditions for the surface anaphors. For particle shift materials, the reading time in the region of the shifted word order construction was longer in mismatching than in matching conditions for surface anaphors but did not differ between conditions for the deep anaphors.

(1027)

An Investigation Into Readers' Sensitivity to Conditional Indirect Meaning. MATTHEW HAIGH & ANDREW J. STEWART, *University of Manchester* (sponsored by Andrew J. Stewart)—People often use conditional statements of the form *if p then q* to implicitly communicate speech acts such as promises (e.g., *if you wash the car, I'll pay you five pounds*) and tips (e.g., *if you want to lose weight, you need to exercise more*). As a result, comprehension of these statements requires an inference to determine the speech act being performed. We used self-paced reading to examine readers' sensitivity to this conditional indirect meaning during reading. A processing penalty was associated with reading an explicitly named speech act (i.e., a promise or a tip) that anaphorically mismatched the implied conditional speech act. We take this as evidence that readers represent conditional indirect meanings rapidly and online during comprehension. Although the majority of psychological research on conditionals treats them as locutionary acts that express logical propositions, a full account requires an understanding of their associated illocutionary force.

(1028)

Colorful Green Ideas Prime Furiously: Objects That Share a Typical Color Partially Activate Each Other. EILING YEE, SARAH AHMED, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*— Many theories of semantic memory describe the representations of object concepts as patterns distributed across semantic features, with objects sharing features having overlapping representations. We used semantic priming to test whether reading an object's name activates representations of similarly colored objects. Participants ($N = 32$) made animacy judgments on written target words (e.g., *cucumber*) after being primed with either color-related words (*emerald*) or carefully matched unrelated words (*pendant*) (all written in black). Responses were significantly faster and more accurate with color-related primes. Participants also completed a color Stroop task prior to the priming task. Across participants, Stroop interference correlated positively with color-priming effects ($r = .41$, $p = .02$). Ongoing work will test the possibility that the Stroop task focused attention on color for the priming task. Together, our findings reveal correlated variance in the strength of participants' conceptual color representations across Stroop and semantic priming tasks, and, critically, that color-related objects have overlapping representations.

(1029)

A Role for the COMT Val[158]Met Polymorphism in Lexical and Syntactic Ambiguity Resolution. RANJANI PRABHAKARAN, DAVID J. M. KRAEMER, JOHN C. TRUESWELL, FALK W. LOHOFF, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by John C. Trueswell)—The extent to which there is correlated variation in individuals' abilities to resolve lexical and syntactic ambiguities, as well as the neurochemical underpinnings of these mechanisms, has not yet been investigated. In the present study, subjects were tested on separate syntactic and lexical ambiguity resolution tasks, and they were also genotyped for the catechol-*O*-methyltransferase (COMT) Val[158]Met polymorphism related to prefrontal cortical dopamine regulation. A significant positive correlation was found between subjects' ability to resolve ambiguities across both tasks. Furthermore, preliminary evidence suggests that variation in COMT is related to both lexical and syntactic ambiguity resolution abilities. Those subjects with the COMT genotype (Val/Val) associated with lower dopamine availability at the synapse also demonstrated greater difficulty with processing of lexical and syntactic ambiguities. These results provide novel evidence indicating that variation in COMT, which has been linked to cognitive control abilities, is also associated with linguistic ambiguity resolution abilities.

(1030)

Representing Abstract Word Meanings: Why Emotion Matters. DAVID P. VINSON, STAVROULA T. KOUSTA, & MARK ANDREWS, *University College London*, ELENA DEL CAMPO, *Università degli Studi di Padova*, & GABRIELLA VIGLIOCCO, *University College London* (sponsored by Gabriella Vigliocco)—Many lexical-processing studies, using numerous tasks, have demonstrated that concrete words have a cognitive advantage over abstract words. However, this well-replicated effect can be reversed by matching concrete and abstract words for a wide range of lexical and sublexical variables, yielding an advantage for abstract words in lexical decision (Kousta et al., 2009, *Proceedings of the Cognitive Science Society*). Here, we explored whether this residual advantage for abstract words can be explained in affective terms; abstract words tend to be more emotionally valenced and arousing than concrete words. We first found that the abstractness advantage was not observed for neutrally valenced words. In a second experiment, using words from the full range of emotional valence/arousal, a reliable abstractness advantage was eliminated once variance related to valence/arousal was factored out. We propose that emotion may provide a crucial basis for representing abstract words, akin to sensory–motor experience for concrete words.

• JUDGMENT/DECISION MAKING •

(1031)

Utility Reversals: Memory and Contextual Biases With Decision Prospects. PETKO KUSEV, *Kingston University London and City University London*, PETTER JOHANSSON, *University College London*, PAUL van SCHAIK, *Teesside University*, PETER AYTON, *City University London*, & NICK CHATER, *University College London*—In three experiments, we studied the extent to which theories of decision making and memory can predict people's preferences. Studying risky decisions, we aimed to answer questions about human preferences, prompted by similarities between the leading economic theory, expected utility theory (EUT), and the leading psychological theory of human choice under risk, prospect theory (PT). Accordingly, we studied (1) the lability of human preferences and their relation to choice justifications given in risky decision-making scenarios, (2) the dynamics of preference formation for choice with monetary gambles, and (3) the limits of existing theoretical accounts (EUT, PT, experience-based decision research) by contrasting them with a new theory of risky choice based on the impact of context, complexity, and prior choices. We found evidence that people do not have underlying preferences for risk; instead, context, skills, and memory determine preferences even when the utilities (risk and reward) of alternative options are known.

(1032)

Neural Pattern Classification Reveals Trial-Specific Outcomes in a Simple Game. TIMOTHY J. VICKERY, MATTHEW R. KLEINMAN, DAEYEOL LEE, & MARVIN M. CHUN, *Yale University*—Many choices depend on past experience in the same context. How do humans represent the outcomes of choices (e.g., wins and losses in a game) in order to track performance and optimize choice? To study this, we examined neural representations of wins and losses, using fMRI and pattern classification. Participants played "matching-pennies" against a computer opponent. Every trial, both opponents chose one side of a coin. If choices matched, the human won; otherwise, the computer won. We decoded the fMRI data to predict wins and losses in successive trials. In a subset of regions (PCC, insula, putamen, and frontal pole), classification accuracy rose above chance following each trial's outcome. Classification accuracy then decayed and rose again following the next trial, suggesting a dynamic tracking of reward over time. Thus, we identified neural signals related to outcomes from specific choices, which might underlie updating of value functions in reinforcement learning.

(1033)

Red Means Stop: The Effect of Color on Medical Diagnostic Accuracy. JON TALL, ROBERT C. MATHEWS, & SEAN M. LANE, *Louisiana State University* (sponsored by Robert C. Mathews)—In prior research, we examined knowledge acquisition in a diagnostic task that involved learning the most effective drug treatments for patients. One consistent finding was that participants appear unaware of negative side effects and yet these negative side effects lower beliefs about the real efficacy of the drug on the primary measure. Two experiments examined how different methods of color coding of feedback in the task can facilitate participants' accurate encoding and memory of effects. In Experiment 1, the use of color-coded feedback facilitated the accurate acquisition of drug side effects. In Experiment 2, the use of a full range color coding scheme outperformed a partial (extremes colored only) coding scheme. We discuss how color labels can facilitate learning.

(1034)

Adaptive Decision Making Under Varying Levels of Ambiguity. DAN LOPEZ-PANIAGUA, CAROL A. SEGER, & MATTHEW G. RHODES, *Colorado State University*—Previous studies have dissociated two types of uncertainty in decision making: risk and ambiguity. Generally, people prefer risky decisions to ambiguous ones, in a phenomenon known as ambiguity aversion. However, many of these studies have categorically defined ambiguity as a complete lack of information regarding outcome probabilities. In a novel task, we parametrically varied the levels of ambiguity for financial decisions involving potential gains whose expected values (EVs) were better than, equal to, or worse than those for a risky decision, to better assess preference for risk or ambiguity. Overall, subjects learned to select advantageous choices and avoid disadvantageous ones. Interestingly, as ambiguity increased, subjects opted more for the risky option (despite having a lower EV) when the choice favored ambiguity but preferred ambiguous options when the choice favored risk. These results suggest a dynamic shift from risk aversion when ambiguity is low to ambiguity aversion when ambiguity is high.

(1035)

Examining the Relationship Between Knowing and Doing: Using Nutrition Education to Improve Decisions. PILAR CHILET, ERICA L. WOHLDMANN, & JILL L. QUILICI, *California State University, Northridge* (sponsored by Erica L. Wohldmann)—Nearly two thirds of American adults are either overweight or obese. Education is negatively correlated with obesity rates, such that as education level increases, body mass index decreases. However, socioeconomic status (SES) is typically greater for educated than for uneducated individuals, allowing them greater access to healthy food. Thus, the true relationship between education and obesity is unknown. This study examined the role of nutrition education and health in college students, controlling for SES. Experiment 1 compared educated (nutrition majors) with less educated (nonmajors) students, and education predicted improved health outcomes. In Experiment 2, nonmajors were trained to use different types of nutritional calculators before making a meal selection. Providing the daily-recommended calorie requirements had the largest effect on immediate food choices. Thus, certain types of nutrition education seem to be more important than others.

(1036)

Impulse Control, Risk Perception, and Aviation Experience. MARY BUTLER, F. RICHARD FERRARO, THOMAS V. PETROS, PAUL LINDSETH, GLENDA LINDSETH, & WARREN JENSEN, *University of North Dakota* (sponsored by F. Richard Ferraro)—Thirty-four students with extensive aviation experience (A+) and 35 students without such experience (A−) completed tests designed to tap into frontal lobe function (Executive Function Index [EFI]; Spinella, 2005) and risk perception (*Risk Perception and Risk Tolerance in Aircraft Pilots*; Hunter, 2002). On three of the four risk perception indices (Composite Risk–Non-Aviation Scenarios, Composite Risk–Aviation Scenarios, and Weather-Related Risk, whereby higher scores mean better risk perception), the association with the Impulse Control subscale of the EFI (in which higher scores mean better impulse control) was positive and significant in those with extensive aviation experience (all $rs > .36$, all $ps < .05$) but were not significant in those without extensive aviation experience. These results suggest that any risk perception training program in pilots would do well to include training on impulse control. Implications for uninhabited aerial vehicles pilot training are discussed.

(1037)

Inhibition Ability: A Modulator in the Normative–Intuitive Mismatch. SARAH FURLAN, *Cornell University*, JORDANA M. LIBERALI, *Erasmus University, Cornell University, and PUCRS*, & SETH T. PARDO, *Cornell University*, LILIAN M. STEIN, *PUCRS*, & VALERIE F. REYNA, *Cornell University* (sponsored by Valerie F. Reyna)—The cognitive reflection task (CRT; Frederick, 2005) is increasingly applied in different areas of decision making. The CRT is a measure of cognitive ability to control impulsive and erroneous responses (generated by System 1) that need to be overridden by System 2. Fuzzy-trace theory (Reyna & Brainerd, 2009) suggests, rather, that the CRT is a measure of inhibition, which independently modulates reasoning. This study tested whether the participant's intuitive response ($N = 190$) in the CRT is a measure of a failure in inhibition. If normative responses depend on System 2, intuitive responses should be inversely associated to need for cognition, intelligence, and objective and subjective numeracy scales. The results suggest that intuitive responses are inversely related only to objective and subjective numeracy scales. Contrary to Frederick (2005), a generalized linear mixed model on the intuitive responses for each CRT problem revealed a weak effect of gender only in interaction with one of the three problems.

• CONCEPTS AND CATEGORIES •

(1038)

Can Diagonal Categories Be Learned Without Postresponse Feedback? MICHAEL B. CASALE & HAL PASHLER, *University of California, San Diego* (sponsored by Hal Pashler)—Some recent behavioral research suggests that learning of "diagonal" category structures (in which stimulus values on two dimensions sum to determine category membership) was much less effective when the learner was shown labels in advance of instances (as compared with a procedure in which the learner first responded to an instance and only then obtained feedback). In Experiment 1, we found that when the relationship of labels to instances was made as clear as possible and the separation between trials was made salient, equally good learning occurred in the two conditions. Model fitting also suggested that the learning in the two training procedures was qualitatively similar. A second experiment asked whether instance–label simultaneity affected the rate of learning. We discuss the implications of our results for the COVIS model of multiple-category-learning processes.

(1039)

Strategy Use and Set Size on Same/Different Judgments. JOHN F. MAGNOTTI, JEFFREY S. KATZ, & KELLY A. SCHMIDTKE, *Auburn University*, & ANTHONY A. WRIGHT, *University of Texas Medical School at Houston* (sponsored by Jeffrey S. Katz)—Early research on abstract concept learning confined the ability solely to humans. Work in our laboratories has shown that nonhuman primates and pigeons can learn the abstract concept of same/different. Training set size is crucial in determining the kind of learning (item specific vs. relational) and, thus, degree of transfer to novel stimuli. The present experiment assessed human acquisition of a same/different discrimination under three training set sizes: two, eight, and trial unique. The experimental parameters mimicked those used for nonhuman animals as closely as possible, including no instructions about the nature of the task. Some, but not all, of the human participants were able to apply the abstract same/different concept. Our results suggest that the training environment influences strategy usage and that animals may not apply "higher" processes, even if available.

(1040)

The Effect of Processing Type on Recategorization and Open-Ended Responses. DAVID G. COSEJO & STELLAN OHLSSON, *University of Illinois, Chicago* (sponsored by Stellan Ohlsson)—The effect of processing type on the process of overriding prior experience and learning—restructuring—was examined within a categorization paradigm. Participants were trained to categorize either explicitly or implicitly or received no training. Explicit training encouraged participants to use hypothesis testing, whereas implicit training encouraged categorizing via intuition. Participants then worked on a modified categorization task in which they learned an initial "misconception" category and later had to restructure their representation to learn a target category. Participants were able to successfully learn the misconception and restructure the target. At the end of the task, participants were asked what attributes of the stimuli determined category membership. Explicit hypothesis testing should result in high awareness, conjunctive categories, and a clear distinction between the misconception and the target category, whereas implicit training should exhibit the opposite. The results support the hypothesis that participants can solve recategorization problems either explicitly or implicitly, depending on circumstances.

(1041)

Comparative Study Between Empirical Data and a Neural Network Modelization of Category Learning. LAURENCE MORISSETTE & DENIS COUSINEAU, *University of Montreal*, & SYLVAIN CHARTIER, *University of Ottawa* (sponsored by Denis Cousineau)—Often, models of simple cognitive processes are used totally independently from empirical studies of the same processes in humans. Our present research was twofold. First, we conducted a study of the differences in the categorization processes between explicit (verbalizable) and implicit (nonverbalizable) tasks. The differentiation was done in term of difficulty, strategy use, and time necessary to learn the rule of the category for family resemblance and conjunctive and disjunctive rules. We then used a FEBAM-SOM neural network to model the categorization and had it complete the same tasks. The comparison between the two gave us insight into how the network can be used as a model of human categorization. The empirical data confirmed an effect of familiarity, as supported by previous studies, but we found a trade-off effect between the success rate and response times for the family resemblance and rule-based disjunctive tasks, denoting different approaches to task completion.

(1042)

The Prototype Enhancement Effect Strikes Back: Beta Version. ETIENNE DUMESNIL & DENIS COUSINEAU, *University of Montreal* (sponsored by Serge Larochelle)—Forty-three years ago, Posner, Goldsmith, and Welton (1967) introduced the dot-pattern paradigm to study category representation. Studies using this paradigm typically observed a prototype enhancement effect. In recent years, the methodology used to create the categories has been questioned. Two factors were shown to boost performance on the prototype: Prototypes were the most compact patterns of each category and were presented with greater frequency at time of transfer (Zaki & Nosofsky, 2004). In the study presented here, we modified the methodology so that any exemplar could be more or less compact. We also used an asymmetric (beta) probability distribution to select every exemplar's level of distortion, separating the most frequent exemplar from the mean for the category. Participants were faster in a classification task and more precise in an inference task with exemplars closest to the mean. The prototype enhancement effect thus appears to withstand the loss of these two bias factors.

(1043)

Essentialist Beliefs of Lay Individuals Concerning Stigma of Mental Disorder Categories. LINDZI L. SHANKS & JESSECAE K. MARSH,

Texas Tech University—Stigma toward mental disorders is prevalent in society (Phelan, 2005).The stigmatization of human categories such as race and ethnicity has been linked to beliefs that a group possesses an essence, something possessed by every member of the group that makes the group unique (Hirschfeld, 1995). We assessed whether essentialist beliefs could also underlie stigmatization of mental disorders. Undergraduate participants answered questions measuring their amount of stigmatization, degree of endorsement of an underlying essence, and endorsement in different causal bases for 10 mental disorder categories. One component of stigma, blame attributable to the individual for the disorder, was correlated with whether the category was seen as naturally occurring or created by society. This was the only correspondence we found between stigma and a measure of essentialism for mental disorders. We discuss possible explanations for these results and how belief in a causal basis of disorder categories may mediate this process.

(1044)

Object Knowledge Biases Memory Over the Short Term for Object Size. MARIE POIRIER, *City University London*, DANIEL HEUSSEN, *Catholic University Leuven*, & JAMES A. HAMPTON & SILVIO AL-DROVANDI, *City University London*—On the basis of Hemmer and Steyvers (2009), we examined the effect of prior knowledge on recall; however, we considered the case of memory over the short term. Participants saw lists of seven images; each list held images of fruit, vegetables, or random shapes. Immediately after list presentation, one of the items was presented again, in a new, randomly determined size. Participants were asked to resize the image so that it was as close as possible to the size of the just-presented item. Preliminary results showed that, for the fruits and vegetables, memory for the item's size was influenced by prior knowledge of the normal size of the objects; this was not the case for the random shapes. Moreover, there was a serial position effect suggesting that for the serial positions, where memory is typically lowest, bias from long-term knowledge is more pronounced.

(1045)

Do People Learn From Their Mistakes? The Role of Error in Learning. GYSLAIN GIGUÈRE, MARC T. TOMLINSON, & BRADLEY C. LOVE, *University of Texas, Austin*—One view is that corrective feedback following errors triggers correction processes that hasten learning. Accordingly, many neural network models learn only when there is prediction error. An alternative view is that errors hinder learning. On this view, errors can cause memory confusions, whereas correctly categorizing an item provides beneficial practice in making the correct retrieval and response. To evaluate these two possibilities, we manipulated learners' error rate by subtly influencing their decisions, using a response deadline procedure. In one condition, learners' error rate was reduced by triggering the response deadline when they were considering the correct option (as inferred by eye gaze or mouse position). In a second condition, error rate was increased by triggering the deadline at the moment the incorrect option was being considered. In transfer testing, across all measures, performance in the low-error condition was equal to or better than that in the high-error condition, suggesting that errors hinder learning.

• HUMAN LEARNING •

(1046)

Ironic Effects of Drawing Attention to Story Facts. ANDREA N. ESLICK, *Duke University*, LISA K. FAZIO, *Carnegie Mellon University*, & ELIZABETH J. MARSH, *Duke University* (sponsored by Elizabeth J. Marsh)—People often encounter factual information about the world in their daily lives. Previous research suggests that when participants read correct and misleading facts embedded in stories, they often use this information to answer later general knowledge questions (Marsh, Meade, & Roediger, 2003). In the present study, we attempted to reduce reliance on story information by drawing attention to story facts. Specifically, participants read fictional stories that contained both correct and misleading facts. Critically, some facts appeared in a red font, and some appeared in a black font. Participants no longer needed to find the red facts; they simply needed to monitor them for correctness. Drawing attention to misleading facts had an ironic effect: It increased, rather than

decreased, suggestibility to misleading information. That is, readers were more likely to answer general knowledge questions with misinformation if they previously had read it in red font, rather than in black font.

(1047)

An Arithmetical-Training Regime Improves Number Representation and Broad Mathematical Performance. ARAVA Y. KALLAI, ANDREA L. PONTING, CHRISTIAN D. SCHUNN, & JULIE A. FIEZ, *University of Pittsburgh* (sponsored by Julie A. Fiez)—We sought to improve analogic representation of double-digit (DD) numbers, assuming that this would improve mathematical performance. Training consisted of five 1-h sessions in which 20 subjects solved addition/subtraction problems. Twenty control subjects were trained to type numbers. All subjects were pre- and posttested in a variety of tasks related to DD number representation and math proficiency. In a number comparison task, accuracy improved for experimental but not for control subjects. Only experimental subjects showed Stroop-like interference in a task testing automaticity of addition by having subjects estimate the size of rectangles with embedded addition problems. In fMRI scans, conducted pre- and posttraining, passive adaptation to addition problems that summed to the same number showed modified recovery from adaptation, with experimental subjects showing stronger adaptation following training. We conclude that the training regime led to more fine-tuned representations of DD numbers that resulted in improvements on simple and complex math tasks.

(1048)

Differentiating Retrieval Processes That Underlie the Transfer of Testing Effects. SCOTT R. HINZE, JENNIFER WILEY, & JAMES W. PELLEGRINO, *University of Illinois, Chicago*—Recent research has demonstrated that the benefits of retrieval practice for learning can transfer to new questions that require the application of complex information (Butler, 2010; McDaniel, Howard, & Einstein, 2009; Rohrer, Taylor, & Sholar, 2010). The processes behind the transfer of these testing effects are less clear. The present research directly manipulated processing during retrieval practice using science text materials. After a 7-day delay, some retrieval practice activities benefited transfer performance over re-reading, whereas other activities did not. Analyses of retrieval protocols suggest that quantitative and qualitative differences in processing affect the extent to which these activities influence learning from text.

(1049)

Cognitive and Perceptual Factors That Affect Manipulation of Virtual Objects. ANDREW T. STULL, MARY HEGARTY, & RICHARD E. MAYER, *University of California, Santa Barbara* (sponsored by Mary Hegarty)—In previous research (Stull, Hegarty, & Mayer, 2009), students learned the structure of a 3-D object (a bone) by using a handheld controller to rotate an on-screen 3-D model to target views. During these investigations, participants commonly confused two orientations differing by 180º (symmetry confusion). In the present experiments, factors that contribute to symmetry confusion were investigated. Experiment 1 varied whether or not participants wore goggles that provided binocular disparity cues when rotating the 3-D model. Binocular disparity cues reduced symmetry confusion. In Experiment 2, the eye fixations of participants were tracked as they performed same–different decisions of views of the object differing in orientation. Participants who were confused by symmetry made significantly fewer fixations before making their decision. These results suggest that unsuccessful participants neglect local details of the object in favor of global shape and that binocular cues help to make local details more salient.

(1050)

The Effects of Repeated Retrieval As a Function of Item Difficulty. KALIF E. VAUGHN, KATHERINE A. RAWSON, & MARY A. PYC, *Kent State University* (sponsored by William E. Merriman)—Research has shown that repeated retrieval yields powerful mnemonic benefits. Pyc and Rawson (2009) showed that final test performance increased as the number of correct retrievals during practice increased. But does repeated retrieval benefit both easy and difficult items equally? The retrieval effort hypothesis states that difficult successful retrievals benefit memory more

than do easy successful retrievals, which should favor difficult items. Sets of easy and difficult word pairs underwent test–restudy practice until they were correctly recalled 1, 3, 5, 7, 9, or 11 times. During practice, difficult items required more trials than did easy items to reach criterion, and latencies for correct responses were slower. However, despite increased difficulty, difficult foreign word pairs were more poorly recalled after a 2-day delay. Furthermore, after the final test, difficult foreign word pairs required more relearning trials than did easy foreign word pairs. These results are inconsistent with the retrieval effort hypothesis.

(1051)

Why Does Testing Improve Memory? Evaluating the Mediator Shift Hypothesis. MARY A. PYC & KATHERINE A. RAWSON, *Kent State University* (sponsored by Christopher A. Was)—Previous testing effect research has demonstrated that retention is greater after test–restudy versus restudy practice. However, it is not well understood why testing is beneficial for memory. The present experiments evaluated one theoretical account, the mediator shift hypothesis, which states that retrieval practice benefits memory because retrieval failures during practice enable participants to identify mediators that are not effective and to shift to more effective ones. Participants were instructed to use a keyword strategy to learn paired associates during practice involving either test–restudy trials or restudy only. Final test performance was greater after test–restudy practice versus restudy only. Most important, as was predicted, a greater proportion of mediator shifts occurred after test–restudy versus restudy practice. For the test–restudy group, a greater proportion of mediator shifts occurred after retrieval failure versus success trials. Finally, a greater proportion of Session 1 mediators were recalled after final test for the test–restudy group.

• COGNITIVE CONTROL •

(1052)

The Representation of Action Plans Can Affect Response Delays Due to Action Feature Overlap. JONATHAN M. GALLIMORE & LISA R. FOURNIER, *Washington State University* (sponsored by Lisa R. Fournier)—Planning and withholding an action to one visual stimulus (A) can delay a response to a later-occurring, second visual stimulus (B) if A and B share some action features (response hand). We examined whether this compatibility interference (CI) generalizes to movement direction (left/right) and to cases where A appears across two events, as compared with a single event. Participants planned and withheld a joystick movement (e.g., left and down) on the basis of the identity of A and then executed a speeded left or right joystick movement on the basis of the identity of Stimulus B. The results showed that CI was reduced when A required planning and withholding a sequence of actions across two events, as compared with one. This suggests that CI may be greater when action features are represented in an integrated fashion than when action features are represented separately. Implications for the theory of event coding are discussed.

(1053)

Rapid Serial Visual–Temporal Presentation: Controlling the Timing of Attention. JACQUELINE C. SHIN, *Indiana State University*—Previous research has suggested that attention can be actively deployed in an oscillatory manner over a time scale of several seconds (e.g., the work of Mari Jones and colleagues). The present work explored whether the timing of attention could be controlled in a sequential manner on a subsecond time scale. Specifically, the temporal predictability of items was manipulated in a rapid serial visual presentation paradigm. As in many previous studies, on each trial, two letter targets were separated by varying numbers of numeral distractors, each displayed in a periodic manner. However, the onset asynchrony between the first target and the immediately following distractor either varied randomly among trials or was fixed within each block of trials. The results are reported with respect to the effects of temporal predictability on the time course and amplitude of the attentional blink.

(1054)

Attentional Bias Toward Somatic Threats Is Mediated By Attentional Set. ROBERT DOWMAN, *Clarkson University* (sponsored by Andreas Wilke)—Work involving the Posner cuing paradigm has shown that threatening somatic targets (e.g., painful electrical stimulation) have a smaller invalidly − validly cued reaction time difference (validity effect) than do nonthreatening targets. In these studies, the threatening and nonthreatening somatic targets were given in separate blocks. Here, we examined whether the attentional bias toward somatic threats is due to threat feature detection or to attentional set by presenting the threatening and nonthreatening somatic targets within the same block. If the attentional bias toward somatic threats is due to threat feature detection, the validity effect for the somatic threat target should be less than that for the nonthreatening target. If the attentional bias is due to attentional set, the validity effect for the nonthreatening and threatening somatic targets should be the same as and smaller than that for nonthreatening targets given in a block design. The results support the attentional set hypothesis.

(1055)

Two Hemispheres for Better Memory in Old Age: Role of Executive Functioning. LUCIE ANGEL, SÉVERINE FAY, BADIÂA BOUAZZAOUI, LAURENCE TACONNAT, & MICHEL ISINGRINI, *University of Tours, UMR CNRS 6234 CeRCA*—This experiment explored the functional significance of age-related hemispheric asymmetry reduction associated with episodic memory and the cognitive mechanisms that mediate this brain pattern. Event-related potentials were recorded while older adults performed a word stem cued-recall task. Regression analyses indicated that the degree of laterality of brain activity determines the accuracy of memory performance and mediates age-related differences in memory performance. They also confirmed a cascade model in which the individual's level of executive functioning mediates age-related differences in the degree of lateralization of brain activity, which, in turn, mediates age-related differences in memory performance.

(1056)

Contextual and Local Effects of Motivation on Cognitive Control. ADAM C. SAVINE & TODD S. BRAVER, *Washington University* (sponsored by Deanna M. Barch)—Cued motivational incentives have been found to influence trial-by-trial cognitive processing (incentive cue effect). Recently, incentives also were found to exert benefits for nonincentive trials occurring within incentive blocks (incentive context effect). The present investigation probed the potentially dissociable incentive context and cue effects using a cued task-switching paradigm, varying the proportion of incentive trials, the incentive category, or incentive cue timing. Incentive trial proportion impacted only the incentive cue effect, and motivational category impacted only the incentive context effect. Furthermore, the incentive context effect decayed away slowly after incentive blocks, whereas the incentive cue decayed quickly. Finally, when the incentive cue was most useful (long preparation time), the incentive cue effect was high; conversely, the incentive context effect was highest when the cue was least useful (no preparation time). These results help elucidate the mechanisms and impact of the two dissociable motivational effects on cognitive control.

(1057)

Influence of Primary Motivational Incentives on Sequential Cognitive Control Adjustments. KIMBERLY S. CHIEW & TODD S. BRAVER, *Washington University* (sponsored by Todd S. Braver)—Cognitive control fluctuates during task performance: Slower and more accurate responses after errors and increased control after conflict (conflict adaptation effect) have been observed. Van Steenbergen et al. (2009) observed selectively reduced conflict adaptation in the flanker paradigm, following unpredicted monetary rewards but not penalties. This finding was interpreted as indicating differential roles for positive versus negative motivation in conflict-based control adjustment. The present study also examined the effect of motivational incentives on conflict adaptation and posterror adjustments in the flanker task, but using performance-contingent primary reinforcements (pleasant vs. aversive liquids). Conflict adaptation was present at baseline but was reduced under both rewards and punishments, with no effects of incentive valence. Posterror accuracy improved under reward but worsened under

punishment. The differential sensitivity of these sequential effects to incentive valence indicates dissociable influences on cognitive control and suggests potential differences related to the type of reinforcement and performance contingency of incentives.

• COGNITIVE SKILL ACQUISITION •

(1059)

Context Effects on Memory-Based Automaticity. NICOLAS J. WILKINS & KATHERINE A. RAWSON, *Kent State University* (sponsored by Katherine A. Rawson)—The key assumption of memory-based processing (MBP) theories of automaticity (Logan, 1988; Palmeri, 1997; Rickard, 1997) is that improvements in response speed with practice are due to a transfer from algorithmic processing to memory retrieval of a response. But what are the effects of list context on these gains? MBP theories are currently silent on this issue, assuming simply that retrieval speed is driven only by amount of practice. During the practice phase of two experiments, participants responded to *target-generate* versions of math equations embedded in a list context that contained either a majority or a minority of filler *read* items. During transfer, the target-generate items remained the same but were now embedded in a list of all generate items. List context affected speedups for target-generate items during practice and loss of speed during transfer. Memory-based theories of automaticity will require revision to account for these context effects.

(1060)

The Phonological Sensitivity Hypothesis Reexamined? A Longitudinal Analysis. WEI PING SZE & SUSAN J. RICKARD LIOW, *National University of Singapore*, & STEPHANIE H.-M. YEONG, *University of Western Australia*—Verbal short-term memory (STM) stores phonological information during rehearsal and supports children's learning of new words while more permanent memory representations are created (Baddeley, Gathercole, & Papagno, 1998). Using a longitudinal design, we tracked the development of verbal STM, operationalized as nonword recall, by following 93 bilingual preschoolers (5–6 years of age) across three 6-month intervals. The results of multilevel modeling revealed that verbal STM increased steadily, but individual growth patterns were varied: Random-effects analysis showed that the changes in English vocabulary and syllable segmentation from T1 to T3 can explain the variation in STM growth in terms of developmental slopes, as well as the observed intercept differences, whereas fixed-effects analysis showed that syllable segmentation moderated the relationship between vocabulary and nonword recall at Time 3. These observed STM growth trajectories lend support to Gathercole's (2006) phonological sensitivity hypothesis regarding the relationship between emergent cognitive–linguistic abilities and temporary memory capacity.

(1061)

Using Rate of Performance Improvement to Quantify and Compare Amount of Practice Within and Across Experiments. BRIAN D. GANE & RICHARD CATRAMBONE, *Georgia Institute of Technology* (sponsored by Richard Catrambone)—Amount of practice completed during learning sessions influences retention and transfer. Unfortunately, there is no standard metric for comparing amount of practice across studies, tasks, and experimental manipulations. For instance, what number of trials corresponds to a "low" amount of practice? Is it the same for easy and difficult tasks? Using a criterion measure of performance is a possible approach, unless a second independent variable prevents the two conditions from reaching the same performance level. For instance, blocked and random practice schedules often produce different learning curves that do not reach equivalent performance levels. We propose a different solution using rate of performance improvement as a quantifiable measure of "amount of practice." We provide experimental data from a practice schedule study in which we fit learning curves, calculate the rate of performance improvement, and use this rate to operationally define levels of the amount-of-practice variable for subsequent studies.

(1062)

Working Memory Training in Typically Developing Children: Interindividual Differences and Transfer. MARTIN BUSCHKUEHL, SUSANNE M. JAEGGI, JOHN JONIDES, & PRITI SHAH, *University of Michigan*—We trained typically developing children on a motivating working memory (WM) game for 4 weeks. Before and after training, the children were tested on different transfer tasks. We compared improvements on the transfer tasks with improvements of a control group who practiced a general knowledge and vocabulary game for the same duration as the experimental group. Our results show that WM training is more effective than the control training on nontrained measures of WM. Furthermore, we found transfer to an attention task that is a common marker for ADHD, the continuous performance task. Finally, we found evidence that interindividual differences moderate the effects of training and transfer: Although WM training was more effective on matrix reasoning than the control training, this effect was driven mainly by the children who showed the most improvement in the training. Ongoing follow-up assessments will establish whether and how long the transfer effects last.

• AUTOMATIC PROCESSING •

(1063)

Testing the Pathway Control Hypothesis by Priming the Global/ Local Processing in English Word Naming. CHI-SHING TSE, *Chinese University of Hong Kong*, & DAVID A. BALOTA, *Washington University* (sponsored by Janet Duchek)—In a primed word-naming paradigm, participants first made local or global judgments to a series of Navon-type letter stimuli and then read aloud an English word that varied in spelling-to-sound regularity and printed word frequency. The processing of Navon stimuli primed the participants to attend to the global or local features, which, in turn, modulated their reliance on lexical or sublexical pathways. Specifically, the theoretically important frequency × regularity interaction occurred only when participants were primed to attend to local features, but not when they were primed to attend to global features. The results are discussed in light of recent arguments regarding attentional pathway control of lexical and sublexical processing.

(1064)

Are Looming and Receding Objects Processed in a Stimulus-Driven Capacity-Free Manner? TODD A. KAHAN, SEAN M. COLLIGAN, & JOHN N. WIEDMAN, *Bates College*—The task-choice procedure can be used to assess whether stimuli are processed immediately upon stimulus presentation and in parallel with other cognitive operations. In this procedure, participants respond to stimuli in one of two ways, and the cue informing participants which task to perform appears either before or simultaneously with the target, which is either visually degraded or clear. Of importance is whether the effect of stimulus clarity (i.e., faster responses to clear than to degraded targets) will disappear when the cue is presented simultaneously with the target, suggesting capacity-free processing, or whether the effect of stimulus clarity will remain unchanged, suggesting that target processing is delayed until after the task cue is deciphered. The present experiment used this procedure to examine whether looming and receding objects are processed in a stimulus-driven capacity-free manner. The results indicate that processing occurs in this manner only when objects are perceived to be moving in depth.

(1065)

Can Task Demands Override Connectedness? CHRISTOPHER KOCH & BREANNA BARR, *George Fox University*—Stroop (1935) presented integrated color–word pairs (e.g., RED in blue print). Subsequent researchers have used nonintegrated color–word pairs (e.g., RED in black print with a blue bar next to the word). Kahneman and Chajczyk (1983) showed that the distance between the two components influences the amount of interference obtained, suggesting that spatial contiguity is important for interference. If spatial contiguity is reframed as proximity, can other Gestalt grouping principles influence Stroop interference? A color-block version of the Stroop task was used in which participants were required to identify the color of a selected block within a pair. Pairs were shown under continuous-viewing conditions. The results indicate that the demands associated with the task can lead participants to utilize a strategy that overrides connectedness, thereby eliminating any interference produced by the task. However, when asked to describe the stimuli, participants offered descriptions consistent with the grouping principle of connectedness.

(1066)

Fearful Faces Elicit Great Repetition Priming Independently of Attention Load at Encoding. ALEJANDRO I. DE LA VEGA & MARIE T. BANICH, *University of Colorado, Boulder*—Evidence that emotional information is processed automatically is in conflict with evidence that its processing can be modulated by attentional load. In this study, we used repetition priming (RP) as a measure of processing of unattended emotional stimuli. Participants were presented with task-irrelevant emotional faces while performing a perceptual discrimination task that varied in difficulty and, hence, attentional load. Task difficulty, but not emotional valence of the distractor, modulated response time (RT) on the perceptual discrimination task. In the RP task, in which individuals made a gender decision about faces, the RT to previously viewed faces, as compared with new faces, was greater for fearful than for neutral faces. These findings support the view that processing of emotional information is prioritized. Moreover, the study suggests that RP is a useful index of information processing, beyond RT on a primary task.

(1067)

Contextual Determinants of the Social-Transfer-of-Learning Effect. NADIA MILANESE & CRISTINA IANI, *University of Modena and Reggio Emilia*, NATALIE SEBANZ, *Radboud University*, & SANDRO RUBICHI, *University of Modena and Reggio Emilia* (sponsored by Natalie Sebanz)—Transfer of learning in a spatial compatibility task consists in the modulation of the Simon effect when it is performed after a spatial compatibility task with incompatible mapping (SCI). A recent work showed that performing an SCI alongside a coactor (practice task) eliminates the Simon effect in a subsequent joint Simon task (transfer task). This work focused on the contextual determinants of the "social-transfer-of-learning" effect. In particular, we asked which elements of the learning context (practice task) need to be maintained for the social transfer of learning to occur. The results indicate that some elements of the joint learning context, such as the presence of a coactor during the practice task (Experiment 2) and the maintenance of the same position in both tasks (Experiment 3), are necessary for the social transfer of learning to occur, whereas coactor identity (Experiment 1) is not crucial.

(1068)

The Relation Between Magnitude and Temporal Order in Automatic and Intentional Processing. SHACHAR BEN-MEIR, *Ben-Gurion University of the Negev*, DANA GANOR-STERN, *Achva Academic College*, & JOSEPH TZELGOV, *Ben-Gurion University of the Negev* (sponsored by Joseph Tzelgov)—The automaticity of numerical and physical processing was investigated in a sequential presentation using the size congruency effect (SiCE). Number pairs were presented sequentially, and participants had to select either the numerically larger or the physically larger number. We found an SiCE in both tasks, indicating automatic processing of both numerical and physical magnitudes under condition of sequential presentation. Automatic processing of numerical size was modulated by the temporal order of numerical size, since it was present only in pairs in ascending, and not in descending, temporal order of numerical size. Automatic processing of physical size was present in pairs in both ascending and descending orders. The present results are discussed in the context of the association between number and time and in the context of the difference between the continuous nature of physical size and the discrete nature of numerical size.

• IMPLICIT MEMORY •

(1069)

Valence and Arousal Effects of Rewards on Implicit Contextual Learning. YUAN-CHI TSENG, *Smith-Kettlewell Eye Research Institute*, & ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign*—Learned spatial contexts facilitate search tasks by guiding attention toward the target location (contextual cuing). This learning effect is implicit and impenetrable to conscious manipulations. Here, we tested whether rewards associated with such contexts can impact the degree of guidance, as well as the speed at which a context is learned. In Experiment 1, we showed that contextual learning was boosted when contexts were associated with rewards (positive or negative), as compared with a no-reward condition. Reward-associated contexts were learned more quickly and had stronger cuing effects on search than did penalty-associated contexts. In Experiment 2, we examined the effect of reward uncertainty and showed stronger learning with fixed rewards than with variable rewards (of equal expected value). Finally, we found that variable-reward contexts, when episodically associated with penalty feedback, produced much stronger cuing effects on their next occurrence, suggesting that contextual learning is greatly sensitive to both feedback-related arousal and valence.

(1070)

Holographic Stimulus Representation and Judgment of Grammaticality in an Exemplar Model. RANDALL K. JAMIESON, *University of Manitoba*, & DOUGLAS J. K. MEWHORT, *Queen's University*—Jamieson and Mewhort (2009, 2010) demonstrated that the Minerva 2 model of retrieval (Hintzman, 1986) anticipates peoples' judgments in artificial grammar learning. However, Kinder (2010) showed that Minerva 2 did not capture peoples' judgments in three selected examples of artificial grammar learning. The failure reflects a problem of stimulus alignment. We resolve the problem by importing holographic encoding to the Minerva 2 model. Holographic encoding allows the model to simulate judgment in Kinder's examples and in other experiments. We reinforce our position that judgment of grammaticality is a retrospective inference reflecting a similarity-based comparison of test strings with the training set.

(1071)

Working Memory and Offline Memory Processes. NEIL B. ALBERT & SIAN L. BEILOCK, *University of Chicago*, & KIMBERLY M. FENN, *Michigan State University*—Working memory capacity (WMC) has been shown to facilitate motor learning, but the specific role that WMC plays in skill development and consolidation remains unclear. In the present experiment, participants completed a serial reaction time task that included both a cued and an uncued sequence. After a 24-h retention interval, participants returned and were tested on their ability to perform both sequences, and WMC was assessed. For the uncued sequence, WMC was positively correlated with improvement during training but was negatively correlated with performance change across the retention interval. Higher WMC participants improved the most during training but did not show further improvement when retested the next day. Lower WMC participants showed less improvement during training but improved following an offline period. These results are consistent with the notion that online and offline systems differentially support the development of skills on the basis of an individual's WMC.

(1072)

Differentiating Implicit and Explicit Processes in the Serial Reaction Time Task. JARED A. LINCK, SCOTT R. JACKSON, & JOEL T. KOETH, *University of Maryland Center for Advanced Study of Language*, & BENJAMIN K. SMITH, *University of Maryland*—The serial reaction time (RT) task has been used extensively to measure sequence learning specifically, but also general processes fundamental to cognition more broadly (e.g., Hunt & Aslin, 2010; Keele et al., 2003). Yet since its introduction over 20 years ago, researchers have continued to use minor variations of the original score: the difference between final sequential block RTs and the subsequent random block RTs. We argue on conceptual and empirical grounds that the traditional scoring method confounds two separate processes: implicit sequence learning and strategic response preparation based on explicit sequence learning. We propose two novel scoring approaches to better disentangle these processes. The results from one large-scale study ($N = 2,286$) and one test–retest design study ($N = 142$) suggest that the new scoring methods are more reliable, improve construct measurement, and may explain seemingly discrepant results from previous studies. Implications for accounts of sequence learning are discussed.

(1073)

Head Orientation Affects Visual Statistical Learning. ELIZABETH R. MARSH, *Arizona State University*, & ARTHUR M. GLENBERG, *Arizona State University and University of Wisconsin* (sponsored

by Arthur M. Glenberg)—Statistical learning (SL) allows discrimination between rule-based and non-rule-based sequences of stimuli. Whereas many theories treat SL as an abstract, domain-general phenomenon, we propose an embodied account based on neuromuscular tuning (NMT). For example, when tracking sequences of spatially defined stimuli, the ocular–motor system is tuned to make transitions between spatial locations that comprise the sequence. This tuning, or ease of tracking, identifies rule-based sequences. To test NMT, participants tracked sequences that were simultaneously composed of spatially defined visual stimuli and auditory tones. In the learning phase, participants faced the computer screen directly or at an angle. Then, when they discriminated between rule-based and non-rule-based sequences, this orientation was either maintained or switched. Changing the angle of regard changes the ocular–motor transitions used in tracking and, hence, should disrupt discrimination. As predicted by NMT, this disruption occurred when the participants were tested on the visual sequences and not when tested on the auditory sequences.

(1074)

A Long-Term Effect of Subliminally Presented Words. AN-DREAS T. BREUER & MICHAEL E. J. MASSON, *University of Victoria*, & GLEN E. BODNER, *University of Calgary* (sponsored by Michael E. J. Masson)—Few studies have examined whether subliminal priming effects are long-lasting, even though memory-based accounts of priming allow this possibility, whereas many activation-based accounts of priming do not. Using the lexical decision task, we investigated whether subliminal words become associated, in a lasting way, with a semantic response category or with a required motor response. In a training phase, each masked word prime (33-msec SOA) was paired with either eight word targets or eight nonword targets. In a test phase, word-paired and nonword-paired primes appeared as visible targets. On early (but not late) test trials, lexical decisions were faster for word-trained targets than for nonword-trained targets. When we reversed the response mappings at test, the reverse pattern occurred. Our results suggest that an association was formed between each subliminal prime and a required motor response, consistent with memory-based accounts of priming.

• WORKING MEMORY •

(1075)

Distinctive Encoding, Cue Congruence, and Collaborative Memory. MATTHEW R. KELLEY, *Lake Forest College*, MATTHEW B. REY-SEN, *University of Mississippi*, & GILLIAN A. KNIGHT & MARIO J. BALDASSARI, *Lake Forest College*—The present project was designed to test two competing theories of collaborative inhibition (CI)—reduction in group recall performance as compared with the combined output of several individuals working alone. The strategy disruption (SD) hypothesis (Basden & Basden, 1995) is the standard explanation of CI but has trouble accounting for some extant data. In contrast, Andersson, Helstrup, and Ronnberg (2007) offered the retrieval cue distinctiveness (RCD) hypothesis—an extension of the SD hypothesis with greater emphasis on distinctive encoding processes—which, they argued, provides a complete explanation of the previously unexplained findings. Experiment 1 directly manipulated distinctive encoding (bizarre vs. common sentences) and retrieval cue congruence (shared vs. unshared) with a collaborative memory procedure. The SD hypothesis predicts that CI will be influenced only by cue congruence and not by distinctive encoding, whereas the RCD hypothesis predicts that distinctiveness will interact with cue congruence (e.g., distinctive, shared cues should eliminate CI).

(1076)

The Item/Order Trade-Off Explanation for the Lexicality Effect. GEORGINA A. TOLAN, *Australian Catholic University*, GERALD TEHAN, *University of Southern Queensland*, & MICHELLE BARRATT-CONRAD-CZAJA, *Australian Catholic University* (sponsored by Gerald Tehan)—The item/order trade-off explanation given by Tehan and Tolan (2007) for the word length effect was extended to the lexicality effect under forward and backward immediate serial recall (20

participants) and recognition (20 participants) conditions. A remember/know task was also completed for the recognition items. In this task, participants were required to indicate whether they consciously remembered seeing the item (remember) or had a familiar feeling of seeing the item (know). In line with the item/order trade-off explanations, real words and nonwords showed dissociative effects. Real words were recalled better than nonwords for both forward and backward recall. However, nonwords were recognized better than real words. Furthermore, more nonwords were identified as "remembered," as compared with real words, which were more frequently identified as "know." The present set of experiments demonstrates that the item/order trade-off explanation does extend to other short-term memory phenomena.

(1077)

Limited to One Item or More Than One Item: Capacity Limits in the Focus of Attention. AMANDA L. GILCHRIST & NELSON COWAN, *University of Missouri* (sponsored by Nelson Cowan)—Within the working memory system, the focus of attention has been proposed to hold a limited number of items in conscious awareness. We propose that the focus of attention is able to hold up to four separate items at once; a contesting view suggests that the focus of attention holds a single item at a time. Recent research by Oberauer and Bialkova (2009) extended the latter view by showing that two items could be maintained in the focus of attention, provided that they were bound into a single chunk. Due to the nature of the task, however, we believe that this paradigm strongly encouraged chunking. We were interested in whether similar results would occur when chunking was discouraged. Using a modified paradigm where two types of associations (shape–letter, color–digit) were simultaneously relevant, we found evidence for a focus of attention that can accommodate two separate items at the same time.

(1078)

Benefits of Spatially Distributed Rather Than Stacked Information Displays. JOOYOUNG JANG & CHRISTIAN D. SCHUNN, *University of Pittsburgh, Learning Research and Development Center* (sponsored by Christian D. Schunn)—Spatial organization of information can impact how information is processed in both problem-solving and learning contexts. For tasks that involve integrating information, displays that integrate content have been argued to be better than displays that separate content (Sweller, van Merrienboer, & Paas, 1998; Wickens & Carswell, 1995). But integrated displays are not always possible. Taking into account practical and theoretical considerations, we extend the framework to include the distinction between spatially distributed and spatially stacked displays. We present lab and classroom results from a series of studies showing that problem solvers and learners adopt a memorization strategy with stacked displays (relative to distributed displays) that produces higher cognitive load and longer eye fixation durations, which can have very large effects on learning and problem-solving time.

(1079)

The Transferability and Persistence of Working Memory Training Over Time. SHARONA ATKINS, MICHAEL R. DOUGHERTY, J. ISAIAH HARBISON, JARED M. NOVICK, ALEXEI SMALIY, JEF-FREY S. CHRABASZCZ, & MICHAEL F. BUNTING, *University of Maryland*—Performing adaptive and challenging working memory (WM) tasks can improve performance not only on WM assessments, but also on tasks that are particularly dependent on WM. We examined the impact of WM executive-function training on (1) general cognitive abilities, including verbal and spatial WM and inhibition, and (2) first-language (L1) and second-language (L2) verbal intelligence and comprehension. English L1 speakers ($n = 26$) and English L2 speakers ($n = 23$) trained on a battery of eight WM tasks for 20 h over 5 weeks. Data yielded main effects of training regardless of language; we observed process-specific transfer to untrained cognitive tasks (e.g., operation span, symmetry span) that rely on the same processes as the trained task. Training generalized to verbal intelligence and verbal comprehension, too. These transfer effects appear to be language indeterminate, implying that the cognitive training is able to influence and improve core cognitive processes.

(1080)

The Discovery of Response Strategies Challenges the Memory-As-Discrimination Hypothesis. KIKI KOUTMERIDOU, JAMES FOWLER, & MARIE POIRIER *City University London* (sponsored by James A. Hampton)—The memory-as-discrimination hypothesis stresses the importance of the discriminative power of retrieval cues (Nairne, 2005) and suggests that the encoding–retrieval match principle is inappropriate. To test this, we used a cued recall task where nonword targets were associated with three shape cues. We manipulated how discriminative each cue was; each one was either uniquely associated with a target or predictive of two targets. Detailed analyses of the results revealed an unexpected response strategy. Participants always associated the shared cue with only one of the possible two targets, and performance was affected accordingly. Because Nairne's hypothesis was based on similar tasks, this might be a confounding variable. Experiment 2 eliminated the response strategy and supported the memory-as-discrimination view. The important factor is not the match but the discriminative value of the cue complex.

(1081)

Bilingualism and Interference Control in Working Memory: The Role of English Proficiency. LIN LUO, *York University*, SYLVAIN MORENO, *York University and Rotman Research Institute*, & ELLEN BIALYSTOK, *York University*—It is unclear whether the well-established bilingual advantage in executive control extends to working memory (WM). We used a variation of the Sternberg paradigm (Jonides & Nee, 2006) to examine the effects of bilingualism on proactive interference (PI) in WM. Twenty-three monolinguals and 40 bilinguals (age, 18–30 years) performed two PI tasks: a verbal task using letters and a nonverbal task using stick figures as memory items. The bilinguals showed significantly less interference than did monolinguals on the nonverbal task but greater interference on the verbal task. For bilinguals, both interference costs correlated with a measure of English vocabulary: Bilinguals with higher vocabulary showed more interference on the verbal task but were more resistant to interference on the nonverbal task. These results suggest that (1) bilingualism has dissociable effects on verbal and nonverbal WM processes, and (2) this dissociable effect is mediated by level of English proficiency (i.e., degree of bilingualism).

• EXPLICIT MEMORY •

(1082)

A Virtual Reality Investigation of Familiarity and Déjà Vu. ANTHONY J. RYALS, *Colorado State University*, BENJAMIN D. SAWYER, *University of Central Florida*, JASON S. NOMI & ANNE M. CLEARY, *Colorado State University*, & ALAN S. BROWN, *Southern Methodist University* (sponsored by Alan S. Brown)—According to the Gestalt familiarity hypothesis, déjà vu results when the configuration of a scene's elements maps onto one in memory, as when a never-before-seen room is similar in its arrangement of furniture pieces to a previously seen room. We examined this hypothesis using virtual reality. Participants were immersed in 3-D scenes through a head-mounted display, turning their heads to look around each scene. Among test scenes, half mapped onto studied scenes in their configuration of elements; half did not. A grid allowed precise mapping of the configuration of new elements from study to test. Participants rated each scene's familiarity, attempted to recall an earlier scene that resembled it, and indicated the presence or absence of a déjà vu state. In the absence of recall, configurations that mapped onto earlier-presented scenes produced higher familiarity ratings and a higher probability of reported déjà vu states than did configurations that did not.

(1083)

An Investigation Into the Interaction Between Attention and Memory. KIMBERLEY A. McFARLANE & MICHAEL S. HUMPHREYS, *University of Queensland* (sponsored by Michael S. Humphreys)—Using the maintenance rehearsal paradigm, in which pairs of words are rehearsed as distractor material during a series of digit recall trials, we have previously found that low-frequency and novel word pairs appear to initiate an attentional process that both impacts delayed recognition of the pairs and interferes with immediate digit recall (Humphreys et al., 2010). The present research extended this work and showed that switching between two novel pairs in a single-digit recall trial initiates a similar process in which increased attention is paid to the second presented pair, thus resulting in poorer delayed recognition for the first pair. In addition, it showed that this process appears to be subject to some degree of top-down control. These findings enhance our understanding of the role that both attention and interference play in long-term memory.

(1084)

Does Aging Affect Prospective Memory? The Importance of Cue Focalilty. HILLARY G. MULLET & GILLES O. EINSTEIN, *Furman University*—Whereas most laboratory studies have shown that older adults perform less well than younger adults on prospective memory tasks, others have reported no age differences. The multiprocess theory of prospective memory retrieval (McDaniel & Einstein, 2000) provides a potential explanation for these discrepancies, with the prediction that older adults should perform less well on nonfocal tasks that require the use of strategic monitoring processes, but not on focal tasks for which spontaneous retrieval processes can be used. In this experiment, younger and older adults performed focal and nonfocal prospective memory tasks, and some older adults received speed-emphasis instructions. As predicted by the multiprocess theory, we found age differences for nonfocal, but not focal, tasks. Older adults who received speed-emphasis instructions performed the ongoing task more quickly, without detriment to either ongoing task accuracy or prospective memory (focal or nonfocal) performance.

(1085)

Multiple-Choice Tests Can Both Improve and Impair Recall of Nontested Related Information. GENNA M. ANGELLO, *Texas A&M University*, & JERI L. LITTLE, ELIZABETH LIGON BJORK, & ROBERT A. BJORK, *UCLA* (sponsored by Elizabeth Ligon Bjork)—Testing can impair the retention of related nontested information, provided that such information competes during retrieval—an effect called *retrieval-induced forgetting* (RIF; Anderson, Bjork, & Bjork, 1994). It is unclear, however, whether multiple-choice tests invoke retrieval processes that will lead to similar impairment of nontested competitive information and, if so, whether presenting those competitors within the test (as incorrect alternatives) will protect them from RIF. The present experiment employed a variation of the RIF paradigm: The study of category–exemplar word pairs was followed by category-cued multiple-choice questions, instead of category-cued recall questions, during initial testing. Competitors not appearing in the multiple-choice test were impaired, whereas competitors that appeared in the test as incorrect alternatives were facilitated, when compared with exemplars from control categories that were not tested. These results suggest that multiple-choice tests can trigger retrieval processes that, in turn, can create or prevent RIF.

(1086)

Single-Neuron Responses in Continuous Recognition Memory for Printed Words. PETER N. STEINMETZ, *Barrow Neurological Institute*, STEPHEN D. GOLDINGER & MEGAN H. PAPESH, *Arizona State University*, & DAVID TREIMAN, *Barrow Neurological Institute* (sponsored by Stephen D. Goldinger)—We investigated continuous recognition memory for printed words in a group of 10 epilepsy patients with microwire electrodes implanted in the anterior cingulate cortex. All words were presented twice per session, with lags up to 32 intervening words. When repeated, words were shown in either their original font or an alternate font. Each word was shown for 1,000 msec, and subjects indicated whether they had seen it previously during the experimental session. In the behavioral data, we observed increasing errors with increasing lag and changes of font. In the neural data, recordings were obtained from 112 well-isolated neurons and from 154 clusters of multi-unit activity. When words were presented in a second experiment (for the third and fourth times overall), neural activity reliably changed, as more clusters changed firing rates. Anterior cingulate neurons encode memory for printed words; the strength of encoding is increased by repeated presentation of these words.

(1087)

Item Repetition Within (But Not Across) Pair Type Helps and Harms Cued Recall. WILLIAM R. AUE, AMY H. CRISS, & NICHOLAS W. FISCHETTI, *Syracuse University* (sponsored by Amy H. Criss)—The representation of item and associative information in memory was investigated in four experiments. Participants studied two lists constructed such that items presented in a pair during List 1 were rearranged to create new pairs in List 2. Critically, Lists 1 and 2 could contain the same or different types of pair. Participants were tested on the most recent list. When the test required associative information (i.e., cued recall), repeating items in the same pair type across lists led to a greater number of correct and incorrect responses in a cued recall task. When items were presented in different pair types across lists, the effect was eliminated. When the test did not require associative information (i.e., single-item recognition), there was no difference between same/different pair type conditions. These data suggest that information specific to the pair type (i.e., associative information) is stored and utilized strategically during memory search.

(1088)

The Blocking and Unblocking of Memory. REBECCA H. KOPPEL, BENJAMIN C. STORM, & STEVE REILLY, *University of Illinois, Chicago* (sponsored by Steve Reilly)—Exposure to a word that is orthographically or lexically similar to a target word can make it difficult to retrieve that target word. For example, exposure to ANALOGY can block the retrieval of ALLERGY, given the cue A_L_ _GY (Smith & Tindell, 1997). In this example, ANALOGY serves as a negative prime for the word ALLERGY. In the present experiment, we examined how this memory-blocking effect is affected by directed forgetting. Participants learned two lists of words, each consisting of several negative primes. Participants who were told to forget the first list before learning the second list were affected significantly less by the negative primes in the first list than by those in the second list. This was not true of participants who were told to remember the first list. These results suggest that directed forgetting can modify a word's susceptibility to the memory-blocking effect.

(1089)

Repeated and Serial Reproduction of Personality Traits: Valence and Processing Goal Effects. LUDMILA D. NUNES, *University of Lisbon and Washington University*, HENRY L. ROEDIGER, III, *Washington University*, & LEONEL GARCIA-MARQUES, *University of Lisbon* (sponsored by Leonel Garcia-Marques)—Following Bartlett (1932), we directly compared repeated reproduction and serial reproduction of a list of personality traits while varying the valence of the traits (positive or negative) and the orienting instructions (remembering the items or forming an impression of a person). Subjects either saw trait adjectives and then recalled them several times in a row (repeated reproduction) or studied items from prior subjects' recall protocols and attempted to recall them (serial reproduction). We replicated prior findings showing that serial reproduction produces great forgetting over trials. However, unlike Bartlett (1932), we found low levels of false recall of related traits that were omitted from the study list under most conditions. The most false recall occurred for positive personality traits under impression formation instructions, which may indicate that false remembering of personality attributes is most likely when positive impressions of people are formed.

(1090)

Is Free Recall More Accurate than Cued Recall? Impaired Recognition Caused by Item-Specific Cues. JASON D. OZUBKO & COLIN M. MACLEOD, *University of Waterloo* (sponsored by Colin M. MacLeod)—Traditional recall paradigms ordinarily show cued recall to be superior to free recall. In these paradigms, researchers must categorize subjects' responses as old (correct) or new (intrusion). In a novel paradigm—the status-uninformative forced-response procedure—subjects are required to generate both studied and novel items at test and, subsequently, must categorize their responses as "old" or "new." Using this paradigm, we find that although more studied items are generated in cued than in free recall, recognition accuracy is impaired in cued recall, resulting in more intrusions and no increase in correct recall (Experiment 1). Telling

subjects whether cues correspond to old or new items does not improve recognition accuracy (Experiment 2) nor does reducing the impact of fluency due to cues (Experiment 3). We conclude that cuing is not a cost-free memory aid: Cuing makes targets more accessible but, paradoxically, also more difficult to recognize.

(1091)

Test-Induced Priming Impairs Source-Monitoring Accuracy in the DRM Procedure. STEPHEN A. DEWHURST, LAUREN M. KNOTT, & MARK L. HOWE, *Lancaster University*—Two experiments investigated the effects of test-induced priming (TIP) on false recognition in the Deese/Roediger–McDermott procedure. Experiment 1 showed that false recognition was increased when critical lures were primed by six studied items from the same list, but this effect was eliminated when participants were instructed to make remember/know judgments or were given diagnostic information to help them avoid false recognition. Experiment 2 showed that false recognition was increased when critical lures were preceded by 10 studied items, but not when they were preceded by 5 studied and 5 unstudied items from the same list. These findings suggest that TIP increases false recognition by disrupting source-monitoring processes, rather than by the activation of associates at test.

(1092)

Selective Interference in Past and Future Episodic Thinking. RACHEL J. ANDERSON, *Leeds Metropolitan University*, & STEPHEN A. DEWHURST & ROBERT A. NASH, *Lancaster University*—The constructive episodic simulation hypothesis (e.g., Schacter, Addis, & Buckner, 2008) argues for shared neural and cognitive processes underlying remembering the past and imagining the future. Although research has uncovered similar neural processes within healthy individuals, cognitive explorations generally focus on individuals experiencing memory difficulties. The present study investigated the cognitive processes underlying episodic retrieval/simulation in healthy individuals. It explored the impact of cognitive load, using concurrent tasks, on speed and accuracy of episodic event retrieval/simulation. All participants retrieved past and simulated future episodes in response to concrete and abstract cue words; participants were randomly allocated to a secondary task condition (no secondary task, dynamic visual noise, irrelevant speech, or random number generation). The results suggest that the impact of cognitive load on past and future thinking varies dependent on both secondary task and cue type. The results are discussed in the context of the proposed constructive system underlying past and future episodic thought.

(1093)

Comparison of Memory Performances Among Healthy Young and Old Adults and TBI/Stroke Patients. HYUN CHOI, KUEM-JU LEE, & JAE-YUN KIM, *National Rehabilitation Center Research Institute, South Korea* (sponsored by Takashi Yamauchi)—A series of memory tests, including immediate recall, delay recall, cued recall, and recognition, were administered to healthy young and old adults and TBI/stroke patients with no or mild cognitive impairments (MMSE score greater than 25/30) to compare memory performances of the three groups. At the encoding phase, subjects were asked to memorize lists of words (three 10-word lists; i.e., 30 words) presented visually on a computer screen and also auditorily through a computer speaker, one at a time. Right after studying each list of 10 words, they performed free- and cued-recall tests in which their short-term memory was evaluated. In order to evaluate their long-term memory, the subjects performed several nonverbal computerized tasks for 15 min and then received another free-recall test and a recognition test for all the words they had studied in the encoding phase. Finally, their working memory was evaluated using the forward and backward digit span tests. The study showed overall memory deficits in older adults and TBI/stroke patients, as compared with young adults, but the patterns of the deficits were distinctive between the two memory deficit groups. Memory impairments in older adults seemed due to a lack of encoding rather than retrieval, whereas TBI/stroke patients showed more retrieval difficulties, and the lack of encoding capacity of the older adults seemed to stem from age-related reduction of mental-processing resources. However, years of education and attention did not significantly affect their memory performances.

(1094)

Release From Proactive Interference in Long-Term Memory: The Role of Retrieval. BRIDGID FINN & KATHLEEN B. McDERMOTT, *Washington University*, & NATE KORNELL, *Williams College*—Although extended study sessions of similar materials can lead to a buildup of proactive interference (PI), interpolating retrieval tests during the acquisition phase shields the learner from PI (Szpunar et al., 2008). In two experiments, we investigated the relation between the number of tests taken and the degree of resistance to and recovery from PI. Participants studied five lists (Experiment 1) or nine lists (Experiment 2); free recall tests followed some lists but not others. Participants were instructed that which lists were tested was determined randomly and always to study in preparation for a test. As the number of prior untested lists increased, PI also increased. However, once a list had been tested, performance on subsequent lists quickly returned to levels similar to those for participants tested after each list. Regardless of the number of previously untested lists, taking two tests allowed complete recovery from PI.

(1095)

Do Backward Associations Cause False Recall? ERIC ZEMBER, CHARLES J. BRAINERD, & VALERIE F. REYNA, *Cornell University* (sponsored by Charles J. Brainerd)—We conducted rigorous tests of Deese's (1959) influential hypothesis that when subjects recall lists of related words, outputting list words stimulates intrusions of strong backward associates of those words (e.g., outputting words such as "mad," "rage," or "fury" causes the unstudied word "anger" to be recalled, with some probability). To generate convergent evidence for this hypothesis, we evaluated four predictions that follow from it: (1) Intrusion probability should increase as recall of list words increases; (2) intrusion probability should increase as the total backward associative strength (BAS) of recalled list words increases; (3) the mean BAS of list words recalled just before an intrusion should be higher than the mean BAS of words recalled just after; and (4) evidence for the first three predictions should be more robust under conditions that permit intrusions. There was no support for any of these predictions in recall protocols for Deese/Roediger–McDermott lists.

(1096)

Individuals' Ratings of Semantic Relatedness Predict False Memories. SUSAN M. STEVENS & KARIN M. BUTLER, *University of New Mexico* (sponsored by Carrick C. Williams)—Variation in the semantic relatedness of associated words, measured at the individual level, was compared with the likelihood of false remembering in controlled experiments. Each individual rated the semantic relatedness ratings of words pairs drawn from associated sets. In a later study–test procedure, ratings for unstudied–studied word pairs were higher for falsely recognized words than for correctly rejected words, despite variation in falsely recognized and correctly rejected words across participants. In a separate study, during the study–test procedure, the theme words were preceded by words deemed either strongly related or weakly related to the theme word during initial rating. Critically, the strongly related words were chosen from lower associates to the theme, according to group norms, than were the weakly related words. The recognition test containing strongly related studied words was predicted to yield higher levels of false recognition than would the test consisting of less related studied words.

(1097)

Sentence Complexity Predicts False Assents to Previously Fabricated Entire Fictitious Events. QUIN M. CHROBAK, *University of Wisconsin, Oshkosh*, & MARIA S. ZARAGOZA, *Kent State University* (sponsored by David C. Riccio)—In an attempt to manipulate the testimony of witnesses, lawyers will frequently use complex question forms (i.e., "lawyerese") when they cross-examine witnesses in the courtroom. Studies have shown that lawyerese confuses children and compromises their testimony (e.g., Perry et al., 1995). In the present study, we assessed whether the complexity of the question form (i.e., whether it was a compound or a simple sentence) would affect the testimonial accuracy of college-aged participants who had witnessed an event and were subsequently exposed to suggestive interviews involving forced fabrication. Specifically, participants were forced to fabricate two entire fictitious events that were not witnessed in the video. The results on a subsequent recognition test indicated that despite the presence of a pretest warning, participants falsely assented to their forced fabrications at a high rate—but only when they were part of a compound sentence.

(1098)

Imaginal Preinstatement of Test Context During Study Improves Recall. MATTHEW J. HAYS, *University of Southern California*, & STEVEN M. SMITH, *Texas A&M University* (sponsored by Steven M. Smith)—During a recall test, imagining the environmental context in which information was learned can assist retrieval, a phenomenon known as "imaginal reinstatement" (e.g., Smith, 1979). In the present study, this procedure was inverted; participants imagined the test context while studying. This "imaginal preinstatement" condition was compared with two other conditions. In one, the participants studied and were tested in the same context. In another, contexts were mismatched. On the final test, participants recalled words best when there was a physical context match, less well when they used imaginal preinstatment, and worst when contexts mismatched.

(1099)

Why Does Life Appear to Speed Up As People Get Older? STEVE M. J. JANSSEN & MAKIKO NAKA, *Hokkaido University*, & WILLIAM J. FRIEDMAN, *Oberlin College* (sponsored by Makiko Naka)—In this study, the influence of retrospective recall of time pressure on the subjective speed of time was examined. Participants first indicated how fast the previous week, month, year, and 10 years had passed (Friedman & Janssen, 2010; Witthoff & Lehnmann, 2005). They were then asked how much time pressure they experienced nowadays and how much time pressure they had experienced 10 years ago. Participants, on average, underestimated how busy they had been 10 years ago when their results about past time pressure were compared with the results of participants who were 10 years younger about current time pressure. Furthermore, participants who reported that they currently experienced more time pressure than they had 10 years ago gave lower ratings for the subjective speed of time on the 10-year scale, whereas participants who reported less time pressure gave lower ratings on the shorter time scales.

(1100)

Categorical Implicit Learning in Real-World Scenes: Evidence From Contextual Cuing. ANNABELLE GOUJON, *LPC-CNRS and University of Provence* (sponsored by Françoise Vitu-Thibault)—This study examined the extent to which learning mechanisms are deployed on semantic-categorical regularities during a visual searching within real-world scenes. The contextual-cuing paradigm was used with indoor scenes in which the semantic category did or did not predict the target position on the screen. No evidence of contextual cuing was observed when participants were merely instructed to search for a specific target (Experiment 1). However, a rapid benefit occurred in the predictive condition when each display containing the target was preceded by a preview of the scene on which participants had to make a categorization decision (Experiment 2). An explicit memory task indicated that this benefit resulted from implicit learning. A rapid but unstable facilitation effect was also obtained when a mere preview of the search scene preceded visual searching (Experiment 3). This suggests that if enhancing the processing of the scene was required with the present material, such implicit semantic learning can nevertheless take place when the category is task irrelevant.

• **METAMEMORY** •

(1101)

An Own-Age Bias in Metamnemonic Accuracy for Faces. KATHLEEN L. HOURIHAN & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*, & SCOTT D. GRONLUND, *University of Oklahoma*—Metamemory judgments have the potential to illuminate aspects of encoding processes that learners believe will be relevant for retention. Here, we consider what such judgments reveal about the own-

group bias in face recognition. We examined memory and metamemory for younger and older faces in younger and older subjects to assess whether individuals are metacognitively sensitive to the intrinsic characteristics of faces that support later recognition. If the memory advantage afforded by within-class faces is owing to greater expertise in encoding characteristics that are most relevant to later within-class discrimination, metamemory should also be superior for same-age than for other-age faces. The results supported this prediction: Judgments of learning predicted recognition to a greater extent for own- than for other-age faces, in both younger and older subjects. The results are discussed in terms of the effects of aging on the representation of faces in memory and the origin of the cross-group recognition detriment.

(1102)

The Hypercorrection Effect Persists Over a Week, But High Confidence Errors Return. ANDREW C. BUTLER, *Duke University*, LISA K. FAZIO, *Carnegie Mellon University*, & ELIZABETH J. MARSH, *Duke University*—Previous research has demonstrated that errors made with high confidence are more likely to be corrected with feedback than are low-confidence errors, a finding called the *hypercorrection effect*. The present research investigated whether the hypercorrection effect persists across a delay of 1 week. Subjects answered general knowledge questions about science, rated their confidence in each response, and received correct answer feedback after every question. A final test on the same questions was given either immediately or after a 1-week delay. The hypercorrection effect occurred on both the immediate and delayed tests, but the proportion of errors corrected was much lower on the delayed test at all levels of initial test confidence. When subjects failed to correct an error on the delayed test, they sometimes reproduced the same error from the initial test. Interestingly, high-confidence errors were more likely to be reproduced on the delayed test than were low-confidence errors.

(1103)

The Influence of Rewards for Performance and the Stimulus Environment on Agenda-Based Regulation of Study. ROBERT ARIEL & JOHN DUNLOSKY, *Kent State University*—Rewards for performance and the stimulus environment can have a powerful influence on learners' study decisions. We examined whether participants' item selection would be influenced more by item reward or by the order in which items were presented for selection. In Experiment 1, participants selected items for study from three-item arrays, which were ordered, from left to right, from lowest (1 point) to highest (5 point) reward, from highest to lowest reward, or in a random order. Surprisingly, study choices were biased in a left-to-right fashion, regardless of the reward value or the time participants were given (restricted or unlimited) to study items in each array. In Experiments 2–4, we manipulated factors to induce strategic behavior. Participants' selections were more adaptive (focusing on high-reward items) when only one item could be selected per array and when the rewards for the high-reward items were large in magnitude (e.g., 50 vs. 5).

(1104)

Are the Unskilled Always Unaware? Exploring Contexts Where Even the Poorest Performers Are Well Calibrated. MARISSA K. HARTWIG & JOHN DUNLOSKY, *Kent State University* (sponsored by John Dunlosky)—Previous studies have shown that when participants make global predictions about their overall performance on a cognitive task, low performers' global judgments are often overconfident, whereas high performers are more accurate or even slightly underconfident. Furthermore, the gross overconfidence of low performers is often assumed to reflect their inability to distinguish what they do and do not know at the level of individual items. Accordingly, we directly explored the relationship between global judgment accuracy and item-by-item judgment accuracy on both an associative-learning test and a general knowledge test. Levels of item-by-item accuracy were not related to global accuracy, which suggests that previous demonstrations of overconfidence by unskilled performers may not be due to poor monitoring. As important, both low and high performers' judgments showed excellent absolute accuracy. Thus, in some cases, the unskilled are entirely aware of their level of performance.

(1105)

Size Still Matters: Emotional Valence Contributes to JOLs Without Eliminating the Encoding-Fluency Effect Caused by Font Size. GABRIEL I. COOK, *Claremont McKenna College*, PAUL S. MERRITT, *Clemson University*, KEITH B. LYLE, *University of Louisville*, & ALLYSA RUESCHENBERG, *Claremont McKenna College*—Rhodes and Castel (2008) demonstrated that judgments of learning (JOLs) for a future recall test increased for words printed in a large font, as compared with those in a small font, even though actual recall for large- and small-font words did not differ. Font size and its influence on JOLs may be limited to experimental or environmental conditions that could otherwise highlight the salience of that particular stimulus characteristic; when other stimulus characteristics compete for attention at encoding, font size might not influence JOLs. In the present set of experiments, we examined the influence that font size has on JOLs when the emotional valence of words (neutral and negative) was manipulated simultaneously. We found independent influences of both font size and stimulus valence on JOLs. Thus, the encoding-fluency effect persists in this mixed-list design and for both neutral and negative stimuli, but perhaps due to separate cognitive mechanisms.

(1106)

Implicit Memory and Metamemory Under Retroactive Interference: Neither Is Immune From Retroactive Interference Effects. DEBORAH K. EAKIN, *Mississippi State University*, ROBERT SMITH, *Florida State University*, & SARAH ANDERSON, *Mississippi State University* (sponsored by Christopher Hertzog)—We examined whether implicit memory was immune from retroactive interference using the modified opposition test (MOT). Not only does the MOT provide a strong test of retrieval blocking, but also the presence of the hint allows an implicit reference to the original list for retrieval. Significant retroactive interference effects were obtained for both explicit and implicit memory, demonstrating that implicit memory is not immune from retroactive interference. We also tested whether metamemory predictions (delayed judgments of learning) tracked retroactive interference effects. Using a cued-recall test, Eakin (2005) had found that metamemory was dissociated from memory under conditions of retroactive interference. However, when the cue was a cue–word-stem pair, metamemory was associated with memory. Subsequent tests showed that, although the cue was not necessary to complete the word stem, the presence of the cue was crucial both for memory and for accurate metamemory predictions.

(1107)

Investing the "Time" in Time-Based Prospective Memory. EMILY R. WALDUM & LILI SAHAKYAN, *University of North Carolina, Greensboro*—People often estimate the duration of experienced time intervals either retrospectively (e.g., how long did it take to get from home to work?) or prospectively (e.g., remove cookies from the oven in 10 min). Prospective estimates are said to be mediated by the amount of attention that is devoted to monitoring time, whereas retrospective estimates are dependent on memory for information that occupied the time interval (for a review, see Block & Zakay, 1997). We conducted two experiments that required participants to provide verbal estimates of an experienced duration (Experiment 1) or to perform a time-based prospective memory task (Experiment 2). In both experiments, we played a varying number of background songs during the concurrent task, while keeping the objective duration of the interval constant across conditions. The results contradict the current attentional view of prospective time estimation and underscore the role of memory in prospective timing.

• SELECTIVE ATTENTION •

(1108)

On Arousal Level and Driving: Drivers' Pupils Shrink As Route Familiarity Increases. MATTHEW R. YANKO & THOMAS M. SPALEK, *Simon Fraser University* (sponsored by Thomas M. Spalek)—We have shown that, as drivers become more familiar with a route, they respond less promptly to sudden events, such as a dog running onto the road. We hypothesize that, with increasing familiarity, drivers become more

relaxed and allow their minds to wander. We tested this relaxation hypothesis by monitoring pupil diameter while manipulating route familiarity. Consistent with this hypothesis, pupil diameter decreased with route familiarity. There was a tendency for this trend to be reversed upon switching to an unfamiliar route. A separate study revealed a positive correlation between direct measures of mind wandering and RTs to unexpected events.

(1109)

Target Selection in Relevant and Irrelevant Visual Search Displays: Intertrial Effects. ALI JANNATI, *Simon Fraser University*, JESSICA J. GREEN, *Duke University*, & VINCENT DI LOLLO & JOHN J. McDONALD, *Simon Fraser University* (sponsored by John J. McDonald)—Repetition of stimulus features across trials can influence search efficiency for a target singleton. Earlier studies focused on intertrial repetitions and switches of local target-defining features. Here, we focused on global aspects of the display. Displays contained either all-cyan or all-yellow bars. In Experiment 1, observers searched for orientation singletons (targets) in go displays (e.g., cyan), but not in randomly intermixed no-go displays (e.g., yellow). In Experiment 2, they searched for targets on all trials regardless of color (all-go trials). Targets elicited an ERP component associated with attentional selection (N2pc) on go and all-go trials, but not on no-go trials. The N2pc was 50 msec later on go than on all-go trials, reflecting the cost of the go/no-go decision, but it was unaffected by color switches in the absence of such decision. We conclude that intertrial effects are contingent on decision making associated with task relevance; they are not triggered by simple sensory switches.

(1110)

The Root Cause of the Attentional Blink: First-Target Processing, Not Disruption of Input Control. HAYLEY E. P. LAGROIX, THOMAS M. SPALEK, & VINCENT DI LOLLO, *Simon Fraser University* (sponsored by Vincent Di Lollo)—Report of a second target (T2) is impaired when presented shortly after the first (T1). T1-based theories ascribe this attentional blink (AB) to a T1-initiated period of inattention. Distractor-based theories ascribe the AB to a disruption of input control caused by distractors trailing T1. Theoretical predictions were tested in Experiment 1 by varying the intervening events between T1 and T2: (1) distractors, (2) blanks, (3) long T1, (4) repeated T1, and (5) repeated distractor. All produced an AB, consistent with T1-based but not with distractor-based models, which predict ABs only in (1) and (5). Experiment 2 rejected the possibility that the AB in (2) was due to a disruption of input control caused by the "surprising" blank display after T1. This questions the option that the ABs in (3), (4), and (5) could have arisen from intervening "surprising" events. These outcomes are uniformly consistent with T1-based theories.

(1111)

Selection for What Versus Selection for Where: Dissociations Between Identity- and Location-Negative Priming. HSUAN-FU CHAO, *Chung Yuan Christian University*—In a task of attentional selection, in order to ignore the distractor and attend to the behavioral target, selective attention is required. Negative priming refers to the phenomenon that it takes more time to respond to a target when it was previously a distractor. Identity-negative priming can be observed in a selection-for-what task, and location-negative priming can be observed in a selection-for-where task. The present study demonstrated that identity- and location-negative priming are dissociable. First, the removal of probe distractor and the perceptual grouping of the target and distractor affected identity-negative priming, but not location-negative priming. Second, the distance between the target and distractor had different effects on identity- and location-negative priming. These findings suggest that identity- and location-negative priming involve different representations.

(1112)

Item-Specific Memory Activation in Visual Search and the Flexible Use of Working Memory Contents. NICK D. LANGE & RICK P. THOMAS, *University of Oklahoma*, & EDDY J. DAVELAAR, *Birkbeck, University of London* (sponsored by Rick P. Thomas)—Research

examining the propensity to engage items matching the contents of working memory (WM) has demonstrated conflicting results. A bulk of evidence supports the claim that attention and eye movements are automatically deployed toward WM-matching items (Soto et al., 2005, 2007, 2008). However, people can also utilize items in WM to flexibly inhibit the engagement of WM-matching items in some cases (Woodman & Luck, 2007). The present experiment employed a novel fusion of standard free-recall and visual search paradigms to test the extent to which item-specific memory activation predicts the degree of automatic deployment of attention and eye movements to WM-matching items. The results implicate the level of memory activation associated with WM items as a factor gating the flexible use of WM contents to support visual search. Specifically, we argue that high WM activation is associated with automatic orienting, whereas low WM activation permits the flexible use of WM-matching items.

(1113)

Event-Related Potentials Demonstrate Control Over How the Contents of Working Memory Guide Attention. NANCY B. CARLISLE & GEOFFREY F. WOODMAN, *Vanderbilt University* (sponsored by Geoffrey F. Woodman)—Theories of visual attention propose that templates are held in working memory to direct perceptual attention to memory-matching items. However, theories disagree about whether the influence of these memory representations is obligatory. Previous work using behavioral measures has led to inconsistent conclusions. In a series of four experiments, we determined whether covert attention was directed to memory-matching items using an electrophysiological measure of the deployment of perceptual attention, the N2pc component. Unlike the variable patterns of RTs during these tasks, the event-related potentials consistently showed that attention was not deployed to memory-matching items during search. We found that memory-matching items attracted covert attention early in the course of visual search only when participants had the explicit goal of reporting a feature from these items. Our findings suggest that we control whether or not to shift attention to memory-matching items in our visual field.

(1114)

Priming of Object-Based Attentional Control. HYUNKYU LEE, *University of Illinois, Urbana-Champaign*, SHAUN P. VECERA, *University of Iowa*, MICHAEL C. MOZER, *University of Colorado, Boulder*, & ARTHUR F. KRAMER, *University of Illinois, Urbana-Champaign* (sponsored by Richard A. Abrams)—In the present experiments, we demonstrate that previous experience affects whether attention is deployed in an object-based or a location-based mode. With stimuli presented on two rectangles, targets appearing in an uncued location on a cued rectangle showed faster response times than did targets on the uncued rectangle, demonstrating an object-based attentional benefit. We investigated the object-based benefit on the current trial on the basis of cue–target validity on the previous trial. The object-based attention benefit was significant only when, on the previous trial, a target was presented on the cued object. There was no object-based attention benefit when, on the previous trial, a target was presented on the uncued object. Further analysis suggests that the previous trial influence was not from the repetition of spatial cue–target location but from adapting to contingencies in the environment. Our experiments demonstrate that recent experience of cue–target validity can influence the control of attention, suggesting that attentional control is responsive to the structure of the environment.

(1115)

Orientation-Specific Control of Attention. FENG DU & RICHARD A. ABRAMS, *Washington University*—Many studies have shown that an irrelevant distractor matched to a target-defining color captures attention involuntarily. However, whether an irrelevant orientation-matched distractor can capture attention is still unknown. A variant of a spatial blink task was used to examine whether an irrelevant distractor matching a sought-for target orientation can capture attention. We found that a peripheral orientation singleton that matched the sought-for orientation captured attention and caused the spatial blink. More surprisingly, a peripheral orientation singleton that was perpendicular to the sought-for

orientation also captured attention, although other, equally salient orientation singletons did not. The results suggest that top-down selection for a specific orientation may recruit neural mechanisms sensitive to multiple orientations.

• SPATIAL COGNITION •

(1116)

Individual Differences in Spatial Navigation: The Influence of Cognitive Styles. DAVID J. M. KRAEMER, VICTOR R. SCHINAZI, PHILIP B. CAWKWELL, RUSSELL A. EPSTEIN, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Navigation in large-scale environments relies on the ability to integrate multiple sources of information. Individuals differ not only in overall navigation ability, but also in strategies they use to accomplish the task—that is, on which sources of information they rely. One reliable, and potentially relevant, difference between individuals is their self-reported preferences for attending to visual and verbal sources of information. These separable preferences, known as visual and verbal cognitive styles, correlate with reasoning and memory in visual and verbal domains, respectively. Here, using novel large-scale virtual environments, we demonstrate that visual and verbal cognitive styles are differentially predictive of performance on navigation tasks. Specifically, higher ratings on the visual dimension predicted better performance on both landmark judgments (old/new) and judgments of relative direction (JRDs). Higher ratings on the verbal dimension, however, predicted performance for landmark judgments but not JRDs. Together, these results suggest that cognitive styles correspond to differences in how individuals represent spatial knowledge.

(1117)

The Effects of Sex and Retention Interval on Performance in Two Novel Spatial Memory Tasks. ALIA L. YASEN & MATTHEW HERSON, *Willamette University*, BRIAN J. PIPER, *Oregon Health & Science University*, & JEREMY K. MILLER, *Willamette University*—The results of an experiment examining the effects of sex and retention interval on two novel spatial memory tests are reported. In the first task, participants navigated around a computerized virtual island and were asked to remember the spatial location of different landmarks. In the second task, participants were asked to learn arrays of stimuli consisting of three pictures of common objects. Participants were subsequently given a recognition test in which they were asked to differentiate between previously studied arrays and arrays in which the identity or spatial location of one of the objects in the array had changed. The results demonstrated that female participants outperformed males on the novel image, novel location test but that the sexes performed equivalently on the virtual navigation task. The results are discussed in terms of previous work examining sex differences in spatial cognition (Rizk-Jackson, Acevedo, Inman, Howieson, Benice, & Raber, 2006).

(1118)

The Effect of Emotion Manipulation on the Representation of Visual Space. CLARK G. OHNESORGE, *Macalester College*, & KAMEKO M. HALFMANN, *University of Iowa*—Previous research has shown that positive (happiness) and negative (sadness) emotions are associated with relatively greater left and right frontal activation,

respectively. The phenomenon of right pseudoneglect is revealed when normal subjects are asked to indicate the center of a line (the line-bisection task). Typically, their perception of the center is 2%–4% to the left of the actual center, indicating either an expansion of left visual space or a diminishment of right visual space (i.e., right pseudoneglect). The size of the effect depends on both response hand and the handedness of subjects, suggesting that it may reflect relative activation in the frontal hemispheres. In our study, we induced emotion using film clips and found that (1) the degree of bias in the line-bisection task is altered by the induction of happiness and (2) the change we observed is limited to right-handed responses, which suggests a frontal locus for the effect.

(1119)

The Influence of Surface Feature Arrangement on Cue Learning in a Blocking Paradigm. VICTORIA L. HARMS, *University of Saskatchewan*, & DEBBIE M. KELLY, *University of Manitoba* (sponsored by Debbie M. Kelly)—We used a blocking paradigm to examine how surface-feature cue arrangement influences learning of geometric and feature information. Two groups of adult humans were pretrained to find a target location in a three-dimensional virtual environment containing only informative geometric cues. Subsequently, they were trained with informative geometric and featural cues. Two other groups did not receive pretraining; instead, they were trained with both informative geometry and features. The results showed that pretraining with geometry impeded the learning of subsequent feature information, depending on the arrangement of the surface features. Specifically, learning of surface features was reduced when a single feature spanned the target corner, but not when two features created a boundary at the target corner. These results show that the encoding of geometric and feature information is influenced by the arrangement of surface-feature cues relative to a target location.

(1120)

Where's the Square? Strategies and Aging in Visuospatial Working Memory. BAILEY M. BONURA, AYANNA K. THOMAS, & HOLLY A. TAYLOR, *Tufts University* (sponsored by Holly A. Taylor)—Two experiments examined aging effects on memory and metacognitive accuracy for objects in spatial arrays. After studying an array, participants made a judgment of learning (JOL) and completed a recognition test assessing object identities, locations, or both. Participants either knew what information would be tested (Experiment 1) or did not (Experiment 2), to assess strategy use. Experiment 1 results demonstrated better location memory, as compared with identity memory or the combination, and no decline in location memory as array size increased. Furthermore, younger adults demonstrated better metacognition calibration and better memory for both identity and combined location–identity information than did older adults. Experiment 2 results showed attenuation of good location memory when location was not strategically processed, particularly in older adults. The roles of automaticity (e.g., Hasher & Zacks, 1979) and strategy in visuospatial working memory are discussed.

(1125–1132)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION II
Friday Noon
Exhibit Hall
Viewing 10:00–1:30, Author Present 12:00–1:30

• PERCEPTION •

(2001)

Effects of Stimulus-Driven Temporal Orienting on Auditory Processing. KATHRIN LANGE, *Heinrich Heine University* (sponsored by Susanne Mayr)—It has been suggested that presenting a regular stimulus sequence leads to an automatic entrainment of attention that selectively favors the processing of future stimuli that continue the sequence. Since evidence for this stimulus-driven temporal orienting has been provided only by accuracy data so far, the present study used reaction times and event-related potentials (ERPs) as dependent variables. Participants listened to targets following regular sequences. The target either continued the sequence (on-time) or was presented early or late with respect to this moment. In a control condition, sequences were irregular. Targets following a regular sequence were associated with faster and more accurate responding. ERP data showed enhancements of both early and late processing levels as reflected in the N1 and P3, respectively. Because, however, effects of regularity were not selective for targets continuing the sequence, the present data provide no evidence for an entrainment of attention to the regular sequence.

(2002)

Temporal Dynamics of Auditory Perceptual Learning: Impact of Progressive Order. MATTHEW G. WISNIEWSKI, BARBARA A. CHURCH, ESTELLA H. LIU, & EDUARDO MERCADO III, *University at Buffalo*—Progressive training, starting with an easier version of a discrimination task and slowly progressing to more difficult distinctions, usually produces faster learning than does training with a hard discrimination. However, this progression has historically been confounded with the variability of training. In previous research, we compared progressive, constant, and (equally variable) antiprogressive training and found that progressive training produced significantly better performance in a birdsong rate discrimination task. In the present experiments, we used this task to further explore the importance of progressive training. First, we compared progressive with constant, antiprogressive, and randomly ordered sequences. We also compared progressive and constant training with perceptual anchoring. Finally, participants received preexposure to stimuli in different orders without rate discrimination training. The results clearly show that progressive order is important for perceptual learning with or without training. The results are discussed in terms of possible cortical retuning in perceptual learning.

(2003)

The Perceptual Cues for Processing Temporal Order of Tones Differing by Frequency or Spatially (Ear). LEAH FOSTICK, *Ariel University Center*, & HARVEY BABKOFF, *Bar-Ilan University and Ashkelon Academic College* (sponsored by Harvey Babkoff)—Data from three experiments are presented comparing the performance of the spectral temporal order judgment (TOJ) (two tones differing in frequency) and the spatial TOJ (two identical tones differing by ear of presentation). We hypothesized that the temporal order of tones differing by frequency is accomplished mainly by discrimination of the different envelopes generated by their order. In Experiment 1, we showed that subjects significantly improve their performance on the spectral TOJ task, indicating an ongoing learning process, whereas similar continued performance on the spatial TOJ task does not significantly improve performance. In Experiment 2, 50% of participants were shown to be able to perform the spectral TOJ at over 75% accuracy, with very short interstimulus intervals (5 msec), but only 3% were able to do so in the spatial TOJ. In Experiment 3, stimulus onset asynchrony predicted 97% of the performance in the spatial TOJ but only 54% of the performance in the spectral TOJ.

(2004)

Learning to Bind Faces and Voices: A Gender-Congruency Advantage. ELAN BARENHOLTZ, DAVID J. LEWKOWICZ, MEREDITH DAVIDSON, & LAUREN KOGELSCHATZ, *Florida Atlantic University*—Hearing a familiar person's voice allows you to infer the speaker's face and vice versa. This cross-modal knowledge may depend on simple associative pairing or may represent a specialized process of binding into a multimodal "identity." Here, we present two experiments suggesting that binding into an identity is essential to efficiently learning face–voice pairs. We compared how well people learned to match faces and voices across gender-matched (e.g., male face/male voice) versus gender-mismatched (e.g., male face/female voice) conditions. In Experiment 1, the faces and voices were presented statically; subjects showed much better performance when the face–voice pairs were gender matched and, thus, likely to be bound into a single identity. In Experiment 2, we used movie stimuli in which the audio of the voices was dubbed onto video of the paired face; performance for the gender-mismatched pairs showed strong improvement, as compared with static stimuli, suggesting that the dubbing increased binding, improving learning.

(2005)

Implicit Synesthetic Perception in Japanese Lexical Processing. MICHIKO ASANO & KAZUHIKO YOKOSAWA, *University of Tokyo*—One form of synesthetic perception in nonsynesthetes involves the existence of certain nonarbitrary mappings between a word's sound and a visual shape. Mechanisms underlying such synesthetic percepts are unclear. Here, we report that this synesthetic association is triggered by phonological activation during normal online lexical processing. We conducted an implicit interference task where participants made lexical decisions about visually presented Japanese nonwords that were contained in shapes. Consonant sounds of nonwords and shapes were either synesthetically matched (e.g., stop consonants within a spiky shape) or mismatched (e.g., stop consonants within a curvy shape). Nonwords were written either in Japanese phonetic Hiragana script or in the logographic Kanji script. Generally, it is assumed that phonology mediates lexical access to Hiragana words, but not to Kanji words. The results showed synesthetic associations occurred only with nonwords in Hiragana script, suggesting that phonological activation during lexical processing is linked to supramodal processing.

(2006)

Perceived Target Location During Suppression of Optokinetic Nystagmus. WILLIAM J. HARRISON, STEFANIE I. BECKER, JASON B. MATTINGLEY, & ROGER W. REMINGTON, *University of Queensland* (sponsored by Roger W. Remington)—Continuous coherent motion in the visual field can lead to reflexive eye movements called *optokinetic nystagmus* (OKN), where the eyes first pursue a moving element, then saccade opposite to the direction of motion to pursue another. OKN can be suppressed by fixating on a stationary object. How is our perceptual organization of the world affected during active suppression of OKN? After replicating previous findings that, during OKN suppression, briefly flashed targets are systematically mislocalized in the direction of motion, we showed for the first time that, during OKN suppression, eye movements were biased in the same direction. By varying the magnitude of OKN that needed to be suppressed, we found that mislocalizations occur mostly during more active OKN suppression, indicating that it is unlikely that visual motion alone explains these mislocalizations. We argue that distortions of visual space at least partly result from mechanisms invoked by OKN and its suppression.

(2007)

The Meaning of Sets: Information From a Single Glance. MELANIE C. PALOMARES, C. HOLLEY PITTS, & WILLIAM Z. MORRIS, *University of South Carolina* (sponsored by Howard E. Egeth)—Due to our limited attention span and memory capacity, we extract an estimate or gist of our surroundings from a glimpse. We extended previous findings that mean size is more readily represented than the sizes of individual items from a briefly presented set. In Experiment 1, we investigated how set size (two to nine squares) affected the representation of the statistical mean. We found that accuracy for reporting the mean size was better than that for reporting the sizes of individual elements, even for a set size of two. In Experiment 2, we explored the possibility that participants were utilizing only the minimum and maximum sizes (i.e., range), rather than

the whole distribution. Discrimination between the true mean versus the "false mean" (i.e., mean of the range) yielded accuracies that were still reliably better than chance, suggesting that information from the whole distribution was used, rather than just the extrema of the set.

(2008)

Perception of Symmetry in Faces and Geometric Forms: An Electrophysiological Study. MARTHA E. ARTERBERRY & JOHANNA S. SALAY, *Colby College*, & MARC H. BORNSTEIN, *NICHD*— Symmetry is present in many biological forms in our environment, and humans report symmetrical stimuli as more attractive than asymmetrical stimuli. The present experiment examined EEG response to the presence of symmetry and axis of symmetry in faces and geometric forms. Across seventy-five 500-msec trials, participants viewed the same form with vertical symmetry, with oblique symmetry, or in a scrambled configuration. Analyses showed differences in N200, P250, and P300 amplitudes between faces and geometric forms, a finding not unexpected given the special nature of facial stimuli. A symmetry × form interaction showed an effect for symmetry for faces, but not for geometric forms. At Fz, vertical and oblique stimuli showed equal latencies; however, the latency for vertical stimuli was significantly shorter than that for scrambled stimuli. The findings suggest that the preference for symmetrical forms may have a physiological footprint and that it is most apparent for facial stimuli.

• SPEECH PERCEPTION II •

(2009)

Hemispheric Lateralization of Allophonic Speech Perception: Evidence From a Phonetic Imitation and Learning Task. ARIEL M. GOLDBERG, *Tufts University*—A growing body of research suggests that the left hemisphere processes speech in a categorical manner, whereas the right hemisphere processes it more gradiently. The right hemisphere thus may be more adept at processing subphonemic and allophonic detail than is the left. This possibility was explored in a phonetic imitation paradigm. Subjects' baseline voice onset time (VOT) was measured in an oral reading task. Subjects were then presented monaurally with words with artificially lengthened VOT for repetition. Finally, baseline words were readministered to determine whether subjects had incorporated the lengthened VOT into their own speech. Subjects who had stimuli presented to the left ear produced significantly longer VOTs in both repetition and posttraining blocks, whereas right-ear subjects showed no significant differences, as compared with baseline. These findings support theories that categorical perception of speech is primarily left-lateralized and suggest that the right hemisphere may play an important role in the (adult) acquisition of subphonemic/allophonic detail.

(2010)

Not Just Mere Exposure: Task-Specific Effects on the Perceptual Learning of Accented Speech. JESSICA E. D. ALEXANDER, *Concord University*, & SABRINA K. SIDARAS & LYNNE C. NYGAARD, *Emory University* (sponsored by Lynne C. Nygaard)—Our study addressed whether type of training influences perceptual learning of accented speech. Listeners were trained with English words spoken by six native Spanish speakers using one of three tasks: accent rating, talker identification, or word transcription. At test, listeners transcribed novel words from a different set of six Spanish speakers. Task type interacted with the lexical properties of the words. For high-frequency, low-neighborhood-density (easy) items, listeners trained with any task performed better at test than untrained controls. However, for low-frequency, high-neighborhood-density (hard) items, listeners trained with transcription or accent rating, but not talker identification, performed better than no-training controls. Training on talker identification did not lead to robust perceptual learning of accent-specific cues. These findings suggest that talker identification may focus attention on differences between talkers, rather than on the systematic cross-speaker variation that characterizes accented speech and is necessary for learning.

(2011)

The Role of Phonotactic Probabilities in the Recognition of Reduced Pseudowords. ELENI PINNOW, *University of Wisconsin–Superior*, &

CYNTHIA M. CONNINE, *Binghamton University* (sponsored by Cynthia M. Connine)—Two experiments examined the role of phonotactic probabilities in processing reduced forms of words, using an artificial lexicon. Trisyllabic pseudowords were presented that varied in phonotactic probability of the medial syllable (high or low), frequency, and number of presentations in training (high or low). At test, high-frequency pseudowords showed no effect of phonotactic probability but were recognized more accurately than low-frequency pseudowords. Pseudowords with a missing low-phonotactic-probability syllable were recognized more accurately than those missing a high-phonotactic-probability syllable. When excised and presented in isolation, low-phonotactic-probability medial syllables were recognized more accurately than high-phonotactic-probability medial syllables (Experiment 2). We suggest that the low-phonotactic advantage stems from enhanced encoding of words with low-phonotactic-probability syllables.

(2012)

Mouse-Tracking of "Subcategorical Mismatch" in Second Language Learners. HIA DATTA & JASON D. ZEVIN, *Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College* (sponsored by Mark S. Seidenberg)—Research using online measures of speech processing (i.e., eye- and mouse-tracking) suggests that word recognition in monolingual native speakers of English involves both anticipatory and retrodictive processes. One such study (Dahan et al., 2001, *LCP*) demonstrated that when early information about coda identity (e.g., the /k/ in "back") was combined with a stronger, conflicting cue (e.g., by replacing the burst for /k/ with that of a /t/ in "bat"), competition between those two items increased, as indexed by eyetracking. Using a mouse-tracking version of this paradigm, we traced native English and native Japanese speakers' ability to process English words that were cross-spliced across real and nonword lexical competitors [e.g., zit, zip, zi(t)p, zi(p)t, zi(ck)t and zi(ck)p]. Effects of "visual world" context and type of splicing provide insights into the differences between native and nonnative speakers' use of different sources of information and nonnative speakers' compensation mechanisms during word recognition.

(2013)

Visual Speech Segmentation: Using Facial Cues to Locate Word Boundaries in Continuous Speech. AARON D. MITCHEL & DANIEL J. WEISS, *Pennsylvania State University* (sponsored by Daniel J. Weiss)—Speech is typically a multimodal phenomenon, yet few studies have focused on the exclusive contributions of visual cues to language acquisition. Here, we examine the role of facial cues in speech segmentation. Previous research has demonstrated that language learners can use lexical stress and pitch cues to segment speech (Jusczyk et al., 1999). Since observers are able to extract pitch and stress information from talking faces (Yehia et al., 2002), we asked whether this visual prosodic information can facilitate speech segmentation. Participants listened to an artificial speech stream that contained no acoustic or conditional probability cues to word boundaries. The speech stream was presented in isolation or paired with a video in which visual prosodic cues either converged or conflicted with word boundaries (defined by frequency cues). Learning was successful only in the convergent audiovisual condition, suggesting that facial cues may contribute more to language acquisition than previously supposed.

• VISION II •

(2014)

Perceptual Instructions Increase Awareness of Primes in an "Unconscious Perception" Paradigm. STEVEN J. HAASE, *Shippensburg University*, & GARY D. FISK, *Georgia Southwestern State University*— We conducted a series of experiments to replicate and extend Vorberg et al. (2003, *PNAS*). We replicated the basic priming effect (i.e., briefly presented arrows primed RT to target arrows). We also measured prime identification (duration = 40 msec) and inferred that participants had some awareness of the prime on the basis of an overall recognition $d' > 0$, contrary to Vorberg et al. In a follow-up 2×2 design, we manipulated target duration (27 vs. 40 msec) and cue information. For the cue information manipulation, we instructed some participants that "perceived

jumpiness" in the display could signal that the prime and target pointed in different directions. We found the highest recognition d' in the 40-msec, "perceived jumpiness" condition, which was well above 0 (95% CI for $d' = 0.096$–0.324). This result suggests, contrary to the interpretation of Vorberg et al., that participants can be aware of primes.

(2015)

Object Persistence Across Saccades Is Influenced by Surface Feature Consistency. CAGLAR A. TAS, CATHLEEN M. MOORE, & ANDREW HOLLINGWORTH, *University of Iowa* (sponsored by Andrew Hollingworth)—The spatiotemporal properties of an object have been assumed to dominate the perception of object persistence across visual disruption. We tested this spatiotemporal dominance hypothesis by probing the role of surface feature information in object persistence across a saccade. On each trial, a saccade target was shifted spatially during the saccade to that object. In previous work (Deubel, Schneider, & Bridgeman, 1996), perception of shift direction was poor when the postsaccade object could be considered a continuation of the presaccade object (object-based updating impaired access to the prechange position information) but was highly accurate when object continuity was disrupted by removing the target briefly after the saccade. In the present study, instead of removing the target, its contrast polarity was changed across the saccade. This surface feature change improved sensitivity to position shifts, relative to the no-polarity-change control, demonstrating that surface feature information is functional in mapping objects across saccades.

(2016)

The Effect of Visual Magnification and Reduction on Hand Size Judgments. ANNE M. WALK, *Saint Louis University*, & MORTON A. HELLER, *Eastern Illinois University* (sponsored by Morton A. Heller)—We investigated the effect of visual magnification and reduction on perceived hand size. Independent groups of participants were asked to look through a 2X magnification lens, a ½X reduction lens, or a control UV filter and make size judgments about square stimuli in Experiment 1 and their hands in Experiment 2. The results showed that the visual distortion was effective only when participants looked at the stimuli under a reducing lens. Furthermore, the effect of visual distortion was limited to judged hand length, not width. A second part of Experiment 2 examined whether field dependence/independence influenced how susceptible people were to the visual manipulations. The results indicated that males had higher field independence scores on an embedded figures test and that females were more affected by visual minification when making judgments about their hands. Thus, field independence was related to judgments of hand length.

(2017)

Object Representation: Dissociating Contributions of Outline and Nonoutline Contour Information to the Priming and Online Recognition of Animals. TOBY J. LLOYD-JONES, *Swansea University*, JASON LAUDER, *University of Exeter*, & JUERGEN GEHRKE, *Leicester University*—We assessed the importance of outline contour, nonoutline contour, and local featural information in mediating both long-term memory and online recognition of the animal category. We examined response times and eye movements to shaded and silhouette stimuli in a repetition priming paradigm with animal-object decision as the retrieval task (i.e., deciding whether or not the stimulus was an animal that may be encountered in real life). The results showed that outline contour provided an important level of object representation that supported long-term memory. Importantly, we also observed dissociations between memorial and online recognition performance. Outline contour was sufficient for long-term memory; however, both outline and nonoutline information constrained online recognition. In addition, the memorial representation of outline contour did not make use of local featural information, and yet salient features around the lower torso and head regions played a useful role in online recognition. We interpret these findings in terms of independent whole- and feature-based priming and recognition processes.

(2018)

Depth Cues Affect Orientation Change Detection, But Not Luminance Change Detection. STEPHEN S. KILLINGSWORTH, ALEX D. FRANKLIN, & DANIEL T. LEVIN, *Vanderbilt University* (sponsored by Daniel T. Levin)—We investigated how detecting orientation and luminance changes is affected by retinal size and by depth cues. Participants saw arrays of larger and smaller objects changing orientation or luminance. Objects were presented either in a hexagon (large and small objects randomly intermixed) or in two rows with smaller objects behind. For the row configuration, we also manipulated whether participants saw the objects on a uniform gray background or on a table image. Participants detected more orientation changes to larger objects than to smaller objects, but this effect was largest in the hexagonal array. Differences were reduced when objects were aligned in rows such that retinal size differences could be interpreted as a monocular depth cue and were further reduced when the scene context suggested by the table promoted a depth-based interpretation of the size differences. In no case did size affect luminance change detection.

• SELECTIVE ATTENTION II •

(2019)

Evidence for Direct Control of Eye Movements During Visual Decision Making. MACKENZIE G. GLAHOLT & EYAL M. REINGOLD, *University of Toronto, Mississauga* (sponsored by Meredyth Daneman)—Eye movements were monitored while participants viewed displays containing eight stimuli. Four of the stimuli were photographs of buildings, and four were photographs of natural scenes. For each participant, one category (e.g., buildings) was relevant and the other (e.g., natural scenes), was irrelevant, and the participants were required to choose their preferred photograph from the relevant category. Participants' first eye fixations on stimuli from the relevant category were longer than those on stimuli from the irrelevant category. In addition, first fixations on the chosen stimulus were longer than first fixations on other relevant stimuli that were not chosen. In a second experiment, parafoveal viewing was restricted using a gaze-contingent window-viewing mode. Even under these conditions, we found a similar pattern of biases in the duration of first fixations. Together, these findings demonstrate that during visual decision making, fixation duration may be directly influenced by the ongoing processing of visual information.

(2020)

A Fearful Gaze Is a Potent Gaze: Evidence From a Novel Attentional-Cuing Method. MARK W. BECKER, *Michigan State University*—The gaze of a fearful face should be an effective cue to attention, allowing one to rapidly attend to potential threats. However, prior research investigating this issue is mixed. In three experiments, we used a novel method in which two static faces simultaneously cued different directions. Across trials, the emotion expressed by each face varied between happy, neutral, and fearful. Our results support the following conclusions: (1) This two-cue method is sensitive to gaze-cuing effects; (2) when the gaze of a fearful face competes with the gaze of a neutral face, attention follows the gaze of the fearful face; (3) this emotional-face advantage is selective to fear and does not occur for a happy face; and (4) the effect of facial expression habituates quickly, whereas the influence of gaze does not. These results help rectify previously disparate findings concerning the impact that facial expressions have on gaze cuing.

(2021)

Bizarre Impressions Enhance Orienting to Eye Gaze. MATIA OKUBO, *Senshu University*—A nonpredictive gaze cue produces a reflexive shift of attention to the gazed-at location. The present study investigated the role of bizarre impressions of faces in the integration of emotion processing and the gaze-cuing effect, using a modified version of Posner's (1980) attentional-cuing paradigm. Bizarre faces were created either by vertically shifting the position of one eye (Experiment 1) or by inverting both eyes (Experiment 2). Such bizarre faces, relative to normal ones, produced a larger facilitative effect of a gaze cue. The enhancement induced by bizarreness disappeared when the face was inverted to eliminate the bizarre impressions (Experiment 3). The present results suggest that the bizarre impression of faces attracts attention of observers and facilitates the processing of the gaze, ultimately enhancing the gaze-cuing effect.

(2022)

Examining the Influence of Task Set on Eye Movements and Fixations. MARK MILLS, *University of Nebraska, Lincoln*, STEFAN VAN DER STIGCHEL, *Utrecht University*, ANDREW HOLLINGWORTH, *University of Iowa*, & MICHAEL D. DODD, *University of Nebraska, Lincoln* (sponsored by John H. Flowers)—The purpose of the study was to provide a descriptive analysis of the influence that general viewing instructions (e.g., nonbiased) have on spatiotemporal characteristics of eye movements during scene perception. Previous work has shown that object-based task sets tend to bias spatial, rather than temporal, parameters (e.g., Castelhano, Mack, & Henderson, 2009). Here, we find that tasks (search, memory, free view, and pleasantness rating) performed under general viewing instructions also bias temporal parameters (e.g., fixation duration) and, furthermore, that this effect was present immediately following scene onset. Interestingly, spatiotemporal differences between tasks became less pronounced as viewing time increased. The results are discussed in terms of the two-mode hypothesis of visual scanning (e.g., Pannasch et al., 2008; Velichkovsky et al., 2005).

(2023)

Investigating the Influence of Task-Specific Goals on Attention Allocation and Eye Movement Behavior While Viewing a Dynamic Scene. SHUICHIRO TAYA, DAVID WINDRIDGE, & JOSEF KITTLER, *University of Surrey*, & MAGDA OSMAN, *Queen Mary University of London* (sponsored by David R. Shanks)—The present study examined the influence of goal orientation on attention allocation, using behavioral measures (self-reported attentional allocation) and eye movement recordings (eyetracking) during the observation of tennis matches. In the first phase, observers were presented with short clips of a singles tennis match and were asked to rank items from the clips from most to least attended. In the second phase, half the observers were asked to indicate which of the players won the point, in addition to performing the ranking task (specific-goal-oriented attention), whereas the rest performed only the ranking task (nonspecific-goal oriented-attention). The critical findings revealed that the specific-goal-oriented observers reported paying more attention to point-related items in the dynamic scene in the second phase, as compared with the first phase. However there was no difference in eye movement recordings. The relationship between task-related knowledge and overt and covert attention is discussed.

(2024)

Implicit Relational Learning in a Multiple-Object Tracking Task. OLGA F. LAZAREVA, JOHN McINNERNEY, & JOYCE YUEN, *Drake University*—We used a multiple-object tracking task to examine whether contextual information presented in a background can facilitate tracking accuracy. College students were instructed to track four out of eight objects and report at the end of the trial whether a single cued object was among those they had tracked (yes/no task). The display also contained two strips of different width. In the informative condition, the location of the cued object predicted the correct choice. If the answer was "yes," the object was located next to the narrower strip; otherwise, it was located next to the wider strip (or vice versa). In the random condition, the location of the object did not predict the correct choice. The informative condition produced significantly more accurate performance (67.4%) than did the random condition (50.6%). Participants in the informative condition were unaware of the predictive role of object location, demonstrating implicit relational learning in a task that requires sustained attention to the objects.

(2025)

Modulation of Overt Capture to a Salient Singleton by Magnocellular Involvement and Spatial Competition. CARLY J. LEONARD & STEVEN J. LUCK, *University of California, Davis*—When a salient yet irrelevant distractor is present in a search display, manual reaction time and overt oculomotor measures show that attention is often captured, at least under certain circumstances. Here, we examined how two biologically motivated changes to a salient singleton influence the competition between target and distractor by measuring manual and saccadic behavior. First, we compared the overt capture effects for two types of salient singletons that differentially activated

the magnocellular pathway. Consistent with the speed and anatomical projections of the M-pathway, a luminance singleton was more likely than an isoluminant one to capture the eyes, and did so more quickly. Second, capture was modulated by the spatial separation between target and distractor, as predicted by the local competition for visual representation that occurs between nearby objects. However, even distractors at the farthest distance led to infrequent oculomotor capture. The results are discussed in terms of local competition, covert selection, and oculomotor production.

• LETTERS/WORD PROCESSING II •

(2027)

The Influence of Language Familiarity and Reading on Visual Search Patterns. KELLY A. SCHWARTZ & BRAD WYBLE, *Syracuse University* (sponsored by Brad Wyble)—These experiments examined whether familiarity with the stimuli's written language influences a person's search pattern. Experiments used targets and distractors composed entirely of English, Hebrew, or nonsense symbols in different blocks. We utilized participants with high fluency in both Hebrew and English to test for potential biases in search patterns: left-to-right saccades during a block of English stimuli and right-to-left saccades during a block of Hebrew stimuli. We compared search patterns of this group with those of a group of subjects highly fluent with English, but not Hebrew. Using an eyetracker, we analyzed the starting eye position, the first saccade direction, and the total bias in saccade directionality, to test for significant differences in search patterns. The results indicate no clear influence of Hebrew expertise on saccade patterns during search of Hebrew characters. Further experiments evaluated the effect of linguistic experience, using words rather than single characters.

(2028)

Transposed Letters Disrupt Morpho-Orthographic But Not Morpho-Semantic Processing. JOANNA MORRIS, *Hampshire College*, KEVIN DIEPENDAELE, *Ghent University*, & JONATHAN GRAINGER, *CNRS and University of Provence*—The results showing statistically equivalent masked morphological priming effects with semantically transparent and opaque (including pseudo-) affixed primes and stem targets (*viewer–view ~ corner–corn*) suggest that morphological structure affects visual word recognition uniquely via sublexical morpho-orthographic segmentation (Rastle & Davis, 2008). Here, we show that priming with transparent and opaque primes is differentially affected by transposing morpheme boundary letters. Whereas priming remains intact for transparent items (relative to replaced letter primes; *viewer–view ~ viewr–view < vieakr–view*), it is reduced to the level of replaced letter primes for opaque items (*corner–corn < corenr–corn ~ coratr–corn*). This pattern of results was predicted by a model of complex word recognition that involves both sublexical morpho-orthographic and supralexical morpho-semantic processing. Transposed letters at the morpheme boundary are harmful for the fine-grained sublexical orthographic code that drives morpho-orthographic processing, but not for the coarse-grained lexical orthographic activation that initiates morpho-semantic processing.

(2029)

How Visual Search for Words Develops in Teenagers. JASON L. G. BRAASCH, JEAN-FRANÇOIS ROUET, CHRISTINE ROS, & NICOLAS VIBERT, *CeRCA, CNRS, University of Poitiers, and University of Tours* (sponsored by Nicolas Vibert)—Two experiments assessed 10-, 12-, and 15-year-old students' visual search for words within lists. Predictions were that teenagers gradually develop control mechanisms to discard distracting information but also become more sensitive to semantic relationships between words. Participants were asked to locate a single word within lists of nine items. Targets were either shown in advance (Experiment 1) or defined by their semantic category (Experiment 2). A within-participants design was used to investigate whether and how the presence in lists of orthographic and semantic distractors impacted the search. As was expected, 10-year-olds always took more time to find the target words than did 12- and 15-year-olds. In Experiment 1, the negative impact of orthographic distractors decreased with

age, whereas semantic distraction affected only older students. In Experiment 2, contrary to predictions, 10-year-olds were insensitive to either type of distractors, whereas older students were affected by orthographic distractors in the same way as adults.

(2030)

Interference From Reversed Anagram Primes: Another Source of Inhibition in Word Recognition? MARY L. STILL, *Missouri Western State University*, & ALISON L. MORRIS, *Iowa State University*—Still and Morris (2008) found interference for word targets preceded by reversed anagrams (*yadl*–LADY) in a lexical decision task. To further investigate this finding, three experiments were conducted using prime exposure durations of 24, 36, and 48 msec. In addition to reversed anagrams, bigram anagrams (*alyd*–LADY), neighbors (*ludy*–LADY), and identity primes (*lady*–LADY) were examined for both low- and high-frequency targets. The results varied by orthographic similarity, target frequency, and prime exposure duration. Significant interference was found for low-frequency, reversed anagram targets for each prime exposure duration. Interestingly, marginally significant facilitation was found for high-frequency, reversed anagram targets with a 24-msec prime exposure duration. No effects were found for bigram anagrams. Significant facilitation was found for low-frequency neighbor targets, but only with a 36-msec prime exposure duration. The consistent finding of interference for reversed anagrams suggests the presence of an additional inhibitory process during the early stages of word recognition.

(2031)

Brain Identification Times of Letters. SYLVAIN MADEC, ARNAUD REY, STÉPHANE DUFAU, MICHAEL KLEIN, & JONATHAN GRAINGER, *CNRS and University of Provence* (sponsored by Arnaud Rey)—In the present study, 125 letter-naming response times were recorded for each of the 26 uppercase letters of the alphabet and for 6 participants. The same participants also produced 100 delayed naming times for each letter. They finally participated in an event-related potential (ERP) study, in which individual-letter ERPs were obtained by recording 100 trials per letter and per participant. We first computed a simple linear regression between naming and delayed naming latencies that led to an r^2 of .79, indicating that a huge amount of the letter-naming variance is produced by output processes. Second, residuals of the regression were used as variance reflecting letter identification processes and were correlated with the individual-letter ERP variance from 0 up to 200 msec after stimulus onset. Significant repeated correlations were observed from 160 to 180 msec after stimulus onset, suggesting that brain letter identification processes take place within this time window.

(2032)

The Effects of Interletter Spacing in Visual-Word Recognition. CARMEN MORET-TATAY & MANUEL PEREA, *Universitat de Valencia*, & PABLO GOMEZ, *DePaul University* (sponsored by Manuel Perea)—Despite the importance of determining the effects of interletter spacing on visual-word recognition, this issue has been rather neglected in the literature. The goal of the present lexical decision experiments was to shed some light on this topic. In Experiment 1, we showed that the masked transposed-letter priming effect (i.e., faster recognition of *jugde*–JUDGE than *jupte*–JUDGE) vanished when the letters of the prime stimuli had an interletter spacing slightly wider than the default value. In Experiments 2 and 3, responses to words when a slightly wider interletter spacing was used were faster than the responses to words when the default interletter spacing was used. This effect was independent of word frequency (Experiment 2) and word length (Experiment 3). Thus, a factor such as interletter spacing plays an important role in modulating the identification of visually presented words.

(2033)

Testing Mediated Priming Using Ambiguous and Unambiguous Mediators: Will "Kidney" Prime "Piano"? KEITH A. HUTCHISON & SARA D. DAVIS, *Montana State University*—Mediated priming effects were explored using prime–target pairs related via a mediating word that was either lexically ambiguous (e.g., *kidney–piano*, through *organ*) or unambiguous (e.g., *lion–stripes*, through *tiger*). Association strengths

from prime–mediator and from mediator–target were equated across item types. Using a 200-msec SOA, facilitative priming was obtained for unambiguous mediated pairs, whereas inhibitory priming occurred for ambiguous pairs. This pattern occurred in both lexical decision (Experiment 1) and pronunciation (Experiment 2) tasks. However, neither type of priming was obtained in a third experiment in which the prime word was masked and presented for only 38 msec. Overall, this pattern of results is problematic for both spreading activation and strategic-matching accounts of mediated priming.

• PSYCHOLINGUISTICS II •

(2034)

Age-Related Changes in Emotion Representation and Control. RENATA F. I. MEUTER & SIERRA VAN WYK, *Queensland University of Technology* (sponsored by Jyotsna Vaid)—Older adults typically show a positivity bias, in contrast to the negative bias seen in younger adults. However, research often fails to control for age-related decline in cognitive functions and possible age-related changes in emotion representation. We explored emotion processing in younger (18–35 years) and older (65–85 years) adults, using emotion variants of the Stroop and the spatial Simon tasks. Differences in speed of processing were controlled for, and word stimuli were selected such that the effects of valence and arousal could be evaluated. Older adults experienced greater interference on both tasks; however, no age-related differences in emotion processing emerged. Word stimuli ratings did not reveal age-related differences in word valence, but older adults did rate all nonarousing words as more arousing. The juxtaposition of these patterns of results suggests that cognitive representations of emotions change with age and it is these changes that affect the processing of emotion words.

(2035)

Football Versus Football: The Effect of Topic on English and American Sports Fans' Speech. JESSICA LOVE & ABBY WALKER, *Ohio State University* (sponsored by Gail McKoon)—Can the topic of a conversation, when heavily associated with a particular dialect region, influence how a speaker realizes a linguistic variable? We interviewed fans of English Premier League soccer at a Columbus pub. Ten speakers of British English and 11 speakers of American English were asked about their favorite American football and English soccer teams. Our results suggest that speakers produce variants more consistent with Standard American English when talking about American football than when talking about English soccer. Specifically, speakers were overall more /r/ful (F3 values were lower in rhotic environments) when talking about their favorite American football team. However, British English speakers who did not identify as fans of American football showed the opposite pattern: They were less /r/ful when talking about American football, suggesting that notions of identity may mediate topic effects.

(2036)

The Role of Knowledge Gained Through Bodily Experience in the Processing of Insults. MICHELE WELLSBY, *University of Calgary*, PAUL D. SIAKALUK, *University of Northern British Columbia*, PENNY M. PEXMAN, *University of Calgary*, & WILLIAM J. OWEN, *University of Northern British Columbia*—The primary purpose of this research was to examine whether knowledge gained through bodily experience influences the processing of insults. We presented embodied insults (e.g., *numbskull*), nonembodied insults (e.g., *cheapskate*), and either noninsults (e.g., *armband*) or compliments (e.g., *eyeful*) in three insult detection task experiments ("Is the stimulus an insult or not?"). After each experiment, participants were given a surprise recall task. In all three experiments, a facilitatory bodily experience effect was observed, such that the embodied insults were responded to more rapidly and were recalled more often than the nonembodied insults. We propose that knowledge gained through bodily experience is an integral component of the conceptual knowledge people possess for insults. Our results are also consistent with the idea that embodied insults are understood by creating mental simulations of underlying bodily experiences (Barsalou, 1999).

(2037)

The Girls and Some of the Boys Kissed: Evidence That Conjoined Plurals Drive Reciprocal Interpretations. NIKOLE D. PATSON & TESSA C. WARREN, *University of Pittsburgh* (sponsored by Tessa C. Warren)—We report two experiments investigating what characteristics are critical to allowing a certain subset of plural NPs to saturate both thematic roles of a reciprocal verb (Patson & Ferreira, 2009). Experiment 1 showed that conjoined NPs made up of two plural sets (e.g., *the men* and *the women*) saturate a reciprocal's thematic roles the same as conjoined NPs made up of two singular sets (e.g., *the man* and *the woman*). Experiment 2 showed that conjoined NPs that contain quantifiers (e.g., *the men* and *some of the women*) operate similarly. These findings suggest that the characteristic critical to saturating the thematic roles of a reciprocal verb is that the NP establish pointers to two different sets. Interestingly, these findings also suggest that NPs that bias only weakly reciprocal interpretations of an event still saturate the thematic roles of a reciprocal verb. This indicates that strong reciprocality is not necessary for thematic role saturation.

(2038)

Facial Emotion Discrimination Task Strategy: Fixed or Malleable? JOËL D. DICKINSON, AMANDA LALANDE, MÉLANIE PERRON, & ANNIE ROY-CHARLAND, *Laurentian University*—Previous research indicates that when required to decode an emotion (fear or surprise), participants rely more heavily on the mouth region than on any other (Perron, Roy-Charland, & Eady, 2009). However, what strategy do participants employ when asked to do an emotion discrimination task? The present study asked participants to respond "same" or "different" when presented with two side-by-side facial expressions (both fear, both surprise, or one of each). Previous research indicates that the speed of a size discrimination task could be manipulated with instruction; however, accuracy remained unaffected (Dickinson & Szeligo, 2008). It was therefore hypothesized that strategy may have been influenced without the benefit of accuracy. The present study also tested whether speed and/or strategy could be manipulated by instruction within this more complex task.

• JUDGMENT/DECISION MAKING II •

(2039)

The Ticking Time Bomb: Individual Differences in Working Memory Affect Decision-Making Strategies During Time Pressure. ANA M. FRANCO-WATKINS, *Auburn University*, & JOSEPH G. JOHNSON, *Miami University*—Many decisions are made under less than ideal circumstances, such as time constraints. We examined how increasing time pressure (i.e., 18, 15, 12, 9, 6, and 3 sec) affected use of a lexicographic (LEX) or a weighted additive (WAD) decision strategy and whether individual differences in working memory accounted for complex strategy use. Participants viewed information about movies for an inference task, using a "moving window" paradigm, where occluded information was revealed by an eye fixation to the associated cell. Choice alternatives were created to be diagnostic of strategy use; we then examined how eye movement patterns predicted choices. Furthermore, we introduce novel transition-based metrics by which to evaluate strategy use in such information acquisition paradigms. Our results indicated a shift in strategy from WAD to LEX during increased time constraints and showed that individuals with higher working memory were better able to maintain a WAD strategy during restricted time pressures.

(2040)

Can People Understand Verification Information for Probabilistic Weather Forecasts? LOUIS NEMEC, SONIA SAVELLI, & SUSAN L. JOSLYN, *University of Washington* (sponsored by Susan L. Joslyn)—Weather forecasting is moving toward probabilistic forecasts and away from single-value deterministic predictions. A predictive interval, for instance, expresses a range of values within which the observation is expected to fall with a specified probability (e.g., 80%). Such forecasts better reflect the current understanding of future weather conditions. They might also increase trust in the forecast, because a forecast that

acknowledges uncertainty may seem less wrong to end users when the single-value forecast fails to be verified. In previous research, we have shown that lay users can understand predictive intervals. The present study asks whether nonexperts also understand verification graphics. We asked participants to identify verification graphics depicting forecasts that performed well. Responses suggested that people realized that for predictive intervals, performance depended on whether observations were within the interval, even though they did not match the single-value forecasts. Responses also indicated that predictive intervals increased trust in the forecast.

(2041)

Advice Utilization Differences Between Informed and Uninformed Decision Makers. STEVEN C. SUTHERLAND & MICHAEL E. YOUNG, *Southern Illinois University, Carbondale* (sponsored by Michael E. Young)—Effects of cost and accuracy on the decision to request expert advice were investigated in the present experiment, using an experienced-based choice task. Participants made a series of 100 choices among three products to purchase on the basis of the products' historical ratings. At each choice point, participants could solicit the advice of an expert on which product to buy. Asking the expert involved a cost. Half of the participants needed to learn the accuracy of their particular expert, whereas the other half were advised of the base rates of their expert's programmed accuracy levels. Half were required to learn the efficacy of using product ratings alone, whereas the other half were advised of the predictive accuracy of the product ratings. The results of this study suggest differences between the experience-based decisions of judges who are either informed or uninformed of the relevant underlying probabilities used to make their decisions.

(2042)

Risk Sensitivity in Retrospective and Prospective Decisions. ELLIOT A. LUDVIG & MARCIA L. SPETCH, *University of Alberta* (sponsored by Marcia L. Spetch)—When faced with risky decisions, people tend to be risk averse for gains and risk seeking for losses. This reversal of risk preference for gains and losses (called the *reflection effect*) is a cornerstone of prospect theory, the influential economic theory of decision making under uncertainty. Studies examining risk-sensitive decision making typically present people with prospective choice scenarios in which the probabilities of potential outcomes are explicitly described. Our research instead focuses on decisions when the outcomes are learned through experience, rather than being explicitly described. In several experiments, we compared described and experience-based risky decisions within a single session. For the retrospective, experience-based decisions, we found a reversal of the usual reflection effect, with greater risk seeking for gains than for losses. This reversal occurred whether the outcomes were points or money. Our findings suggest a fundamental difference between decisions that tap prospective and retrospective evaluation processes.

(2043)

Effects of Cognitive Aging on Credibility Assessment of Online Health Information. VERA Q. LIAO & WAI-TAT FU, *University of Illinois, Urbana-Champaign* (sponsored by Wai-Tat Fu)—We studied the effects of cognitive aging on the perceived credibility of online health information. We found that cognitive aging differentially influenced the processing of central cues (argument strengths in stating the facts and their relations) and peripheral cues (Web features such as layouts of links). Specifically, older participants (65 years of age and above), who in general had lower level of fluid abilities, were worse at distinguishing between strong and weak central arguments than were younger adults (18–35 years of age). However, there was no significant difference between older and younger adults in credibility assessments based on peripheral cues. We also found significant interactions between age and types of cues, suggesting strategy shifts by older adults. Our results were consistent with the notion that strategy shifts were sensitive to fluid abilities: Older adults shifted from systematic to heuristic information processing depending on the context of central and peripheral cues presented on a Web page.

(2044)

Trust and Delegation in Common Investors' Experiences. MARCO MONTI, *Max Planck Institute for Human Development*, & VITTORIO PELLIGRA, *University of Cagliari* (sponsored by Jonathan D. Nelson)—The research aims at investigating how trust and investment decision strategies are related. We analyzed several aspects that contribute to trust formation within the customer–financial-advisor interaction. In particular, we focused on the role of communication and information presentation to determine the level of the investors' participation in the decision-making process. We interviewed 20 financial advisors and 99 customers of an Italian cooperative bank. Preliminary results reveal a high level of trust in the advisors. Investors give their trust mainly because of aspects dealing with the quality of their one-to-one interaction with the advisor. They marginally consider the worth of the content of the advice they receive, because of their lack of knowledge and financial literacy. This frequently leads to a paternalistic relationship dominated by an unbalanced recourse to the "advice-taking heuristic."

(2045)

The Probability Inflation Effect: Calibration and Scales of Conditional Probabilities. GREG J. NEIL & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Michael F. Verde)—If presented with word pairs that share only a backward (target-to-cue) associative relationship (e.g., *king–throne*), people tend to overestimate the conditional probability that the target will be produced in response to the cue, an effect known as probability inflation. Despite the poor calibration in these studies, previous research has shown that the associative strength from free association norms accounts for most of the variance in people's conditional probability ratings and that lexical factors (e.g., similarity and semantic distance) play little role (Maki, 2007). However, our data indicate that ratings of lexical similarity between word pairs also have a significant role to play. Additionally, Thurstone scaling methods were used to demonstrate that decisions made purely on the basis of free association norms do not produce a match to the rank ordering of probability ratings to different stimuli types. Finally, it is demonstrated that arbitrary differences in the type of probability rating requested affects how well people are calibrated in the task.

• CONCEPTS AND CATEGORIES II •

(2046)

The Role of Causal Interventions in Concept Revision. ERIC G. TAYLOR, *Yale University* (sponsored by Daniel J. Simons)—When one learns a causal system, it helps to manipulate certain factors and observe their effects on others, a task called *intervention*. This study bridges work on causal learning and belief revision by examining the role of intervention when updating one's prior beliefs about a causal system. Participants learned the relations between four factors of a novel ecosystem. During a prior learning phase, they viewed three of these properties (A, B, C) and were told that scientists currently believe that A causes B. Then they were shown Property D—in fact, the common cause of A and B—and made interventions to learn the true structure. Learners choosing their own interventions retained a stronger belief that A causes B than did those in an information-equated yoked condition. Other evidence suggests that interventions were designed to confirm the prior belief but, for yoked learners, this bias was absent.

(2047)

An Exploration of Active Sampling in Perceptual Classification Tasks. DOUGLAS B. MARKANT & TODD M. GURECKIS, *New York University*—Experimental approaches to human category acquisition tend to focus on passive learning. However, learning is often more "active," in that people selectively "sample" information they judge to be useful or informative. Recent work has shown that, given the opportunity, people intuitively sample new data in a statistically efficient manner. However, this ability may depend on a variety of factors, including memory for prior observations, knowledge of the task domain (i.e., hypotheses about the unknown categories), and metacognitive understanding of one's uncertainty. In this talk we explore the conditions under which active sampling leads to more efficient learning. In our experiments, people learn hidden category structures either through passive observation or by sampling exemplars they estimate to be informative. The results show that the success of active sampling critically depends on features of the task (e.g., reliability of information sources) and a match between participants' prior expectations and the category structure.

(2048)

Men's Learning About Women's Sexual Interest: Normative Findings and Links to Sexual Aggression Risk. TERESA A. TREAT, *University of Iowa*, & RICHARD J. VIKEN & JOHN K. KRUSCHKE, *Indiana University, Bloomington*—The present study examines young men's learning about women's sexual-interest cues under feedback conditions more characteristic of "real-world" social-learning environments than is deterministic feedback. Six hundred sixty-one undergraduate males completed a category-learning task in which they received four blocks of trial-by-trial feedback on their classifications of photographs of college-aged women into one of two unspecified categories based on the woman's affect (sexually interested or rejecting). Participants received one of five types of feedback: deterministic feedback, one of two levels of rule-plus-exception feedback, or one of two levels of probabilistic feedback. Receipt of rule-plus-exception feedback decreased normative percent-correct performance, relative to deterministic feedback, particularly for exception stimuli. Receipt of probabilistic feedback, which presumably best approximates the feedback young men receive in their social environments, substantially decreased utilization of sexual interest. Marked individual differences in learning also were present in all feedback conditions and were linked to risk for exhibiting sexual aggression toward acquaintances.

(2049)

The Written and the Spoken Word: Individual Differences in Verbal Cognitive Styles. JENNIFER H. DeSANTIS, DAVID J. M. KRAEMER, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by Sharon L. Thompson-Schill)—This study investigated variation, across individuals, in the relations between conceptual representations and linguistic representations. We used a repetition priming paradigm to measure the extent to which visual object recognition activates orthographic or phonological representations of object names. Specifically, we assessed the degree to which viewing a picture of an object facilitated response times in both written and auditory lexical decision trials that included the object's name. Degree of facilitation in each of the trial types was compared with preferences for auditory and written verbal information. These preferences, referred to as "cognitive styles," were measured using a separately validated questionnaire. The results indicate a correlation between written and auditory verbal cognitive style scores and the amount of facilitation in respective lexical decision trials. This indicates that individuals differ in how they use language to represent semantic knowledge, commensurate with their self-reported cognitive style preferences.

(2050)

Children and Adolescents on the Autism Spectrum Show Contrast Effects. CATHERINE J. MOLESWORTH, FRANCESCA G. E. HAPPÉ, & CORALIE CHEVALLIER, *King's College London* (sponsored by Zachary Estes)—A growing body of literature documents atypical cognition shown by individuals with an autism spectrum disorder (ASD). No coherent theoretical account exists for the pattern of findings, and this is exemplified by competing predictions concerning "contrast effects." Stewart, Brown, and Chater (2002) demonstrated these effects using a sequential categorization task. Response accuracy to each boundary item was greater if the preceding item was a member of the contrast category than if it was from the same category as the target. The study reported here presented a similar task to children and adolescents with ASD. The weak central coherence account (Happé, 1994) predicted reduced contrast effects in ASD, and the "reduced perception of similarity" account (Plaisted, 2000) predicted enhanced effects. Contrary to both predictions, the ASD group demonstrated typical contrast effects, and the findings provide further support for the MAC model of categorization (Stewart et al., 2002).

(2051)

Effect of Horizontal and Vertical Primes on English Monolinguals' Time Conceptualization. KEEN S. LIEW & JOEL A. HAGAMAN, *University of the Ozarks*—The basic assumption of linguistic relativity is that cognitive processes are affected by habitual thoughts resulting from the way each language represents the world. Past research in this area (Boroditsky, 2001) has shown significant differences between Chinese–English bilinguals and English monolinguals when responding to true/false temporal statements after being primed with vertical or horizontal spatial questions. Conceptual replications done by January and Kako (2007) and Tse and Altarriba (2008) contradicted Boroditsky's (2001) findings. In the present study, the effects of language usage were explored using a nonlinguistic task. Twenty-three English monolinguals estimated the time required for a dot to travel in four directions (i.e., right, left, up, and down) after horizontal or vertical spatial primes. No statistically significant differences were observed in the effect of spatial primes; however, English monolinguals were more accurate on left-to-right time estimation tasks, reflecting the linear conceptualization of time utilized in the English language.

(2052)

Cross-Modality Transfer With an Isomorphic Category Structure. RYAN FERGUSON & DONALD HOMA, *Arizona State University* (sponsored by Donald Homa)—Learning and transfer were investigated for a categorical structure in which relevant stimulus information could be mapped without loss from one modality to another. The category space was composed of three nonoverlapping, linearly separable categories. Each stimulus was composed of a sequence of on–off events that varied in duration and number of subevents (complexity). Categories were learned visually, haptically, or auditorily and were transferred to the same or an alternate modality. The transfer set contained old, new, and prototype stimuli, and subjects made both classification and recognition judgments. The results showed a significant learning advantage in the visual modality, with transfer performance varying considerably among the conditions in both classification and recognition. In general, classification accuracy was highest for the category prototype, with false recognition of the category prototype higher in the cross-modality conditions. The results are discussed in terms of conditions likely to promote and provide evidence for modality-free (amodal) category representations.

(2053)

Adaptive Design for Model Discrimination. MAARTEN SPEEKENBRINK, NICK CHATER, & DAVID R. SHANKS, *University College London* (sponsored by Nigel Harvey)—Psychology is rich in formal models of learning, categorization, and decision making, to name but a few areas. Although competing models differ in their substantive assumptions, they often make highly similar predictions. For this reason, model comparison based on empirical data is often inconclusive. Optimizing the design of an experiment for model discrimination is difficult, especially when individual participants differ widely in terms of model parameters. To resolve this problem, we present a method for designing experiments adaptively and online, at each trial choosing the stimulus that is expected to minimize the entropy of the posterior probability distribution over a set of competing models. We show the advantages of adaptive design in a simulation study. We then present data from an experiment in which the method was applied to discriminate between competing models of category learning, including an exemplar model (the generalized context model) and a decision bound model.

(2054)

For the Price of a Song: How Pitch Category Learning Comes at a Cost to Absolute Frequency Representations. MELODY DYE, EDWARD SUH, & MICHAEL RAMSCAR, *Stanford University* (sponsored by Michael Ramscar)—Appreciating music is cognitively demanding: Listeners must learn to divide a continuous space of sound into culturally defined, discrete categories and must maintain a high degree of accuracy in their representations of those sounds. Here, we present a formal analysis of pitch category learning that reveals the trade-offs associated with learning the relative pitch categories that facilitate musical cognition. Consistent with this, an empirical study reveals how, under normal circumstances, people's ability to represent absolute frequency information is lost as a consequence of the learning processes that facilitate relative pitch acquisition, a finding that may help explain the rarity of absolute pitch among the general population. Understanding the contradictory computational demands of conceptual and perceptual learning can inform the design of musical training and may offer insight into the development of phonological categories in language.

• HUMAN LEARNING III •

(2055)

How Children Learn to Value Numbers: Information Structure and the Acquisition of Numerical Understanding. MICHAEL RAMSCAR, MELODY DYE, HANNA MUENKE POPICK, & FIONA O'DONNELL-McCARTHY, *Stanford University*—Although number words are common in everyday speech, children's acquisition of these words is slow and labored, occurring over a protracted time scale. Here, we present a formal analysis and simulation suggesting that the reason for this delay may be found in the information structure of the linguistic input available to children and that manipulating this structure should facilitate rapid learning. An experiment with 3-year-olds confirms this prediction, demonstrating significant gains in numerical understanding and competence over a brief training period. Given that this manipulation would be remarkably easy for parents and educators to implement, and given that a large body of research indicates that young children's grasp of numerosity has implications for later educational outcomes, this advance potentially has far-reaching import.

(2056)

Sleep Enhances Abstract Mathematical Learning. KIMBERLY M. FENN, *Michigan State University*, & SUSAN WAGNER COOK, *University of Iowa*—Sleep has been shown to contribute to the consolidation of both episodic and procedural memory. Sleep can help individuals develop insight into an underlying problem structure and is important to generalized learning. However, little is known about the role of sleep in the consolidation of formal reasoning skills, such as mathematics. In the present study, we used an abstract math task (Kaminski et al., 2008) to investigate the role of sleep in math learning. Participants were trained on a commutative group of order three and tested after a 12-h retention interval that either included sleep or spanned a waking day. The results suggest that performance reliably improved after sleep but did not improve when the retention interval did not contain sleep. This work suggests that sleep enhances performance in at least one mathematical task and may, therefore, be important for the development of formal reasoning.

(2057)

The Effects of Multiple-Choice Testing and Feedback on School-Aged Children. ANNA E. GOSWICK, *Duke University*, LISA K. FAZIO, *Carnegie Mellon University*, & ELIZABETH J. MARSH, *Duke University*—Multiple-choice testing can change what children know. The present experiment examined whether providing feedback would strengthen memory for correct answers while correcting errors learned during testing. Thirty-two second-graders answered multiple-choice questions, gave confidence ratings, completed a filler task, and answered the same questions in short answer format (e.g., Who wrote the Declaration of Independence?). Critically, children in the feedback condition received the correct answer immediately following every confidence rating. The children who received feedback produced more correct answers and reproduced fewer multiple-choice lures on the short answer test, as compared with children who received no feedback. Children's confidence in their multiple-choice answers also affected later performance. Children who received feedback corrected more high-confidence errors than low-confidence errors, whereas in the control group, high-confidence errors were more likely to persist than were low-confidence errors. Our results suggest that immediate feedback minimizes negative testing effects and bolsters positive testing effects in children.

(2058)

Longer Intervals Between Practice Yields Less Work and Better Long-Term Learning. CATHERINE O. FRITZ, RACHEL DUFFY, &

PETER E. MORRIS, *Lancaster University*—Participants using *phase-6*, a Web-based system for practice-based learning, either practiced with shorter (1, 2, 3, and 4 days) or longer (2, 5, 9, and 15 days) intervals while learning 28 Finnish-to-English word translations over 10 days. Each day, four new translations were introduced; these and other translations scheduled for study on that day were practiced until they were answered correctly. Incorrect translations were restarted at the shortest interval; correct translations were scheduled for the next longer interval. When tested 3 days after ceasing practice, the groups did not differ significantly, but longer practice intervals led to better learning, as measured by a test 4 weeks later, despite having fewer practice events. This initial experiment was unable to fully test the power of longer intervals, since the longest intervals were outside the length of the study; future work will extend these results.

(2059)

Memory Retention for Stochastic Events. DANIEL H. BARCH & RICHARD A. CHECHILE, *Tufts University* (sponsored by Richard A. Chechile)—A novel paradigm in the form of a card game was developed to examine how memory for stochastic information influences subsequent choices. Three experiments were conducted, each requiring participants to make decisions regarding 225 hands of cards. Some hands were repeated after varying numbers of intervening hands. The experiments differed in regard to the number of cards in each hand. Participants showed good memory for optimal stochastic information only for very short lags. Three additional experiments were conducted to examine memory for the card hands themselves. Participants showed good memory for combinations of cards, except for the longest retention interval of 30 intervening hands. Overall, for the six experiments, the results indicate that for nonzero retention intervals, participants had better memory for which card was reinforced, rather than for which card was the optimal choice.

(2060)

Note-Taking Strategies: Combining Production and Levels-of-Processing Effects. DUNG C. BUI, SANDRA HALE, & JOEL MYERSON, *Washington University* (sponsored by Sandra Hale)—Our study compared the benefits of different note-taking strategies. In Experiment 1, participants handwrote or typed lecture notes and were instructed to organize or to transcribe as much as possible. Surprisingly, those who typed and transcribed had the best immediate recall of important details, perhaps simply because they took more notes: Overall, note quantity was significantly correlated with recall. In contrast, Experiment 2 showed that organized notes produced the best recall after a 24-h delay. Finally, preliminary results for Experiment 3 indicate that when participants studied their notes briefly right after taking them, typing transcribed notes again produced the best recall of important details, even after a 24-h delay. Taken together, our results suggest that both the production effect (Experiment 1) and the levels-of-processing effect (Experiment 2) can contribute to the success of note-taking strategies, but the best learning may result from optimal timing of the two effects (Experiment 3).

(2061)

Equal Versus Expanded Retrieval: An Examination of Participant- and Experimenter-Selected Spaced Retrieval Schedules. GEOFFREY B. MADDOX & DAVID A. BALOTA, *Washington University* (sponsored by David A. Balota)—Healthy young and older participants either self-initiated their own spaced study strategies or were given instructions to use equal or expanded spaced retrieval strategies to learn face–name pairs. To tap metacognitive retrieval strategies, participants simultaneously engaged in a reading task, which could be interrupted (at most four times) to review the face–name pairs at any point they deemed most productive. Across experiments, the influence of corrective feedback during acquisition was examined. The results suggest that both age groups naturally used expanded retrieval. When given instructions, both groups included an initial retrieval attempt shortly after encoding and then successfully applied equal and expanded spacing between subsequent retrieval attempts. There was no difference between equal and expanded spaced retrieval instruction conditions on a 45-min delayed

memory test with or without feedback. Discussion focuses on the role of metacognitive knowledge and corrective feedback in selecting an effective spaced retrieval strategy.

• COGNITIVE CONTROL II •

(2062)

Metric Details Matter: Stimulus and Response Similarity Affect Response Selection. TIMOTHY WIFALL, AARON T. BUSS, JOHN P. SPENCER, & ELIOT HAZELTINE, *University of Iowa* (sponsored by Eliot Hazeltine)—Perceptual and motor systems interact to produce goal-directed behaviors, a process known as response selection (RS). A largely unexplored topic in the study of RS is how interstimulus and interresponse similarity affect task performance. To examine this issue, we manipulated the similarity of stimuli by using colors that were either similar or distinct and manipulated the similarity of the responses by having subjects move a mouse cursor to spatial locations that were either close together or far apart. Traditional stage theories of RS assume that stimulus categorization is completed before RS, and, thus, predict additive effects of stimulus and response similarity. However, our results indicate that these factors interact. For example, the effect of response similarity on the final mouse position was much greater when the stimuli were similar than when they were dissimilar. We account for these effects in a dynamic neural field theory of RS.

(2063)

A Dynamic Neural Field Model of the Hemodynamics Associated With Response Selection and Dual-Task Performance. AARON T. BUSS, JOHN P. SPENCER, TIMOTHY WIFALL, & ELIOT HAZELTINE, *University of Iowa* (sponsored by John P. Spencer)—Recently, Buss, Wifall, Hazeltine, and Spencer (2009) used dynamic neural field theory (DNFT) to simulate the behavioral dynamics of response selection, dual-task performance, and learning over practice. Because DNFT simulates cognition within fields of neurons operating via principles of neural population dynamics, it is also possible to model the time course of neural activity measured using fMRI. We extended the model of Buss et al. (2009) to capture BOLD signal changes observed by Dux et al. (2009) in the inferior frontal junction (IFJ). By convolving the total synaptic activity in the model with a general hemodynamic response function, the model shows an increase in IFJ activity in dual-task trials early in practice and a reduction of this activity to single-task levels by the end of practice. Thus, within the same model, we can simultaneously capture behavior and real-time neural dynamics, as well as changes in behavior and neural dynamics over practice.

(2064)

The Effect of Behavioral Response on Affective Evaluation. DANIEL R. BUTTACCIO & SOWON HAHN, *University of Oklahoma* (sponsored by Sowon Hahn)—In the present research, we investigated how action influences affective evaluation. In three experiments, participants conducted a sequence of go/no-go tasks, then evaluated the pleasantness of a novel shape. In two experiments, participants evaluated the shapes from the go trial more positively than the shapes from the no-go trial. A follow-up experiment demonstrated that the emotional evaluation of a shape is not determined by participants' interaction with a specific stimulus. Instead, inhibition of an action may lead to overall negative affect of an individual. These results show that activation and inhibition of action can modulate affective evaluation. We suggest that affective evaluation can be modulated through cognitive load of inhibitory processing and that individuals can potentially control their affective states through behavioral activation and inhibition.

(2065)

Input–Output Modality Compatibility Mappings Influence Task Switching. DENISE N. STEPHAN & IRING KOCH, *RWTH Aachen University* (sponsored by Iring Koch)—Input–output modality (IOM) compatibility refers to the similarity of stimulus modality and modality of response-related sensory consequences and has been shown to influence task-switch costs (Stephan & Koch, 2010). This influence can be attributed to increased "cross-talk" interference with incompatible IOM

mappings. However, our previous experiments included switching between two compatible (auditory–vocal vs. visual–manual) and between two incompatible (auditory–manual vs. visual–vocal) spatial stimulus–response (S–R) tasks. Yet spatial S–R tasks imply dimensional overlap (Kornblum et al., 1990), which might have contributed to the increased cross-talk potential as a basis of IOM compatibility effects. In the present study, we found that IOM compatibility affects task switching even in tasks with noncompatible (i.e., no dimensional overlap) or spatially incompatible S–R mappings. This finding suggests that IOM mappings affect response selection in modality-specific ways in multitasking contexts generally.

(2066)

Unconscious Strategic Priming: Also With Backward Masking? SEBASTIEN WEIBEL, ANNE GIERSCH, STANISLAS DEHAENE, & CAROLINE HURON, *INSERM* (sponsored by Anne Giersch)—Whether unconscious stimuli can modulate the preparation of a cognitive task is still in debate. In the literature, unconscious strategic priming has been reported with metacontrast (Type B) masking. We use backward (Type A) masking that allows shorter intervals between prime and instruction. In four behavioral experiments, subjects were instructed to initiate a phonological or a semantic strategy on an upcoming word, according to an explicit instruction. Before this instruction, an unconscious prime of the same nature (backward masked) was presented. The congruency between prime and instruction decreased the response time, suggesting that the unconscious prime can initiate the strategy, but only in some timing configurations. Repetition priming (acceleration of the identification of the instruction by the prime) was also considered. Several pieces of evidence against the idea that the strategic priming effect is a repetition priming effect are presented. Especially, the former increases with the prime–instruction interval, whereas the latter decreases.

(2067)

Unconscious Interference May Result in Decreased Connectivity Between Prefrontal Control Areas. JULIE A. HIGGINS & MARCIA K. JOHNSON, *Yale University*—Previous findings (*Abstracts of the Psychonomic Society*, 2009) suggested that the ventrolateral prefrontal cortex (VLPFC), but not the anterior cingulate cortex (ACC), is sensitive to unconscious semantic competition when participants selectively think of (i.e., refresh) a just-seen word. In an fMRI study, participants read a word that was sometimes flanked by briefly flashed, immediately masked words. Participants then refreshed the just-seen word or read a new word. Connectivity between the VLPFC and ACC decreased when the masked words were related, relative to when they were unrelated, to the refreshed word. This suggests that the VLPFC and ACC may functionally "decouple" when high competition is present but not consciously experienced.

(2068)

Facilitative Effects of Task Switching and its Diminishing With Aging: Item RT Analysis in the Numeral Selection Task. ETSUKO T. HARADA, *University of Tsukuba*, AKIHIRO ASANO, *Chuo University*, SATORU SUTO, *Shizuoka University*, & LYNN HASHER, *University of Toronto*—It is known that global task-switching costs become greater with healthy aging, whereas local switching costs do not change. However, an analysis of reaction time on each trial in a variable task-switching task showed a different pattern of cognitive aging. In a numeral selection task, younger adults (university students) showed a facilitative task-switching effect when they were instructed to select the one larger in number (the decision on the nondominant dimension), especially under the incongruent stimulus condition. This effect was not observed with older adults, showing the usual task-switching cost. For trials of decisions on the dominant dimension (selecting the one larger in size), both aging groups showed the usual local task-switching costs. These results show that a change in cognitive control with aging occurred as a less frequent usage of effective strategies with "task-switching" as a external clue, when correct decision requires inhibition of the dominant dimension.

(2069)

Memory Seeding to Improve Calorie Estimates: Applications of Learning and Memory. JILL L. QUILICI & ERICA L. WOHLDMANN, *California State University, Northridge*—Individuals underestimate the calorie content of foods, making healthy choices sometimes difficult. The memory-seeding procedure, used to improve quantitative estimation accuracy, was applied to a calorie estimation task. Ninety-eight participants estimated the calorie content of food items (pretest) before being assigned to one of three conditions. Participants in the seeding condition estimated the calorie content of items and were provided with feedback; those in the view-only condition were shown items with the calorie content; and those in the control condition were shown items without the calorie content. A final test involved estimating calories on both old and new items. Learning and transfer were examined by comparing pretest accuracy with posttest accuracy for old and new items, respectively. Those in the seeding and view-only conditions improved in estimation accuracy and showed transfer of learning to new items, whereas the control group showed no improvement. Theoretical and practical implications are discussed.

(2070)

Auditory Perceptual Learning Through Training on a Task-Irrelevant Dimension. ESTELLA H. LIU, MATTHEW G. WISNIEWSKI, BARBARA A. CHURCH, & EDUARDO MERCADO III, *University at Buffalo*—Perceptual learning subserves fine distinctions among similar stimuli and is fundamental to the development of various cognitive skills. In previous studies, we explored the effect of different training regimens on auditory perceptual learning, by training participants to discriminate between frequency-modulated sounds with similar sweep repetition rates. In the present study, we explored the possibility that perceptual learning could be mediated by task-irrelevant training with the stimulus representations used in the comparisons. We examined this by measuring rate discrimination performance before and after training of sound duration discrimination. We found that training on a task-irrelevant dimension (i.e., duration) could enhance sensitivity to rate discrimination. Furthermore, the amount of task-irrelevant transfer depended on the training regimen, the similarity between the contrasting sounds, and whether or not participants were required to attend to the training sounds. The results are discussed in terms of the role of cortical retuning in perceptual learning.

(2071)

Indices of Transfer: Learning Can Transfer But Still Be Specific. ERICA L. WOHLDMANN, *California State University, Northridge*, & ALICE F. HEALY, *University of Colorado, Boulder*—Learning has been shown in many circumstances to be highly specific to the conditions under which it occurs. However, we argue that the amount of transfer from the learning to the testing situation depends to a large extent on the transfer index. In this paper, we review various indices of transfer used in two different tasks, one a perceptual–motor task and the other a largely cognitive task. Transfer indices compared performance at the start of testing with performance at either the start or the end of training, and they compared performance under either similar or very different training and testing conditions. This analysis indicates that specificity and transfer of learning are not mutually exclusive. Specificity can be found even when participants appear to fully transfer what they have learned to performance at test. Furthermore, depending on the definition of transfer and the measure of performance, different amounts of transfer are evident.

(2072)

Building Blocks for Simulated Surgery Training. ANGELA BRUNSTEIN, *Carnegie Mellon University in Qatar*, ANAM WAHEED & BAKR NOUR, *Weill Cornell Medical College in Qatar*, & JOERG BRUNSTEIN, *Carnegie Mellon University in Qatar*—We investigated optimal training conditions for virtual reality surgery. Eight upper level medical students learned to perform laparoscopic cholecystectomy using a simulation engine in five individual sessions and either were guided by one-on-one instruction of their mentor while performing the procedure or

explored the task on their own. One free-exploration group was matched to the instructed group by time, with both groups spending 5 × 30 min in the simulation. Another free-exploration group was given double the time, to compensate for missing guidance. All participants improved performance from pretest to posttest in terms of proficiency and major injuries to the simulated patients, as well as for task-related procedural and anatomy knowledge. However, only free-exploration participants with extended practice performed as well as guided participants during posttest, indicating that free exploration can be as efficient for skill acquisition as learning by instruction, given sufficient practice.

(2073)

Incremental Learning of Word Meanings: ERP Evidence for Stages of Meaning Acquisition. GWEN A. FRISHKOFF, *Georgia State University*, KEVYN COLLINS-THOMPSON, *Microsoft Research*, & CHARLES A. PERFETTI, *University of Pittsburgh* (sponsored by Charles A. Perfetti)—We investigated stages of word learning from written contexts, using high-density EEG measures with children (ages 9–11). Novel and partially known ("frontier") words were presented in multiple sentence contexts that differed in semantic constraint. After each sentence, participants were shown the target word in isolation and were asked to generate a close synonym. The quality of their response was automatically scored using a Markov algorithm, and EEG epochs were sorted on the basis of degrees of accuracy. High- versus low-constraint contexts led to reduction in an early left frontal negativity (N3) and medial frontal negativity (MFN) during training. Moreover, Markov scores were related to ERP measures of learning and retrieval after a 1-week delay. We discuss implications for stages of word semantic learning and the role of frontal and temporal networks in active retrieval of newly learned word meanings.

• AUTOMATIC PROCESSING II •

(2074)

The Simon Effect and the SMARC Effect Induced By an Auditory Accessory Stimulus. AKIO NISHIMURA, *Sophia University*, & KAZUHIKO YOKOSAWA, *University of Tokyo*—We investigated the effects of the pitch of a task-irrelevant tone, as well as side of tone presentation, on response selection. Depending on the color of a centrally presented visual target, participants pressed either a left or a right response button. Simultaneously with target occurrence, a low- or high-pitched tone was presented (via headphones) to either the left or the right ear. Performance was better when the response and the stimulated ear spatially corresponded (Simon effect) and when the spatial–musical association of response codes (SMARC) correspondence was maintained—that is, pairing of low-pitch/left-ear and high-pitch/right-ear (Nishimura & Yokosawa, 2009, *Psychonomic Bulletin & Review*). These findings revealed an automatic activation of spatially and musically associated responses by a single task-irrelevant auditory accessory stimulus. Further analyses addressed issues of additivity, correlation, time course, and the sequential modulation related to Simon and SMARC effects. Mechanisms underlying these effects are discussed.

(2075)

Investigating the Role of S–R Associations in Subliminal Response Priming. JASON R. PERRY & STEPHEN J. LUPKER, *University of Western Ontario*—The present research investigated the role of stimulus–response (S–R) associations in producing subliminal response priming. In Experiment 1, response priming and semantic distance effects were evaluated simultaneously in a variety of number classification tasks. The response priming effect did not increase in size over trials, and there was always a semantic distance effect, suggesting that the response priming effect was semantically based. Experiment 2 involved learning artificially defined nonword category sets that contained prototype items (i.e., a letter string sharing no letters with the prototype of the other category), which served as primes and appeared as targets. A response priming effect occurred (faster responding when nonprototype targets were preceded by their own prototype vs. the other category's prototype). However, this effect increased in size only when multiple learning sessions were used.

These results indicate that it takes considerable practice before S–R associations will play a major role in producing subliminal response priming.

(2076)

Feature Integration in Masked Priming. WILFRIED KUNDE, *Dortmund University of Technology*, & HEIKO REUSS, CARSTEN POHL, & ANDREA KIESEL, *University of Würzburg*—Participants saw two letters—"os," "so," "es," or "se"—both as prime and target in a masked priming paradigm. One group of participants made a lexical decision and classified the target as being a German word or a nonword. The other participants responded to an XOR-like combination of the features location (left/right) and identity (e/o) of the vowel, resulting in the same stimulus–response mapping ("so" and "es" vs. "os" and "se"). Response congruency of prime and target had an effect only in the lexical task, but not in the XOR task. The congruency effect in the lexical task indicates integration of features of the prime word, which probably relates to the automated processes associated with reading. The necessary explicit integration of features in the XOR task prevents a congruency effect. Thus, subliminal priming is possible for stimuli that require several features to be integrated if automated processes or expertise enable feature integration.

(2077)

An Evaluation Window Account of Negative Compatibility Effects. KERSTIN DITTRICH & KARL CHRISTOPH KLAUER, *University of Freiburg*—One of the most surprising results in category priming is the occurrence of negative compatibility effects (NCEs); that is, responses to targets are inhibited when primes and targets share the same category. Perceptual processes and motor-response tendencies have been proposed to shape NCE in masked arrow priming (Eimer & Schlaghecken, 1998). We propose that a third class of processes may be involved, operating at a more central stage of categorization, which is explained by the evaluation window account (Klauer, Teige-Mocigemba, & Spruyt, 2009). In Experiments 1–3, factors considered obligatory for NCE by current arrow-priming accounts were successively removed; NCE remained intact, as predicted by the evaluation window account. In Experiment 4, masks were left out altogether; still, NCE could be observed. Since none of the current accounts can account for NCE without masks, we propose that the evaluation window account describes a hitherto overlooked mechanism that contributes to NCE.

(2078)

Interference in Simultaneously Perceiving and Producing Facial Expressions: Evidence From Electromyography. ELLEN OTTE, UTE HABEL, ANDREA M. PHILIPP, & IRING KOCH, *RWTH Aachen University* (sponsored by Jochen Müsseler)—The present studies aimed to examine perception–action interactions in a socially relevant domain—that is, whether the perception of socially relevant facial actions (e.g., happy vs. angry facial expressions) can facilitate the execution of such actions. We used a stimulus–response compatibility paradigm, in which subjects responded to the gender of a face by either smiling or frowning while ignoring the fact that the presented face is also smiling or frowning. We measured reaction time (RT) as the onset latency, using electromyography on the two large muscle groups used for smiling and frowning. The results of Experiment 1 showed that on compatible trials, in which perceived facial expression and actually produced facial expression matched, RTs were faster than on incompatible trials. Experiment 2 used preinstructed (i.e., blocked) responses and replicated the compatibility effect, suggesting that the effect is functionally located not in response selection, but in response initiation or execution.

• IMPLICIT MEMORY II •

(2079)

Conceptualization of Task Boundaries Facilitates Implicit Learning in the SRT Task. KIMBERLY M. HALVORSON, TANA N. TRUELOVE, & ELIOT HAZELTINE, *University of Iowa* (sponsored by Cathleen M. Moore)—In the serial reaction time (SRT) task, participants make responses to stimuli that appear in an ordered sequence.

Participants are not informed of the sequence, yet they learn it, as indicated by an increase in RT when the sequence is removed. Often, the sequenced task is accompanied by a secondary distractor task that sometimes prevents implicit learning (Schumacher & Schwarb, 2009) and other times does not (Cohen, Ivry, & Keele, 1990). To address this discrepancy, we manipulated whether the SRT and secondary tasks were conceptualized as integrated or separate. Two groups of participants differed only in the instructions and presequence practice. The separate group was informed that they were completing two distinct tasks and showed implicit learning. The integrated group was informed that they were performing a multipart single task. This group did not show implicit learning. The findings indicate that the conceptualization of task boundaries can facilitate implicit learning.

(2080)

Pupillary Response Measures of Eyewitness Identification. FRANK M. MARCHAK & TANNER L. KEIL, *Veridical Research and Design Corporation*—Marchak et al. (2008) demonstrated the efficacy of employing eye movement measures to validate eyewitness identification. Subjects watched a video of a mock crime, engaged in a word search distractor task, and then completed a questionnaire describing the suspect and the crime. Lastly, a simultaneous lineup of six faces was presented while subjects' eye movements and decision confidence were measured. Eye movement measures successfully differentiated viewing of the suspect from the foils even in some instances when the subject's identification was incorrect. This effort extends the previous work by examining differences in pupil response measures to suspect versus foil images and outlines a conceptualization for development of a model for objective eyewitness identification.

(2081)

Additive Effects and Saturation From Multiple Primes. MICHAEL E. ROBERTS, *DePauw University*—Most semantic priming studies have examined the effects of single primes on facilitating a response to a stimulus. In two studies, we tested the influence of multiple primes in a lexical decision task. In the first study, we compared priming effects from one prime and two primes when the respective primes were semantically unrelated, related, and identical to the target stimulus. Priming with unrelated words did not affect response times. Semantic priming with two related words led to a superadditive decrease in response time, whereas perceptual priming with two target words led to an underadditive decrease in response times. In the second study, participants in a lexical decision task were sequentially flashed four words that were semantically related or unrelated to the target. We found a consistent underadditive priming effect and evidence of dueling primacy and recency processes with regard to order effects with semantically related primes.

(2082)

Normal Aging Reduces Stimulus–Decision Priming of Novel Objects. LEAMARIE GORDON & ANJA SOLDAN, *University of Massachusetts, Dartmouth* (sponsored by Anja Soldan)—We examined repetition priming of unfamiliar objects in healthy young and older adults. Subjects viewed line drawings of 3-D objects and structurally impossible figures and decided whether they depicted structurally possible or impossible objects. Each figure was repeated after a short lag (1 or 2 intervening items), a medium lag (~50 items), or a long lag (~50 items and an additional 15-min delay). Young and older adults demonstrated similar levels of priming for possible figures at the short and medium lags, but only the young adults showed priming at the long lag. This indicates that older adults can rapidly form stimulus–decision associations for unfamiliar 3-D objects to support stimulus–decision priming at shorter lags; however, they cannot maintain these representations over longer delays. Priming for impossible objects was found only in the young adults at the short lag, providing further evidence for an age-related decrease in this kind of priming.

(2083)

Costs and Benefits of Processing Emotionally Arousing Stimuli on Neutral Items. KIMBERLY WEAR & KELLY STAMBAUGH, *High Point University*—Enhanced memory for emotionally arousing stimuli

has been clearly demonstrated. However, the effects of processing emotionally arousing stimuli on memory for neutral information have not. Research has demonstrated both enhancement and decrements in memory for neutral items immediately preceding or following emotionally arousing items (Anderson, Wais, & Gabrieli, 2006; Hurlemann et al., 2005; Knight & Mather, 2009; Strange, Hurlemann, & Dolan, 2003). Previous research has used a variety of stimuli (words, line drawings, IAPS images combined with clipart), retrieval methods, and retrieval intervals. The present series of studies utilized the oddball paradigm (Knight & Mather, 2009) with unpleasant, pleasant, and neutral materials. Two types of stimuli (IAPS images with all natural images and ANEW word lists) and two retrieval methods (immediate free recall and delayed recognition) were used in an attempt to clarify effects on neutral items.

(2084)

The Wisdom of Crowds With Informative Priors. MARK STEYVERS & PERNILLE HEMMER, *University of California, Irvine* (sponsored by Mark Steyvers)—We consider the problem of aggregating eyewitness testimony, trying to reconstruct the true sequence of events as best as possible. We introduce a Bayesian model of aggregation that can integrate the recalled memories from a number of independent individuals, while also taking other important factors, such as individual differences and prior knowledge, into account. In an empirical study, we assess both prior knowledge and memory performance by testing people's ability to reconstruct the order of stereotyped events (e.g., getting up in the morning) or random events (e.g., clay animation without a clear story line). We show how adding prior knowledge leads to improved model reconstructions, especially in small groups of error-prone individuals. This Bayesian aggregation model also leads to a "wisdom of crowds" effect, where the model's reconstruction is as good as that of some of the best individuals in the group.

• **WORKING MEMORY II** •

(2085)

Effect of Simile on Working Memory in Reading Comprehension. MAYA KATSUHARA, YUKI OTSUKA, & NAOYUKI OSAKA, *Kyoto University* (sponsored by Naoyuki Osaka)—We investigated the influence of simile on working memory in reading comprehension. Thirty-six participants performed the reading comprehension test and three conditions of the reading span test (RST): simile targeted, simile nontargeted, and control conditions. In the RST, participants were required to read the sentences aloud while keeping track of the target words in each sentence. Simile-targeted and simile-nontargeted conditions required the ability to understand the sentences with similes, whereas the control condition did not require it. We could not find significant differences in performance among the three conditions. However, two simile condtions showed a difference between the control condition in correlation with the reading comprehension test. The results indicated that the simile makes reading easier independently of WM capacity in reading comprehension.

(2086)

Forgetting in Working Memory: Does the Interference Account Work? PIERRE BARROUILLET, SOPHIE PORTRAT, & EVIE VER-GAUWE, *University of Geneva*, & VALÉRIE CAMOS, *Université de Bourgogne and Institut Universitaire de France* (sponsored by Valérie Camos)—The sources of forgetting in working memory are a matter of intense debate: Is there a time-related decay of memory traces, or is forgetting uniquely due to representation-based interference? In a previous study, we claimed to have provided evidence supporting the temporal decay hypothesis (Portrat, Barrouillet, & Camos, 2008). However, Lewandowsky and Oberauer (2009), reanalyzing our data, demonstrated that they do not provide compelling evidence for temporal decay and suggested a class of alternative models favoring a representation-based interference account. We present two of the most plausible extensions of this alternative model in which forgetting results either from novelty encoding or feature sharing. We show that none of these extensions can account for recent findings related to between-domain working memory performance and that both lead to predictions that are contradicted by new empirical evidence supporting forgetting through time-based decay.

(2087)
Working Memory Differences in Remember/Know Judgments for Falsely Recognized Words. MICHAEL BIXTER, *Stony Brook University*, NESINA KRITIKOS, *University of Illinois, Chicago*, NICOLE PETERSON, *Elmhurst College*, FRANCES DANIEL, *Indiana University Northwest*, & HELGA NOICE, *Elmhurst College* (sponsored by Helga Noice)—When warned about the nature of a false memory task, high-working-memory (high-WM) participants falsely recognize fewer semantically related, nonpresented words than do low-working-memory (low-WM) participants. Additionally, when warned, high-WM participants give falsely recognized words more "know" judgments, whereas low-WM participants give those words more "remember" judgments (Bixter et al., 2010). We had participants learn semantically related words and then perform a recognition task that contained presented and semantically related nonpresented words (false memory task). Participants were blind to the nature of the false memory task. We found that there were no differences in recognition for semantically related nonpresented words and presented words as a function of working memory. More important, there were no differences on remember/know judgments for falsely recognized words as a function of working memory.

(2088)
Working Memory Capacity and the Constraint of Visual Attention: Perceptual Grouping Eliminates Individual Differences. ZACHARY M. SHIPSTEAD & RANDALL W. ENGLE, *Georgia Institute of Technology* (sponsored by Randall W. Engle)—To date, several studies have found a relationship between working memory capacity (WMC) and the ability to constrain attention to specific portions of a visual display. The present study utilized a modified version of Lavie's (1995) low-load flanker task in order to examine the role of perceptual grouping. In the primary experiment, a centrally located target item was presented either alone or embedded in a group of neutral items (0s). Both conditions included peripherally located, response-incompatible distractors. The role of the neutral items was to create a clear distinction between the target and distractor. When these target-flanking neutral items were present, WMC-related differences in distractor effects were eliminated. Critically, high-WMC participants were not affected by the presence or absence of neutral items, suggesting that these individuals were particularly adept at constraining attention to prespecified locations. It is argued that these effects cannot be attributed to perceptual load or memory for target/distractor location.

(2089)
Working Memory Capacity and Timing: An Individual Differences Investigation. JAMES M. BROADWAY & RANDALL W. ENGLE, *Georgia Institute of Technology* (sponsored by Richard A. Block)—Processing temporal information is a basic ability shared across species that is important for organized cognition and action. In the present work, we examined whether working memory capacity (WMC) would predict event timing. In temporal reproduction tasks, low-WMC observers overestimated the shortest and underestimated the longest target durations, while accurately estimating intermediate target durations. In contrast, high-WMC observers were more consistently accurate across the range of target durations. Notably, this interaction did not depend on the absolute durations of target durations. Overall, low-WMC reproductions were more variable than high-WMC. Additionally, in a temporal discrimination task, high-WMC observers were more sensitive than low-WMC observers to differences between event durations. Furthermore, temporal reproduction and temporal discrimination results were not affected by including fluid intelligence as a covariate. The results are discussed in terms of attention, working memory, and other psychological constructs.

(2090)
A Processing Approach to the Working Memory/Long-Term Memory Distinction: Evidence From a Levels-of-Processing Span Task. NATHAN S. ROSE, *Rotman Research Institute*, & HENRY L. ROEDIGER III & JOEL MYERSON, *Washington University* (sponsored by Joel Myerson)—Recent studies have raised questions about the extent to which working memory (WM) is dissociable from secondary or long-term memory (LTM). Although many similarities exist between immediate retrieval on WM span tasks and delayed retrieval on LTM tasks, important differences between the two exist as well. To illustrate this point, we adapted Craik and Tulving's classic levels-of-processing paradigm into a WM span task by having participants process 33 words based on visual, phonological, or semantic characteristics, using the same stimuli and instructions as Craik and Tulving (1975). However, we required recall after every 3 or 8 words (rather than after all the words been processed). No benefit of deeper processing occurred on immediate recall, but the typical effect emerged on delayed tests, suggesting a difference between the processes effective for immediate and delayed retrieval. These results are consistent with a transfer-appropriate-processing account of the WM/LTM distinction.

(2091)
fMRI of Object and Location Change Detection. L. CAITLIN ELMORE, ANTONY PASSARO, & TIMOTHY M. ELLMORE, *University of Texas Medical School at Houston*, KENNETH J. LEISING, *Texas Christian University*, JOHN F. MAGNOTTI, *Auburn University*, & ANTHONY A. WRIGHT, *University of Texas Medical School at Houston* (sponsored by Anthony A. Wright)—Change detection has been extensively used to study visual working memory (VWM) in human subjects. Theories of VWM often suggest that information about objects' identities and locations are stored in parallel or bound together in memory. In order to consider this possibility, we used fMRI to characterize the brain activity related to change detection for objects and locations. Subjects were presented with stimulus displays that were matched between the object and location tasks such that visual input was identical, so that differences in brain activity would be the result of differences in the memory requirement. BOLD responses for object and location change detection were compared, and the findings suggest that many common neural substrates are involved in these two forms of VWM, with several differences that may be important.

• **EXPLICIT MEMORY II** •

(2092)
Recollection Can Be Weak and Familiarity Can Be Strong. KATHERINE M. INGRAM, LAURA MICKES, TRAVIS M. CARLISLE, & JOHN T. WIXTED, *University of California, San Diego* (sponsored by Timothy C. Rickard)—Dual-process theorists often use the remember/know procedure to separate recollection-based recognition from familiarity-based recognition. An alternative view of remember/know judgments, based on signal detection theory, holds that a singular memory strength variable underlies recognition memory. However, the signal detection model cannot easily account for the strong feeling of familiarity in the absence of recollection. A new dual-process model (Wixted & Mickes, submitted) that is entirely based on signal detection theory can account for this phenomenon. This model predicts that it should be possible to find higher old/new accuracy but lower source recollection accuracy for the high-confidence know responses, as compared with less confident remember responses. We tested this notion using a modified remember/know procedure where participants could indicate degrees of both familiarity and recollection for each recognition decision. Participants had better old/new accuracy for the higher confidence familiarity-based responses. However, source accuracy (i.e., the ability to recall details) was higher for recollection-based responses.

(2093)
The Role of Recollection in High-Confidence Know Judgments. LAURA MICKES, VIVIAN HWE, & JOHN T. WIXTED, *University of California, San Diego* (sponsored by John T. Wixted)—Wixted and Mickes (submitted) found that when confidence and old/new accuracy for remember and know judgments were equated at a high level, remember judgments were associated with higher source accuracy than were know judgments. This finding suggests that remember/know judgments can provide valid information about recollection and familiarity. We report results from a new experiment designed to test the possibility that subjects respond "know" when they do not remember the criterial source attribute (screen location) but do remember something else (in which

case, high-confidence know judgments would be indicative of noncriterial recollection, not strong familiarity). Subjects responded "R1" if they remembered the criterial source detail, "R2" if they did not remember the criterial source detail but did remember something else, and "K" otherwise. The results suggest that the high old/new accuracy associated with high-confidence know judgments mainly reflects the contribution of strong familiarity, not the contribution of noncriterial recollection.

(2094)

Influence of List Composition on the Testing Effect. CHRISTOPHER A. ROWLAND & EDWARD L. DeLOSH, *Colorado State University* (sponsored by Edward L. DeLosh)—Past research has revealed effects of list composition on several memory phenomena when the item variable of interest is manipulated within lists versus between lists. This research has shown that the generation, word frequency, and bizarreness effects are typically obtained in mixed lists but are largely absent or reversed in pure lists. The present study extends these of effects of list composition to the testing effect. Experiment 1 produced a testing advantage in mixed lists but not pure lists. Experiment 2, which was designed to disrupt the encoding of serial order information during the intervening test/study phase, produced a testing effect in both mixed and pure lists. These findings are interpreted on the basis of an order-encoding framework (DeLosh & McDaniel, 1996), such that testing encourages superior item processing, but at the expense of order processing, relative to studying target items.

(2095)

Is Response Bias in Recognition Memory a Cognitive Trait? JUSTIN KANTNER & D. STEPHEN LINDSAY, *University of Victoria* (sponsored by D. Stephen Lindsay)—Response bias in recognition memory is typically assessed at the group level, but substantial individual differences in bias often underlie group means. From a signal detection theory perspective, these individual differences suggest that some people require more evidence of "oldness" than do others before they will endorse a test probe as old. We investigated the possibility that response bias at the level of the individual represents a cognitive "trait," consistent across time and generalizable to other cognitive tasks in which an evidence criterion might guide judgments. We measured the correlation of response criterion placement across recognition tests and whether the direction and magnitude of subjects' recognition test bias predicted their performance on a test of general knowledge, a DRM task, and an eyewitness suspect-identification task. We also explored the relationship of response bias to various personality traits.

(2096)

Brain Activity During Feeling Nostalgia and Retrieving Autobiographical Memories: An fMRI Study Using Music Excerpts. JUN KAWAGUCHI, *Nagoya University*, USUI NOBUO, *Nihon University*, SACHIO OTSUKA, *Nagoya University*, & MASATO TAIRA, *Tokyo Medical and Dental University*—When people encounter old pictures and songs, they sometimes have strong feelings of nostalgia. Nostalgia is a kind of emotion that everyone knows, but little is known what exactly it is, how it is elicited, and what kind of neural basis underlies it. This study employed functional magnetic resonance imaging to examine which parts of brain were activated when participants felt nostalgia. On each trial, participants were presented with excerpts of music that had been popular in the last 15 years and were asked to evaluate strength of nostalgia and amount of retrieving personal episodic memories (autobiographical memories). An event-related design was employed. The results showed that the medial frontal cortex and medial temporal cortex, including the parahippocampal gyrus, were associated with the strength of the feeling of nostalgia. These areas are mainly involved in the evaluation of self-relevant information and emotions, suggesting that nostalgia could emerge through these processes.

(2097)

Effects of Perceived Long-Term Stress on Health and Memory Functioning. DANIEL ERIKSSON, *Umeå University*, LARS-GÖRAN NILSSON, *Stockholm University*, & MICHAEL RÖNNLUND & ANNA SUNDSTRÖM, *Umeå University* (sponsored by Lars-Göran Nilsson)—The study examined effects of perceived long-term stress on health and memory functioning in middle-aged individuals (40–60 years). Participants in the Betula study (Nilsson et al., 1997) describing themselves as being stressed in general over three measurement occasions (10 years in total) were compared with a matched (sex and education) group ($n = 98$) reporting no stress. The results revealed a higher incidence of depressive symptoms, flus, and not-healthy-ratings over time for the stress group. In addition, the stress group provided more negative subjective memory ratings, whereas time-related change in memory performance, indicative of a high degree of cognitive stability, did not differ from that of controls. Degree of perceived stress is discussed as a factor underlying variations in regard to the outcome of studies of perceived stress.

(2098)

Combining Physical Exercise and Repetition-Lag Training to Improve Everyday Memory Function in Older Adults. KATHRYN L. GIGLER, *Northwestern University*, JANINE M. JENNINGS, DALE DAGENBACH, JEFFREY A. KATULA, & ROBIN W. DOVE, *Wake Forest University*, & SHANNON STARK, *Arizona State University* (sponsored by Janine M. Jennings)—Cognitive and physical activity interventions have been shown to improve older adults' performance on lab-based measures of memory and executive function. However, less work has examined the real-world benefits of these two types of interventions, particularly when administered in conjunction with one another. The present study, which was part of the Seniors Health and Activity Research Program pilot trial, explored the independent and combined effects of repetition-lag memory training and aerobic exercise training on the frequency of self-reported memory errors in older adults. Following 4 months of training, a significant decrease in errors was observed for both the repetition-lag-only group and the combined exercise and repetition-lag group, with no benefit for the exercise-only participants. These results suggest that repetition-lag training may be more efficacious than physical exercise for reducing everyday memory errors and that cognitive and physical activity training may not produce additive effects when administered together.

(2099)

The Differential Effectiveness of Implementation Intentions. JOSEPH T. MEEKS, MATTHEW K. MEISEL, & JENNA L. WALL, *Southern Illinois University, Edwardsville*—Implementation intentions represent the detailed planning associated with an intention. This planning involves the establishment of effective situational cues, as well as strongly linking the cues to a target action (Gollwitzer, 1999). Previous research demonstrated that these encoding strategies are effective in some laboratory and naturalistic settings (e.g., McDaniel & Howard, 2008). Given that implementation intentions may take time and effort to establish, one goal is to find boundary conditions in which implementation intentions are not as effective. In the present set of experiments, we compared implementation intentions with nonimplementation intentions in a laboratory event-based prospective memory paradigm. The results demonstrated that the effectiveness of planning depended on the number of event cues and the target actions encoded. Implementation intentions were most effective with relatively few cues and with multiple target actions. When multiple cues were used with one target action, the effect of implementation intentions diminished.

(2100)

Signal Detection Analysis of Age Differences in the Revelation Effect. ANJALI THAPAR, JACOBA ZARING, & DEVON DAUTRICH, *Bryn Mawr College*, & MATTHEW J. PRULL, *Whitman College*—Thapar and Sniezek (2008) reported that older adults are susceptible to a memory illusion referred to as the revelation effect. This experiment examined age-related differences in the revelation effect when the revealed word was different from the recognition memory probe and used signal detection theory to investigate the locus of the revelation effect in older adults. A reliable revelation effect was observed in older adults, and the locus of the revelation effect was design dependent. Replicating Verde and Rotello (2004), the effect was due to changes in response bias when

the revealed item was different from the recognition memory probe and to changes in memory sensitivity when the revealed item was identical to the recognition memory probe.

(2101)

The Impact of Knowledge and Mnemonic Chunking Strategies in Eliminating the Fan Effect. TRAVIS R. RICKS, *Brigham Young University–Idaho*, & JENNIFER WILEY, *University of Illinois, Chicago*—This research examines whether domain knowledge or training on mnemonic chunking strategies enables participants to overcome the fan effect with baseball-related sentences. One goal was to enable low-knowledge participants to be able to integrate or chunk stimuli during study even without the aid of prior domain knowledge. In a first study, neither high- nor low-knowledge participants were given strategy training, and neither overcame the fan effect with a set of sentences that randomly paired baseball players and locations. In a second study, participants were presented with sentences with plausible pairings of baseball players and locations. This improved performance for high-knowledge participants. In a third study, all participants were trained on mnemonic chunking strategies. The results revealed an interaction between strategy use and baseball knowledge; however, it was the high-knowledge participants who seemed to take advantage of the chunking strategy. Observed benefits from domain knowledge and strategy use are discussed in terms of improved memory and decision-making processes.

(2102)

The Forgetting of Negative Autobiographical Memories Through Retrieval-Induced Forgetting. TARA A. JOBE & BENJAMIN C. STORM, *University of Illinois, Chicago* (sponsored by Benjamin C. Storm)—One mechanism by which sad, painful, and embarrassing memories might be forgotten is retrieval inhibition. Work on retrieval-induced forgetting has shown that the selective retrieval of some items in memory can cause the forgetting of other items in memory. This forgetting is believed to be the consequence of inhibitory processes that resolve competition from unwanted or nontarget items so as to facilitate the retrieval of wanted or target items. If retrieval-induced forgetting does underlie the forgetting of negative autobiographical events, individual differences in retrieval-induced forgetting should predict the extent to which people are able to recall such events. We tested this hypothesis by measuring retrieval-induced forgetting and correlating that measure with the ability of participants to recall negative events from their own past. Our hypothesis was supported; individuals exhibiting more retrieval-induced forgetting were significantly less able to recall negative autobiographical events than were individuals exhibiting less retrieval-induced forgetting.

(2103)

When and Why Does Pretesting Enhance Subsequent Encoding? PHILLIP J. GRIMALDI & JEFFREY D. KARPICKE, *Purdue University*—Taking a pretest can enhance subsequent encoding even when retrieval on the pretest fails. Kornell, Hays, and Bjork (2009) proposed that when people attempt retrieval on a pretest, they activate concepts related to the retrieval cue and this enhances encoding of the target word during subsequent study. We examined this theory in a series of experiments. Experiment 1 showed that pretesting enhanced subsequent encoding when cues were weakly related to targets, but not when cues and targets were unrelated. Experiment 2 showed that pretesting did not enhance encoding if a brief delay occurred between the pretest and study trial. This absence of a pretesting effect suggests that the activation afforded by the pretest is short-lived (cf. McNamara, 1992). The results support Kornell et al.'s theory. Pretesting enhances encoding of related targets, but not unrelated ones, and the pretesting effect disappears when a delay occurs between the pretest and study trial.

(2104)

Reducing Encoding Resources Paradoxically Boosts Memory on an Explicit Test Without Awareness. NIGEL GOPIE, NATHAN S. ROSE, & FERGUS I. M. CRAIK, *Rotman Research Institute and University of Toronto* (sponsored by Fergus I. M. Craik)—Adults under divided attention (DA) at encoding remember irrelevant information in a remarkably different way, as compared with adults under full attention (FA) at encoding. Gopie, Craik, and Hasher (2010) demonstrated that FA adults had better explicit memory for irrelevant information than did DA adults. The pattern was reversed, however, on an implicit test of memory: DA adults now had better memory than did FA adults. The present study extended the DA adults' memory benefit to an explicit test. The results from a four-alternative forced choice recognition test indicated that DA adults, but not FA adults, benefitted from their implicit knowledge of irrelevant information on an explicit memory test, without any awareness (i.e., when participants thought they were simply guessing). Therefore, DA encoding of irrelevant information benefits both implicit and explicit memory tests despite participants' having no conscious awareness of using information from the prior learning episode.

(2105)

Retrieval-Induced Forgetting of Lateralized Visual Memories. GERD T. WALDHAUSER, *Lund University*, SIMON HANSLMAYR, *Regensburg University*, & MIKAEL JOHANSSON, *Lund University* (sponsored by Alp Aslan)—Selective memory retrieval often leads to forgetting of related and interfering information. We investigated such retrieval-induced forgetting and its neural correlates in lateralized visual memories. Participants learned abstract shapes that were presented twice at a central position. Each shape was paired with two different colors, one appearing in the left and the other in the right visual hemifield. Subsequently, participants practiced retrieval of one color when cued with the shape and a placeholder indicating color position. We hypothesized that practicing retrieval of one color would entail inhibition of the unpracticed and interfering color. Supporting this hypothesis, subsequent recall of unpracticed colors was impaired, when compared with shape–color combinations that were not manipulated in the practice phase. This effect occurred independently of presentation hemifield, indicating memory inhibition in both brain hemispheres. Measuring the electroencephalogram during retrieval practice allowed us to dissociate the lateralized correlates of memory control and inhibition.

(2106)

Memory for Emotional Events in the Misinformation Paradigm. ILSE VAN DAMME, KAROLIEN SMETS, & GÉRY D'YDEWALLE, *Katholieke Universiteit Leuven* (sponsored by Géry d'Ydewalle)—Research has shown that (negative) emotional events are remembered better than neutral events are. Nevertheless, recent studies suggest that they might also elicit an increase in false memories. The present experiment was designed to disentangle the influence of valence and arousal on performance in the misinformation paradigm. Participants were presented with five pictures: positive with high arousal, positive with low arousal, negative with high arousal, negative with low arousal, and neutral with average arousal. Half of the participants were exposed to misleading information. A subsequent recognition test contained true/false statements referring to either correct or incorrect details or to the misinformation provided earlier. Emotional pictures induced more correct responses than the neutral picture did. Also, a "misinformation effect" was obtained: Misled participants more frequently judged the (peripheral) misinformation to be true than did control participants. False memories were most frequent for the pictures depicting neutral and negative highly arousing events.

(2107)

Handedness as a Predictor of Recognition Memory. ELLEN HINKEL REED & DONNA J. LaVOIE, *Saint Louis University* (sponsored by Ronald T. Kellogg)—This study examined the relationship between handedness and recognition performance during completion of a false memory task. Handedness, serving as a proxy for hemispheric processing differences, was predicted to correlate with individuals' false recognition, as well as predict remember/know judgments linked to recognition decisions. Handedness was shown to be a predictor of both veridical memory performance (i.e., hit rates) and false memory (i.e., critical false alarm rates), with left-handed individuals showing higher rates of both. Correlations were also observed between handedness and remember/know judgments. The type of hemispheric processing initially engaged during encoding appears to influence both recognition performance and its corresponding phenomenology.

(2108)

Context Change and Not Retrieval Inhibition is Responsible for Directed Forgetting in Recognition. MACIEJ HANCZAKOWSKI, *University of Hull*, TOMASZ PASEK & KATARZYNA ZAWADZKA, *Jagiellonian University*, & GIULIANA MAZZONI, *University of Hull* (sponsored by Giuliana Mazzoni)—In list-method directed forgetting, people's ability to forget one of the sets of learned material is examined. Research shows that memory of to-be-forgotten items is impaired when assessed by a recognition test reliant on recollective processes. Retrieval inhibition and context-change mechanisms have been proposed to account for the directed forgetting effects. Retrieval inhibition postulates a general impairment in recollection, whereas the context-change account predicts impairment only when recollection makes use of contextual associations. In the present experiments, directed forgetting was examined in recollection-based recognition tasks. The effect was obtained only in a list discrimination task that utilized contextual associations, but not in an associative recognition task that utilized interitem associations. The results indicate that impairment in recollection is not general and provide converging evidence to support the context-change account of the directed-forgetting effect.

(2109)

Source Monitoring in Confabulation. IRENE P. KAN, *Villanova University Memory Disorders Research Center and VA Boston Healthcare System*, & KAREN F. LAROCQUE & MIEKE VERFAELLIE, *Memory Disorders Research Center, VA Boston Healthcare System, and Boston University*—Confabulation, commonly observed in patients with ruptured anterior communicating artery aneurysm, refers to patients' tendency to confuse true and untrue memories. This condition is sometimes referred to as "honest lying," because individuals who confabulate tend to believe in the distorted memories with conviction. Although the nature of these memory distortions varies, one frequently observed characteristic is confabulators' impairment in source monitoring. However, relatively little is known about the specificity of this source-monitoring deficit. Here, we examined whether confabulators may be differentially impaired at monitoring information from different sources. We compared monitoring of self-generated information (imagined/perceived: Did I imagine or see a picture of an apple?) and monitoring of externally provided information (spatial location: Was the picture presented on the left or on the right?). As compared with nonconfabulators, confabulators are impaired at monitoring self-generated information; however, the two groups performed similarly when required to monitor externally provided information.

(2110)

I Just Remember It Was Bad: Recognition of Emotional Images From RSVP Picture Lists. GREGORY E. DEVORE & PAUL HAERICH, *Loma Linda University*—Priority-binding theory predicts enhanced memory performance for negative emotional stimuli in heterogeneous lists combining negative and neutral stimuli at sufficiently fast presentation rates. Counterintuitively, the theory also predicts equivalent memory performance for negative and neutral items if presented in homogeneous lists, because no stimulus receives contextual priority. Here, we tested the predictions of priority-binding theory, using both heterogeneous and homogeneous RSVP (1 Hz) lists and neutral or negative images selected from the International Affective Picture System. Subjects' recognition memory (old/new) was tested following each list. Analyses of recognition performance revealed greater sensitivity (d') for neutral as compared with negative images across both list types. Analyses of remember/know differences revealed a significant increase in the proportion of remember judgments for negative image false alarms, as compared with neutral images. These data do not support priority-binding theory and suggest that a liberal criterion disproportionately affects sensitivity for negative images in RSVP recognition memory paradigms.

• **METAMEMORY II** •

(2111)

Cognitive and Metacognitive Differences Between Problem and Nonproblem Gamblers in Wagering Tasks. SARA E. LUEDDEKE & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Philip A. Higham)—Sensitivity to bias manipulations was investigated between nonproblem gamblers and problem gamblers in two wagering experiments, using Type 2 signal detection theory (SDT). SDT is able to separate three cognitive and metacognitive performance parameters: accuracy, metacognitive monitoring, and bias. Experiment 1 manipulated wager structures using a probability-based dice task and found that nonproblem gamblers demonstrated higher accuracy, better monitoring ability, and set gambling criteria that were more optimal than did problem gamblers. Experiment 2 addressed differences between the two groups using a general knowledge task with the same wager structures as those in Experiment 1. In this experiment, problem gamblers demonstrated accuracy and monitoring similar to those of nonproblem gamblers but again deviated further from their optimal gambling criteria. Together, the findings from both experiments suggest that problem gamblers have a general deficit in setting appropriate gambling criteria, with additional accuracy and monitoring problems when engaged specifically with probability-based tasks.

(2112)

The Effects of Intertarget Association and Encoding Processes on Memory and Metamemory Performance. MEHMET AKIF GUZEL & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Timothy J. Perfect)—Research is described examining the effect of the number of categories represented in study lists on retrieval and monitoring in recall. Although it is well known that categorization can improve retrieval of targets (e.g., Tulving & Pearlstone, 1966), the effect of categorization on metamemory is unclear. In Experiment 1, the number of categories within the study list was manipulated (i.e., two, six, or multiple). The manipulation revealed a dissociation between retrieval and monitoring. That is, as the number of categories decreased (thus increasing interitem associations), retrieval improved as expected. However, there was a cost in that metacognitive monitoring deteriorated. The dissociation is explained in terms of the content of participants' search sets: Search sets were more likely to contain the target with easily identifiable categories, enhancing retrieval, but high interitem association within the set made target identification difficult, harming monitoring. Subsequent experiments investigated inducing these dissociations with processing manipulations.

(2113)

From Bad to Worse: Variations in Judgments of Associative Memory. ERIN M. BUCHANAN, *Missouri State University*—Four different groups were tested in variations of the judgments of memory task created by Maki (2007a). Participants judged word pairs on the strength of their relationship, performed a free association task (Nelson, McEvoy, & Schreiber, 2004), and judged how many words were related to a given cue word. As was seen in Maki (2007a, 2007b), participants cannot discriminate between word pairs with high and low relationships. This finding was extended to show that people also cannot free associate word pairs with different numbers of associates or even judge how many associates a cue word is linked to in memory. However, participants' judgment ability varied widely in each one of the tasks. Working memory and fluid intelligence were measured in order to examine metacognitive errors but had little to no influence on participant ability to judge word pair relationships.

(2114)

Specific and General Warnings in the Misinformation Effect. KARLOS LUNA, *University of Minho*, PHILIP A. HIGHAM, *University of Southampton*, & HARTMUT BLANK, *University of Portsmouth* (sponsored by Elvira García-Bajos)—Previous research has shown that postevent misinformation impairs both memory and metamemory performance. The present research examined the effects of general and item-specific warnings on these effects. Participants watched a slideshow about a crime and later received misinformation in the form of narratives. Before undergoing a two-alternative recognition test, all participants received a general warning about the presence of misinformation. In addition, half of the participants received item-specific warnings: Using a color code, each test question was identified as one for which the participants had either received misinformation or not. The results showed impaired accuracy and metamemory, despite the general warning, but no

effect of misinformation and intact metamemory with specific warnings. The results suggest that a general warning about the presence of misinformation was not sufficient to reduce its pernicious effects but that specific warnings are highly effective in doing so.

(2115)

Direct Retrieval or Generate–Recognize: Strategic Choice of Production Mode. VERED HALAMISH, *UCLA*, MORRIS GOLDSMITH, *University of Haifa*, & LARRY L. JACOBY, *Washington University* (sponsored by Morris Goldsmith)—We examined the idea that rememberers choose an appropriate retrieval strategy on the basis of subjective knowledge about global properties of the solicited information. From a strategic standpoint, when a to-be-remembered list includes both strongly and weakly related word pairs, one should adopt a production mode that is suited to the more frequent type of item: generate–recognize when the majority are strongly related and direct retrieval when the majority are weakly related. Three experiments, conducted within the metacognitively guided retrieval and report framework, supported this prediction: Weakly related pairs were recalled better, and first-candidate production quality was higher, when the majority of studied pairs were weakly related than when the majority were strongly related. The opposite pattern was found for strongly related items, but only when testing was delayed by 24 h, so that a generate–recognize strategy would be more effective than direct retrieval for those items.

(2116)

False Hearing: Age Differences in Meta-Audition. CHAD S. ROGERS, LARRY L. JACOBY, & MITCHELL S. SOMMERS, *Washington University* (sponsored by Mitchell S. Sommers)—Prior research has suggested that as people grow older, they use contextual information to compensate for their age-related hearing loss (Pichora-Fuller, 2008; Schneider, 2002; Wingfeld, Tun, & McCoy, 2005). In two experiments, we tested how older adults' hearing changes in situations where context is misleading. To control for age differences in hearing acuity, we adjusted the level of noise masking according to each participant's hearing thresholds. In addition to accuracy, we measured confidence to assess participants' meta-audition—their subjective experience of hearing. We found that older adults were more likely than young adults to falsely "hear" words favored by context and did so with extremely high confidence. Furthermore, older adults' confidence judgments were less sensitive than young adults' to changes in the amount of noise masking. Such a finding could explain why older adults are frequently unhappy with their hearing aids, because hearing amplification increases sensory, not contextual information.

(2117)

An Act of Memory Retrieval Distorts Time. DOUG YOVANOVICH & MONIQUE ZNAMIEC, *University of California, San Diego* (sponsored by Diana Deutsch)—Two experiments investigated the effect of veridical remembering on the subjective experience of time. Recognition memory was modeled with signal detection theory, and observers' responses were fit to binomial and Gaussian distributions, providing a measure of perceptual distance for remembered versus nonremembered events. The results were further partitioned by the dependent variable of interest—perceived duration—and fit to psychometric response curves for time. The results revealed a time distortion effect accompanying recognition decisions across a wide range of conditions, even when retrieval and rehearsal were controlled. Analysis of duration judgments by confidence ratings showed that the effect occurs most strongly for high-confidence hits and correct rejections, with a Gaussian pattern in between. A follow-up study manipulated signal strength through repetition in the encoding phase and showed converging evidence. The results are interpreted in the frameworks proposed by White and Wixted ("Psychophysics of Remembering," 1999) and current models of time perception.

• SPATIAL COGNITION II •

(2118)

Cue-Based Bias for Location Estimates on Maps or in Virtual Environments. ADAM T. HUTCHESON & DOUGLAS H. WEDELL, *University of South Carolina* (sponsored by Douglas H. Wedell)—Cues can bias memory for location through categorical encoding when features of the environment are unstable. Our study compared two methods of eliciting memory for target locations encoded from a map, either by pointing to locations on the same map or by navigating to locations in a virtual environment (VE) depicted by the map. After learning a target location from a map of a circular arena, participants indicated the location on the map and then navigated to it in the VE, or they performed the tasks in reverse order. Cues were located outside the arena either at the north and south ends or at the east and west ends. The results showed a strong tendency to underestimate distance from the center for VE navigation, but not for map pointing. Estimates were biased toward cue locations for maps, but they were biased in the opposite direction for VE navigation.

(2119)

Spatial Ability and Problem Solving in the Geosciences. DALE S. KLOPFER, LAURA M. LEVENTHAL, & BRANDI A. KLEIN, *Bowling Green State University*, JEREMY R. ATHY, *U. S. Army Aeromedical Research Lab*, & CHERYL A. COHEN, *Michigan Technological University*—Visualizing 3-D structure from 2-D input is a necessary skill for geoscientists, a skill that should correlate with spatial ability. We examine two tasks—deriving topographic profiles from contour maps and creating cross sections of a geologic block—for their correlates with spatial ability and ease of training. Performance on the profile task, which seems to involve visualization of terrain and 3-D rotation, is initially unrelated to spatial ability but is after training. Moreover, terrain visualization is initially unrelated to profile performance but is after training. Performance on the cross-section task, which seems to involve visualization of geologic structures in depth, does not correlate with a visualization test. Nonetheless, there are clear individual differences in how people create cross sections that are close to or far from the front of the block. The cross-section task may draw upon spatial skills not typically measured, such as Kali and Orion's (1996) "visual penetration ability."

(2120)

Map Learning May Be Impaired After Right-Hemisphere Stroke. PEII CHEN, *Kessler Foundation Research Center and UMDNJ*, C. PRISCILLA GALARZA, *Kessler Foundation Research Center*, KIMBERLY HREHA, *Kessler Institute for Rehabilitation*, TARA MICELI, *Atlantic Rehabilitation Institute*, & ANNA M. BARRETT, *Kessler Foundation Research Center and UMDNJ*—Typically, learning a complex figure proceeds in a global-to-local fashion. Lesions in the right cerebral hemisphere may impair this style of processing. However, few studies have addressed how such impairment affects processing of complex figures that are ecological, such as studying a map. In this study, healthy individuals and stroke survivors with right-brain damages were to learn two complex figures, one abstract (the modified Taylor complex figure) and the other ecologically meaningful (a small-scaled political map of Australia). As compared with the healthy participants, one third of the poststroke participants copied and recalled the abstract figure less accurately and in a less organized manner. In addition, these stroke survivors, who showed abnormalities in encoding and retrieval of the abstract figure, performed abnormally in the Australia map test when questioned on the higher, rather than the lower, level of hierarchy (state vs. city). Gestalt processing and functions of the right brain are discussed.

(2121)

Body Parts Facilitate Nonrotational Processes During Judgments About Rotated Figures. ALFRED B. YU & JEFFREY M. ZACKS, *Washington University*, & LAURA M. D'ANDREA, *University of Illinois, Urbana-Champaign* (sponsored by Jeffrey M. Zacks)—Bodies are special; across a range of tasks, people process bodies differently (often more efficiently) than they do other classes of stimuli. We investigated how bodies are processed when judgments are made about the spatial configuration of misoriented figures. Participants made same–different judgments about pairs of rotated figures that varied in similarity to the human form. Abstract block figures led to the slowest judgments. Adding a human head to the figure or replacing the whole figure with a human body improved performance. Adding a teapot in place of the head also

improved performance. These results differ from previous findings, in that adding body parts did not affect the relation between figure orientation and response time. These data suggest that body parts help participants to quickly and accurately identify the orientation of the figures, rather than the process of rotating a mental image. This benefit may be valuable for the design of information displays.

(2122)

Chinking in Spatial Memory From Route Experience. JESSE Q. SARGENT & JEFFREY M. ZACKS, *Washington University*—In exploring new environments, we store visual and other sensory information that describes the particular routes followed. In order to then use that route information to support flexible, adaptive (e.g., navigational) behavior, we must make spatial inferences on the basis of that information. The present study examines this inferential ability. Participants viewed a video shot by someone walking around the circumference of an outdoor park, during which nine target objects were named in a voice-over. Immediately afterward, participants arranged icons of the objects on an overhead line drawing of the path walked in the video. We examine individual differences in performance measures, including Euclidean error, and the degree to which certain object locations appear to be chunked together in spatial memory. The results suggest that the fidelity of inferred survey perspective representations was largely a factor of the influence of categorical information—that is, the grouping of the target objects into discrete chunks.

(2125–2132)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

• SPEECH PERCEPTION III •

(3001)

When Cues Collide: How Distal Speech Rate and Proximal Acoustic Information Influence Word Segmentation. CHRISTOPHER C. HEFFNER & LAURA C. DILLEY, *Michigan State University* (sponsored by Laura C. Dilley)—Contextual, or distal, speech rate has recently been shown to be important for perceiving and segmenting words with highly reduced segmental onsets from continuous speech. How do listeners integrate speech rate with local acoustic cues to determine whether a reduced word is present in speech and where it begins? In several experiments, distal speech rate was parametrically varied in speech fragments containing a reduced token of the function word "her," while also manipulating one of several cues proximal to the critical word: (1) intensity, (2) frequency, (3) word duration, and (4) a naturalistic combination of intensity and noise cues reflecting /h/. For each combination of cues, listeners responded whether the critical function word was present. The results indicate that both distal speech rate and proximal acoustic cues factor into word segmentation decisions, consistent with the view that listeners use every tool at their disposal to make sense of fluent speech.

(3002)

How Lexical is the Lexicon? Evidence for Integrated Memory Representations. APRIL PUFAHL, *Stony Brook University*, & ARTHUR G. SAMUEL, *Stony Brook University and Basque Center on Cognition, Brain, and Language (IKERBASQUE)*—Previous research has shown that lexical representations must include not only linguistic information (what word was said), but also indexical information (how it was said and by whom). The present work demonstrates that even this expansion is not sufficient. Seemingly irrelevant information, such as an unattended background sound, is retained in memory and can facilitate subsequent speech perception. We presented participants with spoken words paired with environmental sounds (e.g., a phone ringing) and had them make an animate/inanimate judgment for each word. Later performance identifying filtered versions of the words was impaired to a similar degree if the voice changed or if the background sound changed. Moreover, we observed the same result when we reversed the roles of the words and the environmental sounds, suggesting this is not a unique property of the lexicon. Lexical representations are memory representations and are not walled off from those for other sounds.

(3003)

Attentive and Nonattentive Native Vowel Perception in French. CHIZURU DEGUCHI, *University of Padua*, JULIE CHOBERT, *Institut de Neurosciences Cognitives de la Méditerranée, CNRS-Marseille*, ANGÈLE BRUNELLIÈRE & NOËL NGUYEN, *CNRS and Aix-Marseille University*, LUCIA COLOMBO, *University of Padua*, & MIREILLE BESSON, *Institut de Neurosciences Cognitives de la Méditerranée, CNRS-Marseille* (sponsored by Lucia Colombo)—We investigated the effects of acoustic distance and of speaker's variability on the preattentive and attentive processing of French vowels by French adult speakers, using the event-related potential (ERP). An auditory oddball sequence including /u/ as the standard and /o/, /y/, and /ø/ as deviants, each produced by three different speakers, was presented while participants watched a silent movie (passive condition) and discriminated deviant vowels (active condition). In the F1–F2 acoustic space, the standard–deviant distance was smaller for /o/ than for the other deviants. In the passive condition, the mismatch negativity reflected acoustic distance between vowels without effects of speaker variability, demonstrating preattentive categorization. In the active condition, acoustic distance influenced task difficulty and the N1, N2, and P3 components. Interestingly, a significant vowel × speaker interaction was found in the active condition, showing that subtle within-category differences are processed only when listeners pay attention to the stimuli.

(3004)

Spoken Gesture Is Integrated With Sentence Meaning During Speech Comprehension. SERENA KLOS & HOWARD C. NUSBAUM, *University of Chicago* (sponsored by Howard C. Nusbaum)—We define spoken gesture as analog acoustic variations in speech that describe events. Previous research shows that spoken gesture is utilized spontaneously by speakers and listeners, but these studies examined spoken gesture use without other descriptive information. The present study examined real-time integration of spoken gesture with lexical-propositional information in a sentence. Sentences were presented in which the lexical-sentential properties and the acoustic properties of the sentence were either congruent or incongruent in describing objects. Participants judged sentence meaningfulness in a speeded task. Although spoken gesture was not necessary to judge meaningfulness, response times were significantly slowed by incongruence. For example, it was harder to judge as meaningful "The car is stopped" when it was spoken quickly than when spoken slowly. These results suggest that spoken gesture may be integrated with propositional meaning during sentence understanding to create a single integrated interpretation of the event being described in speech.

(3005)

Syntactic Influences on Resolving Prior Lexical Ambiguities. CHRISTINE SZOSTAK & MARK A. PITT, *Ohio State University*—A lexically ambiguous spoken word (e.g., "*ing," where * indicates noise) can be resolved by a subsequent disambiguating word (e.g., "The *ing had feathers"). Three experiments investigated what effect sentence closure has on resolving the ambiguity (e.g., "The *ing had feathers. They were found everywhere." vs. "The *ing fell. Feathers were found everywhere."). Regardless of the proximity of the closure to the disambiguating word (near or far), a marked reduction in ambiguity resolution was found when the closure occurred between the ambiguity and the disambiguating word. The integration of syntactic and semantic information in working memory and their joint influence on spoken word recognition are discussed.

• DISCOURSE PROCESSING •

(3006)

A New Measure for Capturing the Component Processes in Comprehension in Prereaders. BRENDA A. M. HANNON, *University of Texas, San Antonio*—Currently, there are no reliable measures that assess higher level processes in comprehension before or as a child begins to read. However, if such a measure were to exist, it would be of great interest to researchers, educators, and parents, because it could serve as a tool for diagnosing problems in reading before they actually happen. Therefore, the goal of this research was to develop and validate the first interactive, theoretically motivated measure that provides estimates of a prereader's ability to execute higher level cognitive processes that are implicated in comprehension (e.g., the ability to access and integrate information from long-term memory with new text information, the ability to make text-based inferences, and the ability to recall text). This new prereader component processes measure is based on the adult version developed by Hannon and Daneman (2001, 2006, 2009), but it uses pictures and auditory text, making it more suitable for 4- to 7-year-olds.

(3007)

Predictors and Consequences of Empathy on Narrative Comprehension. HIDETSUGU KOMEDA, *Northwestern University*, KOHEI TSUNEMI, KEISUKE INOHARA, & TAKASHI KUSUMI, *Kyoto University*, & DAVID N. RAPP, *Northwestern University*—We often empathize with the trials and tribulations of story characters. This form of empathy has important consequences for our processing and comprehension of texts (e.g., Komeda, Nihei, & Kusumi, 2005). The present project begins elucidating an account of the conditions that might encourage such empathy. In two experiments, participants read 42 brief stories that potentially described protagonists as extraverted or neurotic. Participants' personalities were also measured along the dimensions of extraversion and neuroticism, using the Revised NEO Personality Inventory. In Experiment 1, participants were faster to judge protagonists'

emotional states when their personalities matched those of the story protagonist. In Experiment 2, however, participants' explicit reports of empathy for story characters were not uniformly a function of such similarity. Consequently, similarities between story characters and readers might enhance enjoyment of texts but are only partially useful for predicting whether empathy will emerge from reading experiences.

(3008)

Caffeine Enhances Global Language Processing: Evidence From a Proofreading Task. TAD T. BRUNYE & CAROLINE R. MAHONEY, *Tufts University and United States Army NSRDEC*, DAVID N. RAPP, *Northwestern University*, GRACE E. GILES, *Tufts University and United States Army NSRDEC*, HARRIS R. LIEBERMAN, *United States Army Research Institute of Environmental Medicine*, & HOLLY A. TAYLOR, *Tufts University*—The present work investigated the effects of caffeine (0, 100, 200, and 400 mg) on a proofreading task that required readers to identify and correct four error types in extended discourse: simple surface errors (misspelling one- and two-syllable words), complex surface errors (misspelling three- to five-syllable words), simple contextual errors (homonym swaps), and complex contextual errors (subject–verb agreement, verb tense). In two placebo-controlled, double-blind studies using repeated measures designs, we found higher detection rates of complex contextual errors, asymptoting at 400 mg in high consumers (Experiment 1) and 200 mg in low consumers (Experiment 2). Detection rates for the other three error types were not affected by caffeine consumption. Taken together, we demonstrate that caffeine has differential effects on error detection as a function of dose and error type and support the notion that central nervous system stimulants may enhance global processing, perhaps due to increased serotonin and norepinephrine availability in the right brain hemisphere.

(3009)

Comprehension and Learning From Science Texts: Why Refutation Texts Work and Analogy Texts Don't. SANDRA FULTON, *McGill University*, & PANAYIOTA KENDEOU, *Neapolis University Pafos*—This study investigated the effects of prior knowledge and text structure on the comprehension of science texts. Three text structures were compared: refutation, analogy, and expository. Online processes were investigated using a think-aloud methodology. Measures of prior knowledge, reading comprehension skill, and topic interest also were obtained. The results suggested that readers adjusted their processing as a function of the interaction between prior knowledge and text structure. Readers with incorrect prior knowledge made larger adjustments in processing when presented with refutation and analogy texts, but those adjustments resulted in better comprehension only for refutation texts. Analogy texts were more likely to elicit associations and explanatory inferences that did not enhance coherence, even for readers with high prior knowledge. The findings contribute to our understanding of the relation between individual differences and text characteristics as they impact science text comprehension and have implications for theories of reading comprehension and conceptual change.

(3010)

The Language of Love? Humor and Creative Language in Dating Ads. KAREN A. HUSSEY, *Mount Allison University*, ANDREA E. BOWES, *University of Western Ontario*, & SCOTT A. LEITH, *Wilfrid Laurier University*—In conversation, a male confederate employing metaphorical language was more positively perceived than when he used only literal language (Hussey, Katz, & Leith, in review). We tested the hypothesis that creative language is employed as a strategy of sexual selection; the use of creative language (e.g., metaphor, humor) may be used by males as an indicator of intellectual fitness. Using dating ads as stimuli, we created a series of ads that used literal, metaphorical, or humorous language and asked participants to rate the ad writers, who were portrayed as either male or female. Although participants indicated that sense of humor was desirable in a mate, stimuli that employed humor were not rated as positively as those using either metaphor or literal language. This may be related to the agreeableness of different styles of humor. We are currently investigating how styles of humor are related to gender differences in language use.

• VISION III •

(3011)

Rapid Categorization of Paintings and the Efficiency of Artistic Representations. DANIEL J. GRAHAM & MING MENG, *Dartmouth College*—Paintings are readily perceived as representations of objects and scenes, yet statistical relationships between natural images and paintings are nontrivial. Although spatial frequency content is generally similar for art and scenes, paintings cannot reproduce the dynamic range of luminance in scenes, which necessitates nonlinear local and global luminance scaling. Here, we investigate the notion that artists' representational strategies efficiently capture salient features of natural images. We report that humans perform near flawless discriminations of faces and nonfaces in both paintings and natural images, even for stimulus presentation durations of 12 msec. In addition, luminance negation has little effect on performance for both image types, although up–down inversion and $1/f$ noise addition both affect discrimination performance for art more than for natural images. These results suggest that artists create representations that are highly efficient for transmitting perceptual information, and this efficiency may be due in part to artists' luminance-scaling strategies.

(3012)

Relative Salience of Change Signals Affects Decision Strategy in Change Detection. CHENG-TA YANG, *National Cheng Kung University*—Change detection requires perceptual comparison and decision on different features. How relative salience between two feature changes influences the decision process has not been addressed. This study used the systems factorial technology to investigate the decision process when changes in a Gabor patch are detected with information inputs from orientation and spatial frequency channels. The two feature changes were equally salient in Experiment 1, but spatial frequency change was more salient than orientation change in Experiment 2. The results showed that all observers adopted parallel processing and followed a self-terminating rule with unlimited capacity in Experiment 1. In Experiment 2, one observer used coactive processing, and the others adopted serial self-terminating processing with limited to unlimited capacity to detect changes. These results highlight that observers alter strategies in change detection depending on the relative saliency of change signals. When relative salience exists, individual differences in the decision strategy emerge.

(3013)

Perception of Human Face Identity and Expression by a Nonprimate Biological Vision System. FABIAN A. SOTO & EDWARD A. WASSERMAN, *University of Iowa* (sponsored by Edward A. Wasserman)—The human visual system appears to process the identity of faces separately from their emotional expression. One possibility is that identity is processed by an independent, specialized perceptual system. A second possibility is that this finding reflects general principles of perceptual processing. Studying animals without a specialized face perception system may shed particular light on this issue. We report two experiments testing whether pigeons process identity separately from emotion in human faces. In Experiment 1, we fit generalization data obtained using photographs of faces with varied emotions and identities to a spatial model of generalization. A Euclidean metric best fit the data, suggesting integrality of identity and emotion. In Experiment 2, we found that discrimination of emotion was affected by irrelevant variations in identity and vice versa, again suggesting integrality. However, these interference effects were asymmetrical, just as in humans, with a larger effect in the discrimination of emotion.

(3014)

Illusory Brightness Priming Occurs Without Visual Awareness. MARJAN PERSUH & TONY RO, *City University of New York*—We assessed whether real and illusory brightness processing can proceed in the absence of visual awareness by measuring unconscious priming with metacontrast masking. To induce an illusory brightness via simultaneous brightness contrast, a neutral gray priming disk was presented on either a dark or a bright background. When the neutral gray disk was presented

on a dark (or bright) background, such that the gray disk could be consciously perceived as bright (or dark), reaction times were significantly faster to a physically brighter (or darker) annulus than to a physically darker (or brighter) annulus. This illusory brightness priming occurred both with and without any awareness, with stronger unconscious priming from illusory brightness than from real brightness stimuli. Our results demonstrate that both real and illusory brightness contrast can be represented unconsciously and suggest that simultaneous brightness contrast occurs at very early levels of visual input.

(3015)

The Effects of Task and Saliency on TMS-Induced Suppression of Visual Awareness. TATIANA A. EMMANOUIL, PHILIP AVIGAN, MARJAN PERSUH, & TONY RO, *City University of New York*—Visual cortex activity is influenced by both top-down attention and bottom-up saliency effects. We used transcranial magnetic stimulation (TMS) over the primary visual cortex to investigate how different feature tasks and saliencies influence the timing of visual processing. Participants performed color or orientation judgments on stimuli of the same luminance but different color saliency. A TMS pulse was applied at varying SOAs after stimulus presentation to assess the time course of visual suppression. The results showed similar suppression for color and orientation tasks but differences based on feature saliency: The more salient stimuli were more resistant to TMS-induced visual suppression than were the less salient stimuli, especially at the early SOAs. These results indicate a stronger initial representation of more salient stimuli in the primary visual cortex and suggest that different forms of processing may be occurring during early (i.e., feedforward) and late (i.e., feedback) stages of processing.

• PICTURE PROCESSING II •

(3016)

The Role for Visual Information in Transsaccadic Object Identification Depends on Familiarity. DANIEL A. GAJEWSKI, *George Washington University*—Object naming in an extrafoveal preview paradigm is faster when peripherally previewed objects are identical to postsaccadic targets than when they visually differ, suggesting a role for visual priming in transsaccadic integration. Here, the role for visual information was examined with an items-based regression approach using identification and change detection tasks and three visual similarity scales as predictors. The role for familiarity was also considered by testing the items in blocks. In both blocks, the identical preview advantage was most strongly predicted by differences in peripheral identifiability. Additional variance was explained only by viewpoint similarity in the first block and only by change detectability in the second block. The results suggest a stronger role for visual priming when participants have no prior experience with the items and a stronger role for the visual change signal when experience has accumulated. Implications for a type–token account of transsaccadic integration are considered.

(3017)

Influence of Psychological Perspective on Scene Viewing and Memory for Scenes. JOHANNA K. KAAKINEN, JUKKA HYÖNÄ, & MINNA VILJANEN, *University of Turku* (sponsored by Jukka Hyönä)—In Experiment 1, participants viewed photographs of home interiors from either a homebuyer's or a burglar's perspective while their eye movements were recorded. Free recall was collected after the viewing. The results showed that the first two fixations after scene onset were guided by visual saliency; the effect of perspective relevance was observed from the second fixation onward. Salient regions were gazed at longer and recalled better than nonsalient regions, and perspective-relevant regions were gazed at longer and recalled better than irrelevant regions. In Experiment 2, participants viewed scenes from a homebuyer's or a burglar's perspective or in preparation for a memory test. Free recall and picture recognition tasks were administered. The results replicated the findings of Experiment 1. Perspective instructions increased viewing times on relevant and decreased viewing times on irrelevant regions. Recognition rates were higher for relevant than for irrelevant objects. The findings support theories assuming both bottom-up and top-down control of eye movements in scene viewing.

(3018)

Repeated Search in Scenes: Why Looking At an Object Does Not Help Looking For an Object. MELISSA L.-H. VÕ & JEREMY M. WOLFE, *Harvard Medical School and Brigham and Women's Hospital* (sponsored by Jeremy M. Wolfe)—When multiple objects are sequentially searched for in a scene, one might assume that search would improve with increasing familiarity with a scene, especially if targets-to-be were fixated during search for other targets. However, when participants searched the same scene repeatedly for different objects, neither familiarity with the scene nor incidental prior fixations of subsequent targets benefitted search. Only a previous search for a specific object speeded subsequent search for that object. In another experiment, participants searched for 15 letters presented on to-be-target objects. Interestingly, despite the scene's having been searched for almost a minute, subsequently searching for the actual objects within the same scene was by no means faster than searching without previous scene exposure. We therefore propose that repeated search for objects is not modulated by previously looking at an object. Only previously looking for an object will speed search.

(3019)

The Effects of Scrambling Episode Components on Memory for a Picture Story: Not Understanding, But Recognizing What You Saw. ADAM M. LARSON, CHRIS WALLACE, SUSIE GODDARD, & LESTER C. LOSCHKY, *Kansas State University* (sponsored by Lester C. Loschky)—How are episodes of picture stories remembered, and what role does the order of their components (exposition, complication, and resolution) play in that memory? We presented picture sequence episodes of "The Red Balloon," with the order of their components either normal or scrambled. As predicted by story grammar theories, scrambling episode components reduced self-rated comprehension and recall. However, scrambling also produced faster recognition memory responses for hits. This suggests that episode component scrambling interfered with the transformation of perceptual to conceptual information in long-term memory, producing an advantage for familiarity over recollection. Additionally, recall decreased monotonically from exposition to resolution, whereas recognition showed the opposite result, and this was the same whether components were normally ordered or scrambled. This suggests that memory for picture story episode components is based on their information content, rather than on their temporal order, and that information from picture stories moves from perceptual to conceptual memory representations.

• ACTION AND PERCEPTION •

(3020)

Long-Term Effects of Poststroke Changes in Sensorimotor Experience on Manipulation Judgments Involving Common Tools. EVANGELIA G. CHRYSIKOU, *University of Pennsylvania*, DANIEL CASASANTO, *Max Planck Institute for Psycholinguistics*, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Theories of embodied cognition suggest strong relationships between sensorimotor and cognitive systems. This study explored the possible effects of poststroke changes in sensorimotor experience on conceptual knowledge about common tools. Premorbidly right-handed patients experiencing right- or left-hand paresis due to unilateral stroke saw pictures of graspable everyday items that were oriented for either a right- or a left-handed grasp. They identified verbally the type of grasp they would employ (i.e., clench or pinch) when using each object for its typical function. Analyses of voice onset latencies were consistent with the prediction that right-paresis (left-stroke) patients would be faster in these manipulation judgments when the objects were oriented to the left, whereas left-paresis (right-stroke) patients would show the reverse pattern. The results are discussed in the context of the body specificity hypothesis, according to which people who interact with their physical environments in systematically different ways form correspondingly different mental representations.

(3021)

Unconscious Inhibition Separates Two Forms of Cognitive Control. FRÉDÉRIC BOY, *Cardiff University*, MASUD HUSAIN, *University*

College of London, & PETROC SUMNER, *Cardiff University* (sponsored by Frederick Verbruggen)—In the human brain, cognitive control processes are generally considered distinct from the unconscious mechanisms elicited by subliminal priming. Here, we show that cognitive control engaged in situations of response conflict interacts with the negative (inhibitory) phase of subliminal priming. Thus, cognitive control may surprisingly share common processes with nonconscious brain mechanisms. In contrast, our findings reveal that subliminal inhibition does not interact with "control adaptation"—the supposed modulation of current control settings by previous experience of conflict. Therefore, although influential models have grouped immediate cognitive control and control adaptation together as products of the same conflict detection mechanism, their relationship to subliminal inhibition separates them. Overall, these results suggest that the important distinction lies not between "cognitive" or "top-down" processes, on the one hand, and nonconscious "priming" mechanisms, on the other, but between reactive mechanisms that deal with sensorimotor activation after it has occurred and preparatory mechanisms that are modulated before stimulus arrival

(3022)

Temporal Perception and Causality Judgment. CAROLA HÄRING & ANDREA KIESEL, *University of Würzburg* (sponsored by Andrea Kiesel)—Temporal proximity of two stimuli is one indicator of a causal relationship between them (e.g., Michotte, 1963). Here, we investigated temporal perception and causality judgment in an action context. One group of participants adapted to immediate action effects, another group to effects delayed by 250 msec. In test blocks, the effect stimulus was sometimes presented earlier or later than usual. Participants judged either when the stimulus had appeared (earlier, later, or at the usual time) or to what extent they had caused it. Participants in both groups rated stimuli that occurred earlier or later than usual as occurring "at the usual time," yet participants in the delay group rated stimuli of a broader time range as "at the usual time." In both groups, causality judgment and the temporal perception of an effect "as usual" were highly correlated, supporting the assumption that perceived temporal proximity and perceived causality are closely related.

(3023)

Perceptual–Motor Recalibration of Locomotion in Children and Adults Using an Immersive Virtual Environment. CHRISTINE J. ZIEMER, BENJAMIN J. CHIHAK, DAT TIEN NGUYEN, MIA BRANSON, JAMES F. CREMER, & JODIE M. PLUMERT, *University of Iowa*—A fundamental feature of perceptual–motor functioning is the ability to flexibly recalibrate perception and action. The aim of this research was to compare children's and adults' ability to adapt to a perturbation of the regular interaction between perception and action, using a standard recalibration paradigm. First, participants performed a blindfolded-walking distance estimation pretest. Then, participants walked through an immersive virtual environment on a treadmill for 10 min at a self-selected rate. The interface was configured such that the optic flow rate was either plus or minus 50% of the participants' biomechanical rate of walking. Participants then completed a distance estimation posttest, the results of which were compared with their pretest performance. The results indicate some transference from the virtual environment to the real-world distance estimation task, although the observed recalibration effect was less than that reported in previous studies. Possible factors that may affect the robustness of the recalibration effect are discussed.

(3024)

Pop-Out Search Is Affected by Higher Level Task Demands: Evidence for the Role of Episodes. DAVID R. THOMSON & BRUCE MILLIKEN, *McMaster University* (sponsored by David I. Shore)—Maljkovic and Nakayama (1994) demonstrated that response times decrease in a pop-out (PoP) search task when target-defining features repeat from trial $n-1$ to trial n. These priming-of-PoP effects have been argued to reflect changes in low-level attentional control settings by some researchers (Lee, Mozer, & Vecera, 2009) and by others as reflecting the operation of memory episodes (Huang, Holcombe, & Pashler, 2004). If low-level control settings are responsible for PoP, a shift in

higher order task demands from one trial to the next should not affect PoP. Our results show that PoP effects for color- and shape-defined targets can be modulated when the task requirements alter from one trial to the next in both a predictable and a random manner.

(3025)

Locomotor Dynamics of Small Crowds: Characterizing Individual and Collective Behavior. KEVIN W. RIO, STÉPHANE M. BONNEAUD, & WILLIAM H. WARREN, JR., *Brown University* (sponsored by William H. Warren, Jr.)—What are the behavioral strategies governing human crowd behavior? Most existing models of crowd dynamics (Helbing & Molnar, 1995) or pedestrian behavior (Helbing, 1997) describe crowds as sets of individuals following rules for steering to goals, avoiding obstacles, and avoiding one another. But pedestrians may also exhibit collective behavior, by forming coordinated groups, when steering to a common goal. We collected position data from four pedestrians walking in a 12×12 m room as they steered to one of three goals, starting with one of four initial densities. On the basis of Fajen and Warren's (2003) model of locomotor behavior, the results indicate that pedestrians do not simply steer as individuals but form collective groups as a function of the initial density.

(3026)

Construction of Action Time. EVE A. ISHAM, JOY J. GENG, & ELIZABETH A. DISBROW, *University of California, Davis* (sponsored by William P. Banks)—How conscious are we of when we act? We examined the influence of postaction information on the perceived time of a motor act. Twelve healthy volunteers (ages, 18–22 years) pressed a button in response to a cue and received either "winning" or "losing" feedback. Critically, the participants believed that a win was synonymous with a faster response and were unaware that the outcome was randomly assigned. Subsequently, they reported the time of keypress. The results showed that a presumed winning keypress was judged to be earlier than a losing keypress ($p < .05$). In a separate study, Parkinsonians on dopaminergic medication were tested on a modified task. Preliminary data showed a larger effect size of outcome, as compared with healthy volunteers, when the reaction time was faster. These results suggest that our sense of time is constructed, rather than directly perceived, and that dopamine may serve as a modulator in this construction process.

• PERCEPTUAL ORGANIZATION •

(3027)

Effects of Perceived Limb Position on a Tactile Simon Effect Task. JARED MEDINA, DASHA KLIOT, & H. BRANCH COSLETT, *University of Pennsylvania*—Using a tactile Simon effect task (intensity judgments with hands crossed or uncrossed), we previously found that tactile stimuli were encoded in a somatotopic reference frame (e.g., left-hand stimuli are encoded as left regardless of hand position) and that participants were faster overall with their hands crossed versus uncrossed. To investigate the effects of vision of the perceived body on performance, we replicated this experiment using rubber hands placed above participants' hands (crossed or uncrossed). First, participants were significantly faster and more accurate when the rubber hands were crossed. Second, we found a robust somatotopic Simon effect based on the position of the real (not rubber) hands across all conditions. These results suggest that vision of crossed limbs facilitated tactile intensity judgments but did not noticeably affect tactile stimulus code generation. We discuss these and related results with respect to theories of higher order body representation.

(3028)

The Haptic Horizontal–Vertical Curvature (St. Louis Arch) Illusion in Raised-Line and Solid 3-D Stimuli. MORTON A. HELLER, AMY SMITH, RITA E. SCHNARR, DEAN PAPPAS, & JOSEPH MORGER, *Eastern Illinois University*—The horizontal–vertical illusion is robust for curved lines (Heller et al., 2008, in press) in the senses of touch and vision. It was not known whether the haptic horizontal–vertical illusion would occur with curved solids, as has been found in raised-line patterns. An experiment compared illusion strength in independent groups

of blindfolded sighted participants with raised-line stimuli and solid 3-D curves that varied in size from 5.2 to 12.7 cm. Participants felt the stimuli with their right hands. Illusion strength was similar for both types of stimuli, but a difference emerged for the largest curves. Attenuation of the illusion appeared for 12.7-cm solids, but not for raised lines. A second experiment yielded reduced illusion strength with 3-D solids and bimanual free exploration (see Heller et al., in press). The theoretical implications of the results are discussed.

(3029)

What Do Perceivers Learn About When They Learn About Length? JEFFREY B. WAGMAN & ETHAN VAN NORMAN, *Illinois State University*—Recent studies have used transfer paradigms to investigate the organization of perception–action systems. We used this methodology to investigate the organization of haptic perception. If perception of one portion of an object's length from a particular grasp position is (re)calibrated, is perception of a different portion of that object's length from a different grasp position (re)calibrated as well? What do perceivers learn about when they learn about object length? In three experiments, visual feedback was used to (re)calibrate perceived length of a particular portion of the length of an occluded wooden rod when that rod was held at a particular location along its length. The recalibration transferred to perception of the same portion of rod length from a different grasp position (Experiment 1), a different portion of rod length from the same grasp position (Experiment 2), and a different portion of rod length from a different grasp position (Experiment 3).

(3030)

Haptic Perception of Elasticity. BING WU, ROBERTA L. KLATZKY, & RALPH HOLLIS, *Carnegie Mellon University*, & GEORGE STETTEN, *University of Pittsburgh, Robotics Institute*—Three experiments studied the effectiveness of force and torque cues in perception of the elasticity of soft materials. In Experiment 1, just noticeable differences (JNDs) for elasticity were measured in four conditions, with interaction forces and torques that had a positive, negative, or no correlation or with force feedback alone (constant torque). JNDs were lower when force and torque cues were correlated but were higher when the two cues were uncorrelated than with force alone (constant torque). Experiments 2 and 3 used a parallel design to measure the JNDs for force and torque, respectively. The perception of exerted force was effectively facilitated when positively correlated torque was added, and similarly, correlated force facilitated torque perception. Ongoing experiments investigate the efficacy of these cues in perception of viscoelasticity. (The work was supported by NIH Grant 1K99EB008710.)

• LETTERS/WORD PROCESSING III •

(3031)

The Role of Orthography in the Semantic Activation of Neighbors. YASUSHI HINO, *Waseda University*, STEPHEN J. LUPKER, *University of Western Ontario*, & TAMSEN E. TAYLOR, *Humansystems Incorporated*—In this research, we investigated the role of orthography in activating semantic information about a letter string's neighbors (the "turple" effect). Using English nonwords in a semantic categorization task, inhibition due to the existence of an exemplar neighbor was larger for longer stimuli than for shorter stimuli, indicating that greater orthographic overlap leads to greater activation of a neighbor's semantics. In Experiment 2, using Japanese words, we investigated the role of phonology in the semantic activation of neighbors. In a relatedness judgment task, in which word pairs were presented, an inhibitory effect was observed when one word was related to an orthographic and phonological neighbor of the other word, but not when that word was related to a phonological but not orthographic neighbor of the other word. These results suggest that the semantic activation of neighbors is driven mainly by orthography.

(3032)

Parafoveal Processing in Skilled Silent Reading Versus Oral Reading: Differences in Eye Movement Control. JANE ASHBY, *Central Michigan University*, JINMIAN YANG, *University of California, San Diego*, KRIS EVANS, *University of Massachusetts, Amherst*, & KEITH RAYNER, *University of California, San Diego*—In this experiment, we used a moving-window paradigm to manipulate the parafoveal information available during silent reading and oral reading, in order to examine task effects on eye movement control and parafoveal processing. Participants read sentences, such as *Mary yelled as the child pulled her armchair across the hardwood floor*, in two moving-window conditions. No-Preview Condition: Xxxx xxxxxx xx xxx child xxxxxx xxx xxxxxxxx xxxxxx xxx xxxxxxxx xxxxx. Preview Condition: Xxxx xxxxxx xx the child pulled xxx xxxxxxxx xxxxxx xxx xxxxxxx xxxxx. As has been reported in previous studies, we found faster reading times and fewer fixations during silent reading than during oral reading. In addition, significant interactions between reading task and preview condition appeared in several eye movement measures, including fixation durations, number of fixations, and number of forward saccades. These data suggest that parafoveal information plays a weaker role in word recognition during oral reading than during silent reading.

(3033)

ERP Correlates of Letter Position Assignment As a Function of Word Frequency. MARTA VERGARA-MARTÍNEZ, *University of California, Davis*, MANUEL PEREA, *University of Valencia*, PABLO GOMEZ, *DePaul University*, & TAMARA Y. SWAAB, *University of California, Davis*—Transposed-letter (TL) nonwords (e.g., *jugde*) are easily confusable with their base words. Here, we examined the impact of lexical frequency on letter position assignment by comparing the time course of TL effects on low-frequency (LF) and high-frequency (HF) words. Event-related potentials (ERPs) were recorded while participants read LF and HF words, as well as nonwords created from these words (e.g., word, *modular*; TL nonword, *modluar*; replacement-letter [RL] nonword, *mogular*) in a semantic categorization task. For HF items, we found early larger negativities for RL, as compared with TL nonwords; these two conditions showed larger negativities than did their base words. For LF items, ERP waves from RL nonwords differed from those for words, whereas we found no differences between TL and RL nonwords. Thus, perceptual uncertainty occurs to a larger degree for less frequent patterns than for highly familiar patterns.

(3034)

Individual Differences in Visual Word Recognition: Insights From the ELP. MELVIN J. YAP, *National University of Singapore*, DAVID A. BALOTA, *Washington University*, DARAGH SIBLEY, *University of Wisconsin, Madison*, & ROGER RATCLIFF, *Ohio State University*—Empirical work and models of visual word recognition have traditionally focused on group-level performance. Although aggregating data across participants suggests that individual differences are marginal or perhaps unimportant, there is clear evidence that variables such as phonological awareness, vocabulary knowledge, and print exposure predict reading success and lexical processing fluency. In the present study, we conducted trial-level analyses of the English Lexicon Project (ELP; http://elexicon.wustl.edu), an online behavioral repository of nearly 4 million word recognition (speeded pronunciation and lexical decision) trials from over 1,200 participants. The results indicate large but reliable and temporally stable individual differences that are reflected in effects of standard lexical variables, response time distributional characters, and diffusion model (Ratcliff, Gomez, & McKoon, 2004) parameters. Moreover, the magnitude of a participant's sensitivity to frequency, length, and neighborhood variables were systematically related to the participant's vocabulary knowledge and mean pronunciation latency.

(3035)

The Cumulative Lexical Interference Effect. CLAUDIO MULATTI, EDUARDO NAVARRETE, & FRANCESCA PERESSOTTI, *University of Padua, DPSS*, REMO JOB, *University of Trento, DiSCoF*, & MAX COLTHEART, *Macquarie University, MACCS* (sponsored by Remo Job)—In models of visual word recognition and reading aloud, no persistent changes result from a word's having been read; that is, there is no learning. We report an experiment showing that the reading aloud of a word affects the reading aloud of orthographically/phonologically similar words on subsequent occasions. Participants read words drawn from

12 orthographic categories. The number of items intervening between successive presentations of members of the same orthographic category varied from two to eight. Participants' reaction times were slowed by 6 msec for each preceding member of the orthographic category. This lexical interference effect was both linear and cumulative. In addition, the number of intervening items between two exemplars of the same category was irrelevant to the effect. The implications of these findings for current models of reading aloud, picture naming, and speech production are discussed.

(3036)

Bias Toward Negative and Positive Words in the Attentional Dot Probe Task. TINA M. SUTTON, *Union College and University at Albany*, & JEANETTE ALTARRIBA, *University at Albany* (sponsored by James H. Neely)—Individuals more readily pay attention to negative information than to neutral information (Öhman, 1993). In two experiments using the dot probe task, participants viewed negative, positive, and neutral words for a brief period of time, followed by a mask. In Experiment 1, words were presented in separate blocks, and in Experiment 2, words were intermixed. Participants responded faster to the probe when it appeared in the same location as the negative emotion word, relative to when it appeared in the same location as an emotionally neutral word, in both experiments. The findings from Experiment 2 also indicated that positive words have the ability to automatically capture attention and influence subsequent processing when they are presented below the threshold of awareness and intermixed with negative words. Additionally, results from both experiments supported the right-hemisphere hypothesis, indicating that the negative and positive words were processed more efficiently in the left visual field.

(3037)

Visual Attention Processing Is Impaired in Developmental Dyslexia. SYLVIANE VALDOIS, MURIEL A. LOBIER, & DELPHINE LASSUS-SANGOSSE, *LPNC–CNRS UMR 5105* (sponsored by Elsa Spinelli)—A purely visual attention disorder in developmental dyslexia would predict similar deficits in alphabetic and nonalphabetic element strings. To validate this prediction, visual processing in dyslexic individuals was assessed using a global report and a categorization task. In the global report, dyslexic readers were impaired for letters and digits, but not for colors. Importantly, their performance was correlated with reading measures only for letters and digits. In a novel multielement categorization task with alphanumeric and nonalphanumeric stimuli, dyslexic readers were impaired for both types of stimuli, and task performance was correlated with reading performance regardless of stimuli type. These results are explained within the framework of the visual attention span deficit hypothesis of dyslexia. They show that the deficit in the visual processing of multielement arrays posited by this hypothesis can be extended to nonalphanumeric stimuli.

• PSYCHOLINGUISTICS III •

(3038)

The Role of Phonological Short-Term Memory in Vocabulary Acquisition. JASON E. CROWTHER, *Baylor College of Medicine*, & RANDI C. MARTIN & TAO HE, *Rice University*—The present study assessed whether vocabulary acquisition is related only to phonological short-term memory (STM) or complex working memory (WM) capacity. Three experiments were conducted comparing the acquisition of novel phonological forms in a paired-associate word–nonword learning task with a measure of phonological STM (nonword span) and complex WM (operation span). For nonword targets with a low degree of association to real words, nonword span predicted paired-associate learning in the first experimental session, whereas operation span made no significant unique contribution. In contrast, operation span alone predicted paired-associate learning in the second experimental session or when nonword targets were more easily associable with known words. The study supported the notion that, under conditions in which semantic information is not easily accessible or association strategies cannot be used easily, phonological STM capacity alone supports the acquisition of novel phonological forms, whereas WM plays a role when semantic information can be used.

(3039)

Eye Movements in Reading: Skipping of Articles Is Not Fully Automatic. BERNHARD ANGELE & KEITH RAYNER, *University of California, San Diego* (sponsored by Keith Rayner)—One of the words that readers of English skip most often is the article "the." Most accounts of reading assume that in order for a reader to skip a word, it must have received some lexical processing. The article "the" is skipped so regularly, however, that the oculomotor system may have learned to skip articles automatically. We tested whether skipping of "the" is automatic, using the gaze-contingent boundary paradigm (Rayner, 1975) to provide readers with false parafoveal previews of the article "the." All experimental sentences contained a short target verb, the preview of which could be identical ("lie"), dissimilar ("tda") or a false article preview ("the"). Our results suggest that although readers tended to skip the false "the" previews frequently, they seem to sometimes be able to detect the syntactic anomaly in the preview parafoveally, since they also showed increased skipping of the pretarget word in the "the" preview condition.

(3040)

Exploring Media Bias With Semantic Space Models. NICHOLAS S. HOLTZMAN & JOHN PAUL SCHOTT, *Washington University*, MICHAEL N. JONES, *Indiana University, Bloomington*, DAVID A. BALOTA, *Washington University*, & TAL YARKONI, *University of Colorado, Boulder* (sponsored by Michael N. Jones)—Semantic space models have made extensive contributions to cognitive psychology but could be more widely used in other areas, such as social and political psychology. Here, we use the semantic space component of BEAGLE (Jones & Mewhort, 2007), an efficient computational model of semantic representation, to explore media bias. Semantic spaces help guide impartial text analysis—and thus could help moderate arguments about media bias. An interaction term, which contrasts associations between ideology and valence (e.g., liberal–good vs. liberal–bad), accounts for baseline information. Differences in bias between three major U.S. news outlets (MSNBC, Fox News, and CNN) are presented. We argue that, as our example illustrates, semantic space models could help address a wider array of social science questions. Accordingly, we offer a Web site with user-friendly software implementing the methods, with the hope of further facilitating the discovery of idiosyncrasies in different texts (www.casstools.org).

(3041)

Timing Influences on the Specificity of Implied Movement Interference Effects. TYLER HUBBARD, ALAN BISBY, SAMANTHA EMERSON, JOHN IBANEZ, RICHARD TILLMAN, & WILLIAM LANGSTON, *Middle Tennessee State University*—Langston, Hubbard, and Emerson (2009) found that sentence–letter-movement interference effects were specific. For example, identifying moving letters was influenced by sentences describing movement in the same direction, but not by sentences describing words naming objects in static locations. One open question related to these results was whether the interaction between prime (sentence or word) and target movement would produce facilitation of target identification or inhibition of target identification. The purpose of the present studies was to manipulate the timing of events to determine whether shorter prime presentations would lead to facilitation (due to the prime and target integrating into a single event) and longer prime presentations would lead to inhibition (due to the prime and target being perceived as separate events). Reading speed was also measured as an important individual difference affecting the timing variable.

(3042)

A Study of the Double-Deficit Hypothesis in College Students With Dyslexia. STACY BIRCH, *College at Brockport*—The double-deficit hypothesis of developmental dyslexia suggests that deficits in naming speed and phonological processing together are associated with more severe reading disabilities than is either deficit alone (Wolf & Bowers, 1999). This proposal was tested in a group of college students with (and without) dyslexia. Participants completed subgrouping tasks assessing phonological and naming speed ability and several other reading-related tasks. Of participants with dyslexia, 52% had single and 24% had double deficits. Although comprehension and nonverbal IQ scores were similar

among groups, the group with both deficits read more slowly and with more print deviations; was slower on speeded naming of words, non-words, and "pig-latin" translations; and had lower scores on standardized tests of spelling, math, word identification, and word attack (although for the latter two tests, the phonological deficit group was similar). Although subgroup sizes were small, the results seem to support the double-deficit hypothesis.

(3043)

Attention to (Changing) Objects in the Visual Scene During Linguistic Change Detection Task. PIRITA PYYKKÖNEN & MATTHEW W. CROCKER, *Saarland University*—In an eyetracking study, we examined whether changing objects in the visual scene captures overt attention while people are performing a linguistic change detection task and whether fixation of the changing objects interacts with linguistically focused attention. Participants heard three-sentence stories while being shown people in complex visual scenes, in a 2 × 2 × 2 design: (focused/unfocused, linguistic change/no change, visual change/no change). Changes in the story and in the scene occurred in modifiers important for identifying the person under discussion. The results showed that overt attention was captured by visual change, rather than by linguistic focus. However, this did not modulate the speed of linguistic change detection responses; rather, a main effect of linguistic focus resulted in shorter RTs than for the unfocused conditions. The study shows that—at least under some circumstances—language comprehension processes can be kept separate from information received from the visual environment.

• BILINGUALISM •

(3044)

Fast Morphological Effects in First- and Second-Language Word Recognition. KEVIN DIEPENDAELE, *Ghent University*, JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain, and Language*, JOANNA MORRIS, *Hampshire College*, & EMMANUEL KEULEERS, *Ghent University* (sponsored by Robert J. Hartsuiker)—We compared masked morphological priming in English lexical decision with a group of native participants, Spanish–English bilinguals, and Dutch–English bilinguals. The results show no significant differences across the three experiments. In line with recent meta-analyses, we observe a graded pattern of facilitation across stem priming with transparent suffixed primes (e.g., *viewer–view*), opaque (including pseudo-) suffixed primes (e.g., *corner–corn*) and form control primes (e.g., *freeze–free*). Priming was largest in the transparent condition, smallest in the form condition, and intermediate in the opaque condition. Our data confirm that bilinguals largely adopt the same processing strategies as natives in a given language (Lemhöfer et al., 2008). They constrain the hypothesis that bilinguals rely more heavily on whole-word processing in their second language (Ullman, 2004). The specific pattern of morphological priming that is observed follows the findings of earlier monolingual studies and highlights the reality of semantic transparency effects within the initial stages of word recognition.

(3045)

Lexical Competition in a Spoken Sentence Context. EVELYNE LAGROU, ROBERT J. HARTSUIKER, & WOUTER DUYCK, *Ghent University* (sponsored by Wouter Duyck)—The visual world paradigm was used to investigate parallel language activation when one listens in a second language (L2) or in the native language (L1). With this aim, eye movements were recorded while Dutch–English bilinguals listened to low-constraining sentences in L2 or in L1. The results demonstrated that participants fixated (1) more on competitor pictures with Dutch names (e.g., *fles* [bottle]) phonologically related to English target names (e.g., *flower*) than on phonologically unrelated pictures and (2) more on competitor pictures with English names (e.g., *flower*) phonologically related to Dutch target names (e.g., *fles* [bottle]) than on phonologically unrelated items. However, this was observed only when the phonologically related onset of the competitor picture was pronounced identically to the phonologically related onset of the target picture. This provides evidence for lexical competition in a spoken sentence context when one listens in L2 and L1 but highlights the importance of subtle phonological cues.

(3046)

Second-Language Experience Trumps Age of Acquisition As a Predictor of Lexical-Semantic Processing: Evidence From Linear Mixed Effects Regression (LMER). NAVEED A. SHEIKH, JULIE MERCIER, IRINA PIVNEVA, & DEBRA A. TITONE, *McGill University* (sponsored by Debra A. Titone)—The critical period hypothesis (CPH) proposes a biological window for acquisition of second-language (L2) skills. There is debate, however, concerning L2 lexical-semantic development. Some work supports a version of the CPH for lexical-semantics (Isel, Baumgaertner, Thrän, Meisel, & Büchel, 2010); other work suggests that L2 proficiency is the major predictor of lexical-semantic processing (Hernandez & Li, 2007), provided adequate L2 experience since initial L2 age of acquisition (AoA). We used linear mixed-effects regression (LMER) to evaluate the explanatory value of AoA and L2 experience on semantic categorization performance of 76 French–English bilingual adults. AoA and L2 experience were both significant predictors when evaluated individually. However, L2 experience alone predicted performance when both variables were evaluated simultaneously. Moreover, LMER models including L2 experience accounted for significantly more variance than did those including AoA. These results do not support a CPH for lexical-semantics but, rather, suggest that L2 experience is a better determinant of performance than is AoA.

(3047)

Practice Makes Better: Effects of Short-Term Second-Language Use on Subsequent Fluency. HADAS SHINTEL, *Center for Academic Studies*, & MIRIAM FAUST, *Bar-Ilan University*—Subjective experience suggests that using a second language (L2) becomes easier after an initial period of adjustment. We investigated whether a short period of L2 use can facilitate L2 lexical retrieval. Native Hebrew speakers completed phonemic and semantic verbal fluency tasks in English. In a subsequent experimental session, participants performed a short task, in Hebrew or in English, and subsequently completed an additional round of the English fluency tasks. English use resulted in a reliable improvement in phonemic fluency, associated with executive functioning. No reliable difference was observed following Hebrew use. However, there was no reliable improvement in semantic fluency, associated with semantic-lexical knowledge. The results suggest that even a short period of L2 use can facilitate retrieval, possibly by increasing the relative activation of the L2 lexicon. Improvement occurred even in a task that did not involve direct cross-language lexical competition, suggesting that increased activation affects the lexicon as a whole.

(3048)

The Relationship Between Cue-Based Sentence Interpretation Strategies and Proficiency of Second-Language Learners. LAURA M. MORETT, *University of California, Santa Cruz*, & BRIAN MacWHINNEY, *Carnegie Mellon University* (sponsored by Brian MacWhinney)—According to the competition model, second languages are learned by shifting reliance from cues that convey the most information about thematic roles in the native language to those that convey the most information about thematic roles in the target language. The results of experiments that tested sentence comprehension using language-nonspecific cues in English and Spanish indicate that learners rely on cues with high validity in their native language to a greater extent than on cues with high validity in the target language, demonstrating evidence of forward transfer. The results of experiments that tested sentence comprehension using language-unique cues in these languages indicate that learners rely on these cues regardless of proficiency, suggesting that these cues are learned quickly, enhancing target language sentence comprehension. Overall, the results are consistent with functionalist models of second-language acquisition, demonstrating that second languages are learned in a gradual manner in accordance with exposure.

• JUDGMENT/DECISION MAKING III •

(3049)

Adaptive Experimentation Methods for Comparing Risky Choice Models. DANIEL R. CAVAGNARO, JAY I. MYUNG, & MARK A. PITT, *Ohio State University*, & RICHARD GONZALEZ, *University*

of Michigan—Experimental comparisons of risky choice models have yielded opposing conclusions depending on which noise specification is assumed, making it impossible to assess the core theoretical assumptions of the models. Here, we present a Bayesian framework for comparing such models (i.e., functional forms of indifference curves) without relying on the assumption of a particular noise specification. This type of analysis is made possible by employing a novel testing methodology (adaptive design optimization [ADO]), in which the gamble pairs are carefully selected to maximally discriminate the models under consideration. ADO tailors the stimuli to each participant, thus accounting for individual differences while maximizing the efficiency of experimentation. In simulation studies designed to demonstrate the ADO technique, we discriminate expected utility and weighted expected utility models.

(3050)

Inferences From Memory: The Biological Basis of Heuristic Decision Making. THORSTEN PACHUR, *University of Basel*, PATRICK KHADER, *Philipps University, Marburg*, & KERSTIN JOST, *RWTH Aachen University* (sponsored by Thomas T. Hills)—One key notion in decision making is that due to natural limits in the capacity to process information, decisions are often made using heuristics that embody controlled information search. We examine the biological basis of the use of such a heuristic when information about decision alternatives has to be retrieved from memory. In particular, what is the contribution of controlled and automatic retrieval processes? We designed two fMRI experiments in which participants learned visual cue information and then made decisions on the basis of this information, using the take-the-best heuristic. As it turned out, the dorsolateral prefrontal cortex responded parametrically to the amount of information required for a decision. A similar increase was also observed in the posterior visual areas, but systematically modulated by the amount of required information. These information-specific modulations indicate that using a noncompensatory heuristic is associated with controlled, as well as automatic, activation of specific memory representations.

(3051)

How People Judge the Relative Frequency of Sequential Events. MIDORI TOKITA & AKIRA ISHIGUCHI, *Ochanomizu University*—We investigated the manner in which people judge the relative frequency of sequential events, while incorporating recent findings from studies of numerosity representation. In the behavioral experiment, we tested whether and how both the total number and perceptual features of events affect the precision and accuracy of the relative frequency discrimination in which the observers were asked to choose the sequence consisting of more events. The results demonstrated that (1) perceptual features had no effect on accuracy and precision and (2) the total number of events affected the precision in such a way that the larger sets yielded higher precision. In the subsequent computational study, we compared the results of two models (accumulator model and Bayesian model) with the behavioral data. The comparison results showed that the Bayesian model fitted the behavioral data better, although previous studies have predicted that the accumulator model would account for the numerosity representation.

(3052)

When and Why Rare Events Are Underweighted in Choice. ADRIAN R. CAMILLERI & BEN R. NEWELL, *University of New South Wales* (sponsored by Ben R. Newell)—Two paradigms are used to operationalize the nature of risky choice made following experiential sampling over time. The feedback paradigm is associated with a large number of repeated, consequential choices and puts into conflict the objectives of exploring and exploiting options. In contrast, the sampling paradigm separates these objectives into distinct phases. Despite differences, choices in both paradigms appear consistent with the idea that rare events are underweighted, relative to their objective probability. We examine when and why underweighting occurs. We conclude that, in a context of pure exploration, underweighting is eliminated when samples are representative. In contrast, in a context of repeated, consequential choice, underweighting is present even when samples are representative because of "choice escalation"—that is, initial preferences favoring the option with the best modal outcome, coupled with subsequent choice inertia. These findings are contrasted with overweighting of rare events when choice alternatives are described.

(3053)

Testing Computational Models of Choice. ANDREI TEODORESCU, *Tel-Aviv University*, KONSTANTINOS TSETSOS, *University College London*, & MARIUS USHER, *Tel-Aviv University* (sponsored by Marius Usher)—We present computer simulation results for three types of choice-RT models, showing diverging predictions. In particular, we examine how race versus diffusion or LCA models respond to manipulations in the amount of conflicting evidence, in the starting point of the accumulation process, and in the magnitude of noise in the evidence. The simulations demonstrate that whereas race models speed up with conflicting evidence, diffusion models slow down, and LCA (depending on parameters) can interpolate between diffusion and race models. Furthermore, we find that the amount of noise in the evidence has a large, qualitative impact on the models' predictions. Finally, we develop a number of experimental manipulations that allow distinguishing these models, and we present experimental results that tested these predictions.

(3054)

Holistic Versus Analytical Processing in Preference Transitivity. LEONARD LEE, *Columbia University*, & LISA K. SON, *Barnard College* (sponsored by Lisa K. Son)—In a series of four experiments involving a pairwise product choice task, we examined factors that affect the transitivity of individuals' product preferences (as opposed to logical transitivity in inferential reasoning typically investigated in developmental and animal psychology). The results indicated that participants made more transitive choices (1) when they thought about three individuals who would like each product, as opposed to three features of each product; (2) when they considered why they would buy each product, rather than how they would use each product; (3) when they chose products for distant-future instead of near-future consumption; and (4) after they had been primed to adopt a global (vs. local) mind-set in an unrelated prior task (i.e., Navon task). Together, these results suggest that greater holistic (vs. analytical) processing engenders greater preference transitivity, consistent with prior findings that demonstrated that emotional processing leads to greater preference consistency than does deliberative cognitive processing.

(3055)

Domain Independence and Stability in Delay Discounting by Young and Older Adults. KOJI JIMURA, JOEL MYERSON, TODD S. BRAVER, & LEONARD GREEN, *Washington University* (sponsored by Leonard Green)—Individual discounting rates for delayed rewards are typically assumed to reflect a single, underlying trait of impulsivity. If so, those who steeply discount one type of reward also should steeply discount other types of reward. To test this hypothesis, the present study examined the discounting of hypothetical money and real liquid rewards. A hyperboloid discounting function provided good fits to the data for both types of reward from young and older adults. Individual differences in discounting of both reward types were stable over a 2- to 4-week interval (rs > .70), but there was no significant correlation between discounting of the two reward types. Older adults discounted liquid rewards more steeply than did younger adults but discounted monetary rewards less steeply. These results suggest that although similar decision-making processes may be involved, the discounting of different types of rewards reflects separate, temporally stable individual characteristics, rather than a single trait of impulsivity.

• HUMAN LEARNING III •

(3056)

Effects of Spaced Rereading and Retrieval Practice on Prose Recall. SEAN H. K. KANG & HAL PASHLER, *University of California, San Diego*, & DOUG ROHRER, *University of South Florida*—Studies on the testing effect typically compare initial testing with immediate rereading, with the finding that testing improves retention more than does rereading. But what if rereading is done after a delay? Will the benefit of spaced rereading eliminate the testing advantage? Subjects

were presented passages to learn. After reading each passage, they either recalled or reread the passage. The recall/reread opportunity occurred immediately and/or after 1 week. Final recall was assessed 4 weeks after last exposure to each passage. Whereas immediate testing produced better final recall than did immediate rereading, delayed rereading was superior to delayed testing (without corrective feedback; Experiment 1). With feedback (Experiment 2), delayed testing produced higher final performance than did delayed rereading, but the difference was not statistically reliable. Testing immediately and again after 1 week (with feedback) produced significantly better final retention than did rereading immediately and again after 1 week (Experiment 3), underscoring the advantage of repeated retrieval with feedback.

(3057)

An Eye Movement Analysis of the Spatial Contiguity Effect. CHERYL I. JOHNSON & RICHARD E. MAYER, *University of California, Santa Barbara* (sponsored by Richard E. Mayer)—In two studies, participants' eye movements were recorded while they viewed a short multimedia presentation about how car brakes work, consisting of two frames and text. In Experiment 1, participants viewed a separated presentation, in which the text was presented below the diagram on the screen, or an integrated presentation, in which the text was placed next to the corresponding part of the diagram. Experiment 2 was identical, except that the separated condition also included lines pointing to the diagram (similar to a legend). Previous research has shown a spatial contiguity effect, such that performance on transfer tests is higher for those who receive an integrated presentation (Ginns, 2006). In the present studies, eyetracking analyses showed that with an integrated presentation, learners made significantly more eye movements between the diagrams and text, as compared with those with the separated presentation. The results are explained by the cognitive theory of multimedia learning (Mayer, 2009).

(3058)

No Testing Effect in Category Lists. PETER P. J. L. VERKOEIJEN, *Erasmus University Rotterdam*, PETER F. DELANEY, *University of North Carolina, Greensboro*, & SAMANTHA BOUWMEESTER & LEONORA C. COPPENS, *Erasmus University Rotterdam*—Inserting a memory test into a learning sequence produces less forgetting of the to-be-remembered information than does studying the information for an equivalent amount of time. This so-called testing effect is reflected in an interaction between retention interval (typically, 5 min vs. 7 days) and learning type (restudying vs. immediate testing). In the present study, we sought to investigate a boundary condition to the testing effect. Specifically, on the basis of a recently proposed "retrieval-cue" hypothesis by Karpicke and Zaromb (*Journal of Memory & Language*, 2010), we reasoned that the testing effect should be reduced or even disappear in category lists. Consistent with expectations, we failed to find a testing effect in category lists. By contrast, a typical testing effect interaction was found when noncategory lists were employed. Furthermore, the testing effect did not emerge in category lists, because forgetting of restudied category lists resembled that of immediately tested category lists.

(3059)

Collaborative Inhibition in a Classroom Setting. GUNES AVCI & JESSICA M. LOGAN, *Rice University*—Collaborative inhibition refers to the poorer memory performance of collaborative groups, as compared with noninteracting groups. In other words, when people remember in groups, they do not perform up to their potential. Collaborative inhibition has mostly been studied by means of recall tasks. In the present study, we examined the collaborative recollection of students with a multiple-choice exam on curricular material (i.e., a recognition task). The study groups varied in size (between 2 and 6). The results showed that when students worked in groups, they displayed poorer memory performance, as compared with individual activity, as was expected. Contrary to previous studies, group size did not significantly affect collaborative recognition.

(3060)

Can Pretesting With Multiple-Choice Questions Facilitate Learning? JERI L. LITTLE & ELIZABETH LIGON BJORK, *UCLA*—A pretest (with short-answer questions) can improve later recall of the correct answers to those questions, when compared with a condition in which the participants spend the whole time studying, even when participants initially cannot answer those questions correctly (Richland, Kornell, & Kao, 2009)—a finding inconsistent with the arguments of the proponents of errorless learning (e.g., Skinner, 1958; Terrace, 1963). This benefit, however, might not extend to pretests employing multiple-choice questions, since such tests can promote or even encourage test-takers to endorse incorrect answers. Thus, multiple-choice pretests could well lead to increased recall of those incorrect answers later. In the present experiment, we compared a multiple-choice pretest–study condition with a study–study control condition and found such pretests to improve the effectiveness of a study event, even when most of the questions were answered incorrectly on the initial pretest. This work provides evidence for the usefulness of multiple-choice pretests in facilitating future learning.

• COGNITIVE CONTROL III •

(3061)

Not All High-Pressure Situations Are the Same: Choking Under Pressure and Implicit Sensorimotor Skill Performance. MARCI S. DeCARO, *Vanderbilt University*, NEIL B. ALBERT, *University of Chicago*, KRISTA D. CARLSON & ROBIN D. THOMAS, *Miami University*, & SIAN L. BEILOCK, *University of Chicago* (sponsored by Robin D. Thomas)—Recent work suggests that different high-pressure situations impact the attention allocated to skill execution in different ways. Situations in which others watch and evaluate performance (monitoring pressure) increase the attentional control devoted to performance, whereas situations with an important outcome at stake (outcome pressure) lead to divided attention. Such findings indicate that monitoring pressure, but not outcome pressure, should selectively harm skilled performance that operates optimally outside of explicit attentional control. To test this prediction, we trained participants on an implicit sequence-learning task and then tested them in one of three pressure situations: monitoring pressure, outcome pressure, or a low-pressure control. Participants facing outcome pressure (performance-based monetary incentive) performed as well as the low-pressure control group. But under monitoring pressure (video surveillance), participants' performance fell below that of the other two groups. These results suggest that not all high-pressure situations are the same: Implicit sensorimotor skill performance suffers only when pressure that prompts maladaptive attention to execution is at play.

(3062)

Role of Phonological Short-Term Memory in Global But Not Local Task Switch Costs. CORINNE M. ALLEN & RANDI C. MARTIN, *Rice University* (sponsored by Randi C. Martin)—Previous research has suggested that phonological short-term memory (STM) is involved when self-cuing of task switches is required. In this study, we examined whether semantic STM also plays a role in shifting and assessed the effect of increasing memory load and of individual differences in STM capacity. Older adults were tested on a cued shifting paradigm under low- and high-memory-load conditions and in both standard and articulatory suppression (AS) conditions. For global switch costs, AS disrupted performance in the high- but not the low-load condition, and there was a negative correlation between global shift costs and phonological retention capacity. For local switch costs, AS did not disrupt performance in either load condition, and there was no relation to STM capacity. We hypothesize that a phonological code is used to maintain task sequence in mixed task conditions under high-load conditions and is equally involved in shift and repeat trials.

(3063)

Goal Maintenance in Cascaded Cognitive Tasks. CHRISTOPHER A. STEVENS & RICHARD A. CARLSON, *Pennsylvania State University* (sponsored by Richard A. Carlson)—Previous work has shown that subjects in task-switching paradigms gradually slow down as they complete successive trials within a run (Altmann, 2002). We demonstrated a similar effect in a cascaded task: multiple-step arithmetic. Subjects added or subtracted a series of 6–8 one-digit numbers, starting with a two-digit

number, reporting a final result. The display of numbers was self-paced, and the dependent variable was time spent on each step. The functional decay hypothesis (Altmann, 2002) suggests that within-run slowing is the result of the decay of goal representations in working memory. However, the slowing in this task could also be explained by proactive interference in working memory. We manipulated the presence of task cues and whether the operation (addition or subtraction) varied between trials. We consider the results in terms of the hypotheses above and how goals and other information are managed in working memory.

(3064)

Mathematics Anxiety: Separating the Math From the Anxiety. IAN M. LYONS & SIAN L. BEILOCK, *University of Chicago* (sponsored by Sian L. Beilock)—We examined the relation between math anxiety and math performance, using fMRI to separate neural activity during the anticipation of doing math from activity during math performance itself. High-math-anxious individuals (HMAs; $n = 14$) performed worse on the math task (but not on a difficulty-matched word task) than did low-math-anxious individuals (LMAs; $n = 14$). However, the more HMAs activated a set of fronto-parietal working-memory-related regions in response to a cue (indicating that they were about to do math), the less they were impaired in their actual math performance. This relationship was not seen for LMAs. Furthermore, the relation between frontal-parietal cue activity and math performance was fully mediated by task activity in the caudate and hippocampus (effects also specific to HMAs). Individual differences in motivational and working memory (as opposed to math-specific) processes shape math performance in HMAs—consistent with the view that math anxiety leads to transient deficits in general cognitive abilities that can be observed even before the math begins.

(3065)

Increasing Executive Control With a Flick of the Eyes. JAMES M. EDLIN & KEITH B. LYLE, *University of Louisville* (sponsored by John R. Pani)—Performing 30 sec of bilateral saccadic eye movements enhances the subsequent retrieval of memories. The cause of this surprising effect is unknown, but saccades are known to activate brain regions involved in attentional processing, and therefore Lyle and Martin (2010) hypothesized that saccades may enhance memory retrieval by altering attentional processing. To test whether saccades affect subsequent attentional processing, we compared performance on the attention network test (ANT) following saccades with that in a no-eye-movement control condition. The ANT measures three distinct components of attention: alerting, orienting, and executive control. We also examined performance as a function of subjects' handedness (strongly vs. weakly lateralized), because strongly lateralized individuals benefit more consistently from saccades. Saccades affected executive control only. Specifically, saccades increased executive control, regardless of lateralization. However, mixed-handers showed a greater orienting effect than did strong-handers. These results suggest that saccades may enhance retrieval by increasing executive control.

(3066)

Developmental Differences in the Use of Task Goals in a Cued Stroop Task. THOMAS C. LORSBACH, *University of Nebraska, Omaha*, & JASON F. REIMER, *California State University, San Bernardino*—The ability of third graders and college students to update and maintain task goals was examined on a cued, task-switching version of the Stroop color–word task. On each trial, a cue was presented 1,000 or 5,000 msec prior to a stimulus that instructed participants to either read aloud the forthcoming word or name the color of the word's lettering. Children experienced greater interference than did college students at each of the cue–stimulus delays in the color-naming condition. More important, additional analyses based on the process dissociation procedure of Lindsay and Jacoby (1994) indicated that word-reading (but not color-naming) process estimates varied with age group and cue–stimulus delay. Young adults were superior to children in the inhibition of irrelevant word information only during a long cue–stimulus delay. Findings suggest that children have difficulty updating task goals and taking advantage of additional time to suppress stronger, goal-irrelevant responses.

(3067)

Working Memory and Intertemporal Choice: The Effect of Working Memory Load on Intertemporal Choice. SARAH J. GETZ, *Princeton University and Princeton Neuroscience Institute*, DAMON TOMLIN, LEIGH E. NYSTROM, & JONATHAN D. COHEN, *Princeton Neuroscience Institute*, & ANDREW R. A. CONWAY, *Princeton University* (sponsored by Jonathan D. Cohen)—The present experiments provide a resolution to previously contested claims about the effects of a working memory (WM) load on impulsive decision making in an intertemporal choice task. In the first experiment, previously raised issues of erratic responding under WM load were addressed by titrating temporal choices to the best estimate of individual participants' indifference points. In the second experiment, choices adapt online to choice behavior in an effort to drift with participants' drifting discount rates. The results from the first experiment suggest that a high WM load led to more impulsive responding, such that participants under higher load chose the sooner reward more often. The results from the second experiment replicated those of the first by again showing that participants discounted more steeply under a WM load while choices were dynamically adapted to drifting discount rates. Implications for impulsive temporal decision making under a high WM load are considered.

• IMPLICIT MEMORY III •

(3068)

Sense of Agency Over Thought: External Misattribution of Thought in a Memory Task and Proneness to Auditory Hallucination. ERIKO SUGIMORI, *Yale University*, & YOSHIHIKO TANNO, *University of Tokyo*—Many people with schizophrenia describe an experience of passivity. This experience may be caused by an abnormal sense of agency, which refers to the feeling of causing one's own actions. This study investigated the relationship between external misattributions of thoughts in a memory task and auditory hallucination-like experiences, which can be construed as events involving passivity. After reconfirming that the AHES-17 was suitable for measuring auditory hallucination-like experiences in Study 1 ($N = 613$), Study 2 investigated the relationship between the results obtained with the DRM paradigm and scores on the AHES-17 ($N = 172$). We found that critical lures elicited increased numbers of false alarms as AHES-17 scores increased. This result indicates that external misattributions of thoughts may occur because normal healthy people prone to auditory hallucinations are less likely to develop a sense of agency over their thoughts or images.

(3069)

The Role of Awareness in Anticipation and Recall Performance: Implications for Sequence Learning. KATHERINE GUÉRARD, JEAN SAINT-AUBIN, & PIERRE BOUCHER, *University of Moncton*, & SÉBASTIEN TREMBLAY, *Laval University* (sponsored by Sébastien Tremblay)—Sequence learning has been studied by numerous researchers using different methodologies—notably, the Hebb repetition paradigm (Hebb, 1961) and the serial reaction time (SRT) task (Nissen & Bullemer, 1987). These two paradigms produce robust learning effects but diverge with regards to the role of awareness: Awareness has no effect on sequence learning in the Hebb repetition paradigm, whereas it helps to anticipate the next stimuli in the SRT task. In the present study, we examine the role of awareness in anticipation and recall performance, using the Hebb repetition paradigm. Eye movements were monitored during a spatial reconstruction task in which participants had to memorize sequences of dot locations. One sequence was repeated every four trials. The results show that recall for the repeated sequence improves across repetitions for all participants but that anticipation increases only for participants aware of the repetition. The implications for theories of sequence learning are discussed.

(3070)

The Role of Inhibition in Resolving Interference: Evidence of an Age-Related Deficit. M. KARL HEALEY, KAREN CAMPBELL, LYNN HASHER, & LYNN OSSHER, *University of Toronto*, & ROSE T. ZACKS, *Michigan State University* (sponsored by Rose T. Zacks)—We have recently shown that for young adults (18–30 years), resolving

interference during memory retrieval entails suppressing competing responses (Healey, Campbell, Hasher, & Ossher, in press, *Psychological Science*). Here, we tested the hypothesis that older adults have difficulty suppressing competitors during retrieval. Both younger and older (60+ years) adults performed a vowel-counting task that included pairs of orthographically similar words (e.g., ALLERGY and ANALOGY). After a delay, they solved word fragments (e.g., A _ L _ _ GY) that resembled both words in a pair but could be completed only by one. We then measured the consequence of having successfully resolved interference by having participants read a list of words including the rejected competitors as quickly as possible. Naming time was compared with that in control conditions that did not require resolving interference. Younger adults showed slowed competitor naming after interference resolution, indicating that suppression had occurred. Older adults, however, showed no evidence of suppression. Impaired suppression abilities may contribute to the well-documented age differences in memory retrieval.

(3071)

Effect of Repeated Exposure of a Novel Figure Embedded in Different Figures on the Mere Exposure Effect. HISATO IMAI & YUKIKO ISHII, *Tokyo Woman's Christian University*—We examined whether the mere exposure effect would occur when a novel figure was presented repeatedly, which was embedded in different figures on each presentation. Stimulus figures were 4×4 dot matrices with eight lines and 3×3 dot matrices with five lines, and the latter 3×3 matrices were embedded as a part of the former 4×4 ones. Forty-one undergraduates were exposed to 4×4 matrices for 1 sec. Then they were presented two 3×3 matrices simultaneously for two-alternative forced choice preference judgments. One of them was exposed in the first phase as a part of the 4×4 matrices once or four times; in the four-times condition, four different 4×4 matrices that contained the same 3×3 matrices were presented. The mere exposure effect was found only in the four-times condition. These results indicate that repeated exposure of the same 3×3 matrix that was embedded in the different 4×4 matrices would be extracted and would enhance preference for them.

(3072)

Repetition Priming in Lexical Decision Reflects Parallel Automatic and Strategic Processing Routes. YOAV KESSLER & MORRIS MOSCOVITCH, *University of Toronto and Rotman Research Institute* (sponsored by Nachshon Meiran)—In a lexical decision task, faster RTs for old than for new items are taken as evidence for an implicit memory involvement in this task. In contrast, the present study shows the involvement of both implicit and explicit memory in repetition priming. We claim that lexical decisions can be made using one of two processing routes: (1) a lexical route, in which the lexical properties of the stimulus are used to determine whether it is a word or not, and (2) a strategic route that builds on the inherent correlation between "wordness" and "oldness" in the experiment. Examining the RT distributions, we show that eliminating the strategic route by removing this correlation results in diminishing the priming effect in the slow end of the RT distribution, but not in the fast end. This dissociation is interpreted as evidence for the involvement of explicit memory in repetition priming

(3073)

Previous Visual Experience Affects Aspects of Later Language Processing. LISA VANDEBERG, WING Y. TANG, & ROLF A. ZWAAN, *Erasmus University Rotterdam* (sponsored by Rolf A. Zwaan)—To what extent does previous visual experience affect later language processing? In an experiment adopting a visual memory paradigm, participants first performed a word–picture verification task. Next, after a 20-min filler task, their eye movements were tracked while they read sentences that implied either the orientation or the shape of an object. This seemingly unrelated task contained sentences with object orientations or shapes (e.g., *the knife/flag was put away in the drawer*) that either matched (*horizontal knife/folded flag*) or mismatched (*vertical knife/unfolded flag*) the orientation or shape in the previously presented pictures. Early-stage comprehension measures (i.e., first-pass reading times) suggested that previous visual experience influenced reading in certain disambiguating

regions of the sentence, but not in others. Implications for theories of embodied cognition will be briefly discussed.

• WORKING MEMORY III •

(3074)

Age-Related Differences in Working Memory Span Performance. DEVON DAUTRICH, JACOBA ZARING, & ANJALI THAPAR, *Bryn Mawr College* (sponsored by Anjali Thapar)—This study examined age-related differences in working memory span performance. Younger and older adults provided set-by-set reports of strategy use while completing an operation span task. Reliable age differences in operation span scores were observed for larger set sizes (set sizes, 4–6). In contrast, reliable age differences were not observed in the choice of strategy use. The results are not consistent with the strategy deficit hypothesis, which states that age-related differences in working memory span performance result from age differences in the use of effective strategies.

(3075)

A High Working Memory Load Eliminates the Numerical Distance Effect. ERIN A. MALONEY, *University of Waterloo*, EVAN F. RISKO, *University of British Columbia*, & DEREK BESNER & JONATHAN A. FUGELSANG, *University of Waterloo* (sponsored by Jonathan A. Fugelsang)—Number comparison is undoubtedly one of the most fundamental numerical abilities. Numerical comparison tasks elicit a pattern of data, the numerical distance effect (NDE), that is thought to provide insight into how numbers are represented and processed. According to Verguts, Fias, and Stevens's (2005) "model of exact small-number representation," the NDE arises due to concurrent activation of multiple competing responses. If the NDE arises due to response competition, the NDE should behave like other response competition effects (e.g., Stroop). In the present investigation we examined the interaction between WM and the NDE in a two-Arabic-digit comparison task. Interestingly, whereas response competition accounts predict a larger effect under high WM load, the opposite is true of the NDE. In three experiments, we found that an increased WM load leads to the statistical elimination of the NDE. These results are discussed in terms of alternative accounts of the NDE.

(3076)

Accessing What's Available: The Number of Features Matters in Visual Search, But Not Memory Search. PAUL VERHAEGHEN & SHRIRADHA SENGUPTA, *Georgia Institute of Technology* (sponsored by Paul Verhaeghen)—It has been claimed that memory strength in visual short-term memory is dependent on visual complexity/discriminability (often measured using visual search slopes) and independent of the number of features (e.g., Awh, Barton, & Vogel, 2007). Little is known about speed of access. We directly compared RT by set-size slopes for visual search and memory search for 2-D cubes consisting of one, two, or three colors. Visual search and memory search dissociated: Visual search rates increased monotonically with the number of colors/cube (slopes of 7, 19, and 52 msec, respectively), but memory search rates were constant at about 9 msec/item. We did find similar monotonic relations for item availability, as measured by accuracy. The data are in line with a growing number of observations suggesting that item availability in working memory is different from item accessibility.

(3077)

Practice Doesn't Make Perfect: An Exploration of the Role of Practice and Switch Trials on the Expansion of the Focus of Attention. JOHN M. PRICE & GREGORY J. H. COLFLESH, *Georgia Institute of Technology*, JOHN CERELLA, *Syracuse University*, & PAUL VERHAEGHEN, *Georgia Institute of Technology*—There is debate over the capacity of the focus of attention (FOA) and whether it can be expanded. Some researchers suggest that the capacity is one item, whereas others suggest that the capacity is four. Verhaeghen, Cerella, and Basak (2004) found that the capacity of the FOA increased from one to four items in an *N*-back task over the course of ten 1-h sessions. However, Oberauer (2006), using random-order probing, was unable to demonstrate a similar expansion. Here, we used two tasks, a random-order probe without

updating (with an additional manipulation of the proportion of switch trials) and a Sternberg task with exhaustive probing. In neither task was there any evidence for a disappearance of focus switch costs or an expansion of the FOA. This adds to the growing evidence that forward-order search in short-term memory has a unique status.

(3078)

Math Anxiety Effects on the Measurement of Working Memory Span. ROBERT T. DURETTE & DAVID E. COPELAND, *University of Nevada, Las Vegas* (sponsored by Colleen M. Parks)—When working memory span is measured, one factor that could bias scores is anxiety. The goal of the present study was to examine the effects of math anxiety on working memory span, using the operation and reading span tasks along with a math anxiety questionnaire. Current theory suggests that math anxiety consumes critical working memory resources when math problems are completed; also, individuals with high levels of math anxiety avoid math situations. Both hypotheses would have a negative impact on operation span performance, but not necessarily on reading span performance. Our results indicate that the 85% cutoff that is typically used for processing performance disproportionately removes high-math-anxiety individuals from the operation task, but not the reading span task.

(3079)

The Role of Working Memory Capacity in Conflict Monitoring. REBECCA B. WELDON, MYEONG-HO SOHN, & JOHN W. PHILBECK, *George Washington University* (sponsored by Matia Okubo)—It is well established that working memory capacity (WMC) affects cognitive control, but it is not exactly clear how WMC does so. We hypothesized that WMC contributes to the efficiency of conflict monitoring to eventually change the efficiency of cognitive control. In Experiment 1, individuals with differing WMCs completed two blocks of Simon tasks. In the 20/80 condition, 20% of the trials were congruent, and the rest were incongruent. In the 80/20 condition, 80% of the trials were congruent. Both low- and high-WM groups showed smaller conflict effects in the 20/80 condition than in the 80/20 condition. However, whereas the high-WMC group revealed a nearly perfect conflict adaptation effect, the low-WMC group showed a reversed conflict effect. In Experiment 2, we examined the effect of the concurrent WM load on conflict monitoring and found similar results. These findings support our hypothesis that WMC affects the efficiency of conflict monitoring.

(3080)

Selective Decrements in Spatial Working Memory Under Pressure. AKIHIRO KOBAYASHI, *Senshu University Graduate School*, & MATIA OKUBO, *Senshu University*—Choking under pressure refers to performance decrements under pressure circumstances. This may occur, at least partially, because pressure deprives working memory (WM) of resources. However, it is unclear which component of WM (e.g., visuospatial scratch pad, articulatory loop) deteriorated under pressure. The present study compared performance of spatial and verbal three-back tasks under high and low pressure. High levels of pressure disrupted the performance of the spatial task for participants with high trait anxiety, but not for those with low trait anxiety. This disruptive effect disappeared for the verbal task. These results suggest that pressure does not homogeneously affect WM systems; rather, it hampers spatial WM more severely than verbal WM. It has been found that pressure increases the level of anxiety. This increase of anxiety, which activates the right hemisphere (RH), may interfere with the spatial WM system in the RH, causing the performance decrements in the spatial WM task.

(3081)

Checking in Prospective Memory: Attentional Filtering and Memory Retrieval. ASHLEY J. SCOLARO, *Iowa State University*, ANNALISA COHEN, *Yeshiva University*, & ROBERT L. WEST, *Iowa State University*—Strategic monitoring is important for prospective remembering and is supported by retrieval mode and target checking. Studies using ERPs have identified the neural correlates of strategic monitoring but have not distinguished between these two types of processes. Here, we examined the neural correlates of target checking in a lexical decision task. The behavioral data provided evidence for strategic monitoring. The

ERP data revealed two modulations that were related to target checking: a posterior negativity/anterior positivity between 300 and 400 msec and a parietal slow wave between 600 and 1,000 msec. When the prospective cues were words, the posterior negativity distinguished words from nonwords; when the cues were nonwords, the posterior negativity was seen for both words and nonwords. The parietal slow wave distinguished words from nonwords earlier when the PM cue was a word than when the PM cue was a nonword. These results indicate that at least two distinct processes underpin target checking.

• EXPLICIT MEMORY III •

(3082)

Mood Is Encoded As an Influential Component When Planning Delayed Intentions. JUSTIN B. KNIGHT & B. HUNTER BALL, *University of Georgia*, GENE A. BREWER, *Arizona State University*, & MICHAEL R. DeWITT, *University of Georgia* (sponsored by Jason L. Hicks)—Event-based prospective memory involves delaying an intention by associating it with some environmental cue to be processed in the future. The influence of mood on forming such intentions remains unclear. In our studies, participants were induced into a positive, negative, or neutral mood state at intention formation, and they returned to their baseline mood before beginning the task with event-based cues. Relative to the neutral control group, event-based performance was improved in the positive group and impaired in the negative group. We also manipulated the valence of the cues and the mood congruency between intention formation and retrieval. Mood specifically influenced prospective memory encoding, with implications for the understanding of episodic future thinking and mood congruency.

(3083)

Multidimensional Source Monitoring: Prior Retrieval of One Source Attribute Improves Source Memory for a Second. MICHAEL R. DeWITT, JUSTIN B. KNIGHT, & B. HUNTER BALL, *University of Georgia*, & JASON L. HICKS, *Louisiana State University* (sponsored by Richard L. Marsh)—There is a debate in the source-monitoring literature as to whether the reinstatement of one contextual attribute improves source memory for a second attribute. Previous research has not found compelling evidence for reinstatement effects in source memory. Our approach differed from previous work in that we did not reinstate any source information at test per se but, rather, manipulated whether participants were asked to make a source judgment at test on one attribute prior to making the source judgment on the critical attribute. Previous research used exact reinstatement of an attribute, sometimes showing improved source memory for the critical attribute; we found consistent evidence with our new procedure that explicit access of related details improves source memory. Theoretically, the source-monitoring framework must make a distinction between the exact reinstatement of source information at test and the retrieval of related memorial information regarding another source attribute. Our new approach may be more powerful for accessing other attributes of an item in episodic memory.

(3084)

Neural Activity Supporting the Encoding of Intraitem Versus Item–Context Associative Memory. HEEKYEONG PARK & JOHN BIGGAN, *University of Texas, Arlington*—We employed fMRI to investigate whether the regions engaged during encoding of item–item associations differ from those engaged during item–context encoding. At study, participants were presented a list comprising unrelated object picture pairs with the names of those objects in either a male or a female voice. Participants were scanned while they made a judgment as to which of the denoted objects would "fit" inside the other. Following the study phase, a surprise recognition memory test was administered for the study status and study context of test pairs. In accordance with previous findings, study pairs that were correctly endorsed as intact elicited enhanced activity in the left inferior prefrontal area and bilateral fusiform areas than did pairs that were incorrectly endorsed as rearranged. Conjoint encoding activity for item–item and item–context associations was associated with activity in the medial temporal lobe. The role of the medial temporal lobe in associative memory is discussed.

(3085)

Distraction Can Serve As Implicit Rehearsal to Boost Older Adults' Recall Performance. RENÉE K. BISS & LYNN HASHER, *University of Toronto and Rotman Research Institute*, & SARA J. SHETTLE-WORTH, *University of Toronto* (sponsored by Sara J. Shettleworth)—Older adults have difficulty downregulating attention to distracting information, which often negatively impacts memory performance. Recent research suggests that this susceptibility to distraction can be beneficial if distraction reappears as target information on a later task. We investigated whether presentation of distraction can also reduce forgetting of encoded information by serving as implicit rehearsal episodes. At the beginning of the experiment, younger and older adults intentionally encoded and recalled a list of words. During a filled interval, half of the words were presented as distractions in a one-back task. In a final free recall trial, older adults showed a significant mnemonic benefit for the words that were implicitly rehearsed in the one-back task. In contrast, younger adults did not benefit from exposure to the distracting words. This finding suggests that presentation of distraction can function as implicit rehearsal for older adults, keeping encoded information accessible and aiding subsequent recall.

(3086)

Better Recall Following Error Generation: An Error Correction Effect, Not a Generation Effect. DANIEL R. KIMBALL & WILLIAM B. LANDON, *University of Oklahoma* (sponsored by Daniel R. Kimball)—Kornell, Hays, and Bjork (2009) found that generation of errors followed immediately by correction enhanced cued recall of correct items, relative to simply reading correct items. They concluded that generation success is not a precondition for observing a generation effect. In their study, however, read items were always correct; generated items were always errors that were then corrected. Our experiment unconfounded these two variables by also including generated correct items and read-and-corrected errors. For correct items, we observed a standard generation effect in cued recall. For corrected errors, generation had no effect: Recall improved to a similar degree, relative to read correct items, regardless of whether the corrected error was initially read or generated. Error correction therefore better explains improved recall of generated-and-corrected errors than does generation. We also ruled out error suppression as an underlying mechanism: Error items exhibited positive priming in a lexical decision task.

(3087)

Medial Prefrontal Cortex Supports Accurate Source Memory Retrieval for Items Encoded Under Self-Reference. ERIC D. LESHIKAR & AUDREY L. DUARTE, *Georgia Institute of Technology* (sponsored by Eric H. Schumacher)—Previous behavioral work suggests that encoding information in a self-referential manner boosts item memory, a finding that neuroimaging evidence suggests relies on the medial prefrontal cortex (Macrae et al., 2004). Little work, however, has examined the effects of self-referential encoding on the retrieval of source. In this experiment, we examined source memory accuracy for multiple sources. Subjects studied common objects superimposed on one of two scenes under self-referential or self-external encoding instructions. Consistent with previous work, item recognition was enhanced for the objects encoded self-referentially. Source memory accuracy for the scene was enhanced after self-referential encoding. Furthermore, participants were more likely to remember the scene if they remembered the encoding task. Neural activity revealed that the medial prefrontal cortex supported source memory accuracy for the stimuli encoded self-referentially, but not for those encoded self-externally. Overall, these data suggest a role for the medial prefrontal cortex in the accurate retrieval of multiple sources during self-reference.

(3088)

Effects of Sleep on Autobiographical Memory. GERT KRISTO, *University of Tilburg*, STEVE M. J. JANSSEN, *Hokkaido University*, & JAAP M. J. MURRE, *University of Amsterdam* (sponsored by Martijn Meeter)—Several studies have recently found a positive correlation between sleep and memory consolidation. In this online study, the effects of the quality of sleep on autobiographical memory were examined, using an Internet-based diary technique (Kristo, Janssen, & Murre, 2009). Each participant recorded on a Web site one recent personal event and was contacted after a retention interval that ranged between 2 and 45 days. The recall of the content, time, and details of the recorded event was compared with the quality of sleep, which was measured with the Pittsburgh Sleep Quality Index. Participants who reported having slept well lately could recall their personal events better than could participants who had slept poorly. Several subject and event variables, such as age, gender, importance, and pleasantness, were examined for their potential mitigating influence on the relationship between sleep quality and the recall of autobiographical memory.

(3089)

Association Directionality and False Recognition. JASON ARNDT, ADAM DEDE, CLOE SHASHA, KRISTIN CORBETT, & SOPHIE DOROT, *Middlebury College*—An experiment investigated the influence of study-item-to-lure (backward associative strength, or BAS) and lure-to-study-item (forward associative strength, or FAS) association strength on false recognition in the Deese/Roediger–McDermott paradigm. Stimulus sets were constructed such that BAS and FAS were independently manipulated. In order to examine the effects of these manipulations on retrieval processes, participants were asked to respond within 700 msec of test item presentation (speeded test) or were given unlimited time to respond (unspeeded test). The results of the study demonstrated that both FAS and BAS increased lure errors on the speeded test. However, when lure errors on the speeded test were compared with those on the unspeeded test, FAS was the primary factor that altered error rates. These results are consistent with theories that propose multiple bases for lure errors and suggest that BAS and FAS play different roles in lure error production.

(3090)

No BURPI in Prospective Memory. JOYCE M. OATES & ZEHRA F. PEYNIRCIOĞLU, *American University* (sponsored by Zehra F. Peynircioğlu)—Memory impairment due to previously learned information, or proactive interference (PI), has been studied extensively in retrospective memory (RetroM). PI builds up quickly when successive to-be-remembered lists comprise similar items but then dissipates when the nature of the items changes. In this study, we examined whether a similar build-up-and-release-from-PI (BURPI) would also be observed in prospective memory (ProM), or remembering to remember in the future. The question of interest was whether the similarity of the successive trigger cues or responses would impair performance. Participants recalled lists of items from a single category while simultaneously performing a ProM task when certain category items appeared as cues. The usual build-up of PI occurred in RetroM, along with a healthy release when the category was changed for the last list. Interestingly, in the ProM task, there was no evidence of build-up of PI; accuracy remained the same across all lists. Implications are discussed.

(3091)

Direct and Indirect Memory for Source Identity in Social Contexts. BIANCA BASTEN, *University of Wisconsin, La Crosse*, & PASCAL BOYER, *Washington University* (sponsored by Michael C. Mozer)—Three experiments addressed the role of source memory in social contexts. Participants were presented with four sources (either actual persons or personnel folders) that provided information about two targets (either participants' friends/enemies or stereotypical characters). Target familiarity, strength of social context, and source congruence were manipulated. The results revealed better source memory for incongruent sources than for congruent sources only when target familiarity was high (i.e., best friend/enemy) and the social context was strong (i.e., actual person as source). Participants then read a series of trivia statements provided by the same four sources and were asked to judge the likelihood that, considering the source, the statement was true. The results showed lower veridicality ratings for statements made by previously incongruent sources only when the sources were actual persons. Findings suggest that memory for source identity is affected by source congruence. The potential effects of both coalitional and epistemic vigilance are addressed.

(3092)

Is Survival (or Sex) Special? Item-Level Effects in the Survival-Processing Paradigm. DEVON E. McINTYRE & JENNIFER H. COANE, *Colby College*—Both processing words for their relevance to survival and stimulus/encoding congruity enhance memory. This study explored the role of survival information at the stimulus level and the effects of congruity, to assess the boundary conditions of survival processing. If evolutionary pressures designed memory systems, information that has inherent survival value or is relevant to passing on genetic material (i.e., reproduction) should be remembered better. In lexical decision, stimuli with inherent survival value yielded slower RTs but were not remembered better in a surprise recall task, as compared with matched control stimuli. In Experiment 2, three scenarios were compared: survival, sex/cheating, and bank robbery, using word lists congruent with all scenarios. Overall, sex/cheating words were recalled best, and there was a marginal survival-processing advantage. Across both experiments, words with inherent survival value did not show a mnemonic advantage, suggesting that the benefits of survival processing are not acting at the item level.

(3093)

Emotional Enhancement Takes Time: The Emotional Memory Effect Increases With Test Delay. JOHANNA SIMPSON, *University of Stirling*, STEPHEN M. LAWRIE & JEREMY HALL, *University of Edinburgh*, PATRICK O. DOLAN, *Drew University*, & DAVID I. DONALDSON, *University of Stirling*—Emotional memory (EM)—the enhancement of memory through emotional stimulus content—is a widely studied but far from robust effect. Although many papers have reported an EM effect in performance, others have shown an emotion effect only in secondary measures, such as confidence ratings or remember/know judgments. On inspecting the literature, it seems that the EM effect can be shown more reliably if longer study–test intervals are used. To test this hypothesis, we employed a within-subjects design, testing different subsets of a studied series of emotional and neutral pictures at three study–test intervals: immediately, 1 day, and 1 week after study. There was no significant emotion effect on performance at immediate test. After 1 day, there was a nonsignificant trend toward an EM effect. Only after a 1-week study–test delay was the EM effect significant. These findings show the importance of choosing a suitable study–test interval in studies of emotional memory.

(3094)

Response Bias for Emotional Words in Immediate Recognition Memory Is Due to Relatedness Rather Than Emotional Valence. COREY N. WHITE, *University of Texas, Austin*, AYCAN KAPUCU, DAVIDE BRUNO, & CAREN M. ROTELLO, *University of Massachusetts, Amherst*, & ROGER RATCLIFF, *Ohio State University* (sponsored by Roger Ratcliff)—Although there is evidence that memory is enhanced for emotional stimuli, recent work suggests that emotion leads to a liberal response bias, rather than increased discriminability. We explored whether this bias is due to relatedness or categorical effects, because emotional stimuli belong to a well-defined category, whereas comparison stimuli are often from a less salient category (e.g., neutral words). The saliency of the emotional category was manipulated in a recognition task by presenting lists with a small (12.5%), medium (25%), or large (50%) proportion of emotional words. The liberal bias for emotional words was found only in the high-proportion condition, suggesting that valence affects bias only when it is a salient component of the experimental lists. Similar results were found with words from an emotionally neutral category (animal names), providing further evidence that the liberal bias for emotional stimuli is due to relatedness, rather than to emotional valence.

(3095)

Relationships Between Time Perspective and the Characteristics of Memories and Imagined Futures. ERIK HARPSTEAD & RUTHANNA GORDON, *Illinois Institute of Technology* (sponsored by Ruthanna Gordon)—Time perspective refers to people's comfort in thinking about, and their affective attitude toward, their past, present, and future. It is correlated with personality differences, risky behaviors,

and levels of depression. We used the Memory Characteristics Questionnaire to explore how time perspective influences memories and imagined futures. Participants rated cognitive, affective, contextual, and sensory details for positive and negative events that had occurred within the past year, then did the same for positive and negative events that might plausibly occur within the next year. Present hedonistic individuals thought often about positive events, but with relatively little context and detail. Present fatalistic individuals had similarly nonspecific contextual memory. Future-oriented individuals were notable for the specificity of detail for both past and future events, as well as for their positive mood in the present. We discuss these and other correlations in the context of overgeneralized memory findings.

(3096)

Differences in the Organization and Free Recall of Self-Related Information in People with Depression. EMRE DEMIRALP, HYANG-SOOK KIM, RICHARD GONZALEZ, SUSANNE M. JAEGGI, MARC BERMAN, PATRICIA DELDIN, & JOHN JONIDES, *University of Michigan* (sponsored by John Jonides)—We investigated the organization and free recall of self-related information in people with and without depression, diagnosed using structured clinical interviews for DSM (SCID). Individuals were instructed to provide a listing of dimensions about their selves (i.e., academic, gender, physical appearance, mother) and traits/adjectives that they associated with these aspects of their selves (e.g., powerful, curvy, ambitious, loving), as well as the valence, representativeness, and arousal ratings of these traits. Subjects were allowed to provide as many aspects and traits as they wished. The pervasiveness of individuals' traits across their self-aspects was calculated as the ratio of overall number of traits (including duplicates that were associated with multiple self-aspects) to number of unique traits. Individuals with depression had a larger number of pervasive traits, especially for traits with negative valence.

(3097)

Collaborative Encoding Deficits Are Attenuated With Specific Warnings. SARAH J. BARBER, SUPARNA RAJARAM, & BAVANI PANEERSELVAM, *Stony Brook University* (sponsored by Suparna Rajaram)—Collaboration can sometimes be damaging to memory. Individuals remembering together remember less than their potential, an effect known as collaborative inhibition (Weldon & Bellinger, 1997). Similarly, recent work in our own lab has demonstrated that individuals encoding together do so less effectively than individuals encoding alone, an effect we termed the *collaborative encoding deficit* (Barber, Rajaram, & Aron, 2010). In the present work, we examined the potential role of warnings in attenuating the collaborative encoding deficit. Whereas the collaborative inhibition effect at retrieval is unaffected by motivational manipulations (Weldon, Blair, & Huebsch, 2000), across two experiments, specific warnings attenuated the collaborative encoding deficit. Collaborating participants who were specifically told about the collaborative encoding deficit and were given additional suggestions for how to complete the encoding task later had memory superior to that of participants who received no warning. In contrast, a less specific warning did not enhance performance.

(3098)

Transfer-Appropriate Testing Effects with Numerical Stimuli. ANTHONY J. BISHARA, *College of Charleston*—Previous research on the testing effect has shown an impact of initial test operations, but the match between initial and later test operations may also be relevant. The testing effect was examined with numerical stimuli—specifically, event–year pairs. In the study phase, stimuli were read three times or were read once and tested twice, with tests on the ones, tens, or both digits (e.g., 193_, 19_9, 19__). The final test phase consisted of an exact test, where participants retyped digits, and an order test, where participants decided which event came first. A significant interaction occurred between the study and final test conditions. In the exact-final test, performance was best if the initial test was on both digits. However, in the order-final test, performance was best in the tens digit condition. The processing of magnitude information on an initial test may improve performance on later tests that also emphasize magnitude.

(3099)

Memory for a Tailgating Scenario: Planning and Survival Processing Compared. NOELLE L. BROWN, BENJAMIN A. MARTIN, & JASON L. HICKS, *Louisiana State University*—Recent work has demonstrated a recall advantage for information processed either as related to survival or with regard to planning for the future. We examined both of these processing modes, in addition to pleasantness ratings, with a recognition memory paradigm. Participants learned word lists containing items rated by others as highly relevant to a sports tailgating event (e.g., *grill*) or irrelevant (e.g., *computer*). In general, pleasantness ratings produced recognition performance as good as, or better than, the planning and survival conditions. The results suggest limitations on the predicted advantage of survival- and planning-processing modes, including their generalizability across different memory tasks (e.g., recall vs. recognition) and across different encoding scenarios (e.g., outdoors/grasslands scenarios vs. contemporary leisure activities). Schema theory will also be considered with regard to explanations of planning- and survival-processing effects in recognition.

(3100)

Susceptibility in Two False Memory Paradigms: Individual Differences in the DRM and Misinformation Paradigms. JENNIFER L. TOMES, PAMELA TAYLOR, & COURTNEY ARSENEAU, *Mount Allison University*—The purpose of the present study was to examine whether the same individuals who develop false memories in response to misleading information (via the misinformation paradigm) also tend to develop false memories when no misleading information is presented (via the DRM paradigm). The study also examined a variety of individual-difference measures (including measures of working memory span, absorption, delusional ideation, and others) to determine whether the same factors were related to false memory creation in the two paradigms. The results indicated that the tendency to produce illusory memories in one paradigm was not associated with false memory creation in the other paradigm. Although few significant individual differences were found, that pattern of individual differences was not consistent for the two paradigms, reinforcing the suggestion that for false memory creation, the two paradigms likely reflect different memory mechanisms.

• **METAMEMORY III** •

(3101)

The Dynamic Interplay Between the Quality and Quantity of Contextual Information in the Feeling of Knowing. STACEY J. DUBOIS & AYANNA K. THOMAS, *Tufts University*, & JOHN B. BULEVICH, *Rhode Island College*—Previous research suggests that the quality (accuracy) of retrieved contextual information influences feeling-of-knowing (FOK) judgments, but only when the retrieved contextual information is semantic (Dubois & Thomas, 2010). The present study investigated whether quality of contextual information would be less important in FOK magnitude when inherently meaningless stimuli were encoded. Using pairs of ambiguous images, we found that mean FOK judgments were higher when participants retrieved a greater amount of relevant contextual information, regardless of whether that information was correct or incorrect. Research supports the conclusion that the retrieval of relevant contextual information is crucial for generating FOK judgments. They way in which that contextual information is used depends on the nature of the to-be-remembered material. The present research demonstrated that as to-be-remembered stimuli became increasingly meaningful, the quality of contextual information became more important in FOK judgments.

(3102)

Are There Individual Differences in Metacognitive Control? SARAH K. TAUBER, *Kent State University*, & MATTHEW G. RHODES, *Colorado State University* (sponsored by Matthew G. Rhodes)—Minimal research has explored individual differences in metacognitive control and potential changes to such metacognitive processes with practice. Thus, we examined classroom performance (exam scores) and intelligence (Ravens Progressive Matrices; RPM) as predictors of metacognitive control. In three sessions, participants answered general knowledge questions (forced report), provided confidence judgments for each answer, and decided whether an answer should contribute to their overall score (free report). The results showed that participants with lower classroom performance or lower RPM scores exhibited smaller gains in free-report accuracy than did higher scoring participants. However, with practice, lower scoring participants demonstrated gains in free-report accuracy commensurate with higher performers. These data suggest that individual differences contribute to the efficacy of metacognitive control processes.

(3103)

Testing Benefits the Relative and Absolute Accuracy of Judgments of Learning (JOLs). BENJAMIN D. ENGLAND & MICHAEL J. SERRA, *Texas Tech University* (sponsored by Patricia R. DeLucia)—Testing is known to improve memory, but participants often use their previous test performance as a heuristic for their judgments of learning (JOLs) on later trials. This is believed to increase the relative accuracy of the judgment, but also induces underconfidence. Prior research has not considered the separate effects of prior studying, judging, and testing on later JOL accuracy within the same experiment. To do so, we introduced a new method in which pairs that were not judged, not tested, or neither were included on the first trial. Prior judging had no effect on second-trial JOL accuracy, but testing improved not only the relative, but also the absolute accuracy of JOLs for previously tested items, as compared with nontested items. Importantly, our findings suggest that a memory for past-test heuristic is unable to explain underconfidence on later trials, because items tested on earlier trials showed reduced underconfidence, as compared with nontested items.

(3104)

The Interactive Influences of Level of Processing and Item Value on Recall and Metamemory Judgments. MICHAEL S. COHEN, ALAN D. CASTEL, MICHAEL C. FRIEDMAN, & ROBERT A. BJORK, *UCLA* (sponsored by Alan D. Castel)—Level of processing (LOP) and the value accorded to remembering individual items are factors known to heavily influence subsequent recall, but little is known about how those factors interact in their influence on recall and metacognitive monitoring. We presented participants with four successive word lists, within which each word was assigned both a value (1, 5, or 10 points) and a yes/no question that induced one of three different levels of processing. LOP had a consistent effect on subsequent free recall, whereas assigned value affected recall only on the later lists. Participants' judgments of learning, on the other hand, were sensitive to value and largely insensitive to LOP across all lists. The details of the interactions of depth of processing and item value provide some insights into the potentially differing mechanisms that govern levels of processing and value-directed remembering.

(3105)

Of Course I'll Remember That! Stability Bias with Text Passages. JOHN F. NESTOJKO, MIA C. NUNEZ, & ROBERT A. BJORK, *UCLA* (sponsored by Robert Bjork)—People often inaccurately judge their ability to retain specific information, despite holding somewhat accurate beliefs about learning and forgetting. In previous work using lists of paired associates, participants consistently underestimated both forgetting and learning, a result dubbed the *stability bias* (Kornell & Bjork, 2009). It is conceivable, though, that participants' relatively limited experience being tested on paired associates led to a disconnect between their beliefs and their judgments, thus leading to their metacognitive inaccuracies. Conversely, university students are highly practiced at studying and being tested on information from text passages. Thus, in the present experiment, participants read a 1,500-word passage, were asked for judgments of learning, and were tested after 10 min or 1 week. Despite presumably higher familiarity with this type of task, participants once again showed poor sensitivity to forgetting across a long retention interval, a result that further supports the stability bias.

(3106)

Metacomprehension Accuracy From Illustrated Text. ALLISON J. JAEGER, JENNIFER WILEY, & THOMAS D. GRIFFIN, *University*

of Illinois, Chicago—Students generally experience poor metacomprehension accuracy when learning from expository text, meaning they are not able to monitor their own understanding of what they have read. This research is exploring the effects of adding illustrations. In an initial study, the inclusion of either conceptual or seductive images increased comprehension, as compared with a no-image condition. Also, students tended to have greater interest in the texts when images were included. However, seductive images led to lower metacomprehension accuracy, as compared with the no-image condition. This suggests that seductive images may provide readers with a false sense of fluency, which could be undermining effective self-regulation. This effect is further explored with eyetracking and an intervention designed to help students take advantage of the conceptual illustrations.

• SELECTIVE ATTENTION III •

(3107)

The Attentional Blink and Lag 1 Sparing Are Nonspatial. RASMUS LUNAU, *University of Copenhagen* (sponsored by Gordon D. Logan)—The attentional blink (AB) refers to the finding that the perception of the second of two targets (T2) is impaired when T2 is presented in close temporal proximity to the first target (T1). An exception to this deficit occurs when T2 immediately follows T1, an effect referred to as lag 1 sparing. So far, it has been unclear whether the AB is location specific or nonspatial in nature. Most demonstrations of an AB across different locations have shown an absence of lag 1 sparing, due to accompanying spatial switch costs. This means that the AB pattern itself may be explained through such switch costs. In this study, to minimize spatial switch costs, attention was made to move continuously across multiple locations by aid of a cue. An AB across different locations was found, including lag 1 sparing. We conclude that the AB and lag 1 sparing are not tied to a location but represent a central deficit, in line with current theory.

(3108)

An Investigation of Attentional Biases in Problem Drinkers, Using Change Detection Methodology. BONNIE L. ANGELONE & DAVID J. ANGELONE, *Rowan University*—Researchers have examined attentional biases (a tendency to visually attend to certain stimuli) in a variety of psychiatric disorders. Although several methods have been used, it is unclear whether they assess attention selection early in the process or response criterion late in the process, subsequently leading to the use of change detection. However, only single images have been used with this method; thus, any findings may represent a unique stimulus effect. The present study attempted to overcome this limitation by using potentially improved methodology, related to alcohol. Understanding possible mechanisms for alcohol use disorders is essential for effective treatments. In the end, performance differences between problem and social drinkers, using an improved methodological paradigm, were not replicated. Given the novelty of this methodology, the inconsistencies in results, and the importance of the findings for treatment, the authors discuss current implications and future directions in this field of study.

(3109)

Impact of Media Multitasking on Attentional Filtering and Disengagement. MATTHEW S. CAIN & STEPHEN R. MITROFF, *Duke University* (sponsored by Stephen R. Mitroff)—People have nearly constant access to media and electronic sources of information. Whereas some people often consume multiple sources simultaneously, others regularly consume one source at a time. Recent research has shown that individual differences in trait media multitasking relate to the ability to filter distracting information (Ophir, Nass, & Wagner, 2009). We reveal that these differences occur at the level of attention. Using a singleton distractor task, we found that heavy media multitaskers do not take advantage of information that would allow them to selectively ignore an irrelevant color singleton to the same degree as light media multitaskers do. Furthermore, in a related task, we have found that heavy media multitaskers take more time to inhibit planned responses, suggesting a deficit in disengaging from salient stimuli. Complex everyday activities, such as consuming multiple media simultaneously, may have measurable impacts on basic attentional processes.

(3110)

Simplistic Fear-Relevant Stimuli Interfere With Task Performance. SARAH J. FORBES, HELENA M. PURKIS, & OTTMAR V. LIPP, *University of Queensland*—Fear-relevant images have been shown to capture attention preferentially, in comparison with fear-irrelevant images. Current theory suggests that this preferential processing is mediated by an evolved module that allows stimulus features to attract attention automatically, prior to more detailed processing of the image. The present research investigated whether fear-relevant stimuli with reduced detail or reduced clarity interfere with target detection in a visual search task. In Experiments 1 and 2, silhouettes and degraded silhouettes of fear-relevant animal stimuli interfered more with task performance than did fear-irrelevant stimuli. Additionally, Experiment 2 demonstrated that fear-relevant stimuli produced interference regardless of whether participants were instructed as to stimulus content. Experiment 3 directly compared fear-relevant and fear-irrelevant stimuli and confirmed that fear-relevant interference was not an effect of novelty. The three experiments provide evidence that fear-relevant stimuli interfere with task performance even when the images have reduced detail and clarity.

(3111)

The Intertrial Effects in Visual Search for Faces With Emotional Expressions. XIAOANG WAN, *Tsinghua University*—Searching for a color singleton and identifying its shape was faster when the distractor color was viewed than when the target color was viewed in the preceding target-absent trial. This intertrial effect, known as the distractor previewing effect (DPE), was also observed with face stimuli. In two experiments, we employed the DPE paradigm to investigate the intertrial effects in visual search for faces expressing negative, neutral, or positive emotions. Real faces were used in Experiment 1, whereas schematic faces were used in Experiment 2. Participants were asked to search for an emotion singleton (i.e., the face that expressed a different emotion from the other faces) and identify its certain feature. We found that the DPE was influenced by the emotion that the target face expressed. Preliminary data also showed a search asymmetry favoring neutral faces in Experiment 1. The underlying mechanisms are discussed.

(3112)

The Effects of Threat Salience in Visual Marking of Emotional Faces. ELISABETH BLAGROVE & DERRICK G. WATSON, *University of Warwick* (sponsored by Derrick G. Watson)—The top-down, intentional deprioritization of previewed items increases search efficiency for new items—the preview benefit (Watson & Humphreys, 1997). Previous work has demonstrated a robust, but partial, preview benefit with schematic and photographic faces. However, valence-based differences for suppressing positive (happy) or negative (sad) expressions occurred only at short preview durations (250–750 msec). The present study used pictures of facial affect as stimuli (Ekman & Friesen, 1976) in a preview search task, exploring processing differences in expressions with stronger threat signals (e.g., angry faces) and/or similar perceptual salience (e.g., with/without open mouths). A robust preview benefit was obtained whenever there was a small perceptual difference between old and new stimuli. However, with large perceptual differences, a partial preview benefit was obtained only when searching for positive faces. These results extend our understanding of processing valenced face stimuli and are interpreted in terms of threat salience and the ecological properties/constraints of time-based visual selection.

(3113)

The Generalization of Item-Specific Control to Semantically Related Words. THOMAS G. HUTCHEON & DANIEL H. SPIELER, *Georgia Institute of Technology* (sponsored by Daniel H. Spieler)—In the Stroop task, interference is modulated by the proportion of congruent and incongruent trials. Manipulation of item-level condition proportions has a similar influence on interference. This finding may suggest a form of cognitive control (Jacoby, Lindsay, & Hessels, 2003) operating at the individual word level, or it may simply reflect the learning of associations between specific words and specific responses. We demonstrate that the condition proportion associated with individual words generalizes to semantically related words. Words related to mostly congruent items are responded to more slowly than those related to mostly incongruent items. We suggest

that the effect of an item-level manipulation reflects generalization constrained by discrimination between items with heterogeneous probabilistic associations. In contrast, a list-level manipulation reflects generalization across items encouraged by homogeneous probabilistic associations.

(3114)

Testing the Irrelevant Speech Effect on a Grammaticality Judgment Task. CHRISTY M. SEIDEL, EMILY M. ELLIOTT, & JANET L. McDONALD, *Louisiana State University*—The issue of auditory distraction effects has received empirical attention, but questions about the nature of such distractions remain. In the present research, we compared the irrelevant speech effect, using grammatical and ungrammatical sentences, in two different tasks: grammaticality judgment and letter recall. This is a controlled follow-up of research by Jones, Miles, and Page (1990), which had participants do a proofreading task. Jones et al.'s findings, as well as those in Baddeley, Eldridge, and Lewis (1981), showed that irrelevant speech did not affect the ability to detect grammatical errors. Consistent with these findings, irrelevant speech did not significantly impact letter recall. However, ungrammatical irrelevant speech corresponded to poorer grammaticality judgment performance over the silent condition. Yet, the silent and grammatical irrelevant speech conditions did not differ. The results suggest that task demands play a role in auditory distraction effects, consistent with the theoretical position of Jones and colleagues.

• SPATIAL COGNITION III •

(3115)

In Recognition of the Category Adjustment Model: A Forced Choice Location Memory Study. MARK P. HOLDEN, NORA S. NEWCOMBE, & THOMAS F. SHIPLEY, *Temple University* (sponsored by Nora S. Newcombe)—How do we remember locations? Intuitively, we remember that our keys are on a table, roughly 10 cm from the edge. A Bayesian combination of categorical and metric information offers an optimal strategy under uncertainty. Prior research supports the use of such a strategy within simple figures (e.g., Huttenlocher, Hedges, & Duncan, 1991) and within complex natural scenes (Holden, Curby, Newcombe, & Shipley, 2010) by demonstrating bias in recall toward central (prototypical) points. Using a two-alternative, forced choice recognition task, Sampaio and Wang (2009) revealed that metric information is not lost in this combinatory process. Here, we build upon these results by examining recognition for spatial locations, using much more complex stimuli (photographs of everyday objects and scenes), and a four-alternative forced choice task. Experiment 1 replicates the major findings of Sampaio and Wang with these complex stimuli. Experiment 2 examines the nature of errors made in this task under uncertainty.

(3116)

Mental Bending: Mental Simulation of Nonrigid Transformations. KINNARI ATIT & THOMAS F. SHIPLEY, *Temple University*, & BASIL TIKOFF, *University of Wisconsin, Madison*—Much research has focused on mental rotation, yet rotation is not the only way objects can change. This study addresses the question, is mental rotation a good proxy for mental simulation of transformations in general? We investigated individual differences in visualization of nonrigid transformations. Participants were presented with images of a bent sheet of transparent plastic that contained a circle and star. Their task was to decide whether the star was to the right or left of the circle when the transparency was flat (unbent). Three levels of bending created three levels of difficulty. Fifty-two undergraduates completed the unbending task, reported their strategies, and completed the Vandenberg and Kuse MRT-A. Accuracy on the bending task was correlated to MRT performance for both medium ($r = .63$) and hard ($r = .75$) levels for those who reported using mental unbending ($n = 19$) for the task, suggesting that mental rotation skill reflects broader mental transformation skills.

(3117)

Spatial Memory in the Real World: Representations of Everyday Environments. STEVEN A. MARCHETTE, ASHOK YERRAMSETTI,

THOMAS BURNS, & AMY L. SHELTON, *Johns Hopkins University* (sponsored by Amy L. Shelton)—When people learn an environment, they appear to establish a primary heading just as they would determine the top of a novel object. Evidence for reference orientations has largely come from observations of orientation dependence in pointing judgments: Participants are most accurate when asked to recall the space from a particular orientation. However, these investigations have generally tested memory for room-sized spaces (or smaller) on the same day as learning, leaving open the possibility that larger spaces experienced daily over time depend on a different organizational scheme. To test this possibility, we asked undergraduates to perform judgments of relative direction on familiar landmarks around their well-learned campus. Participants showed clear evidence for a single reference orientation, generally aligned along salient axes defined by the buildings and paths. These results suggest that the presence of a reference orientation is a general property of spatial memory, from tabletops to rooms to college campuses.

(3118)

Environment- or Path-Aligned Spatial Reference Directions in Spatial Memory of an Irregular Multiple-Leg Path. WEIMIN MOU, *University of Alberta*, & TIMOTHY P. McNAMARA, *Vanderbilt University*—Two experiments examined the spatial reference directions in memory when participants walked an irregular multiple-leg path. Two hypotheses were tested. One hypothesis was that participants would establish a common allocentric frame of reference, with reference directions aligned with environment geometry. An alternative hypothesis was that participants would establish path-aligned reference directions at each path leg. Participants donned a head-mounted display and were asked to navigate through a virtual array of six objects along a predetermined path. Three of the six path legs were orthogonal to the walls of a virtual room, and three were nonorthogonal. At each path leg, participants perceived only the object on the end of the leg. After participants had walked the paths and studied the locations of all six objects for 10 study trials, they conducted judgments of relative direction (JRDs; e.g., "imagine you are standing at X, facing Y, please point to Z"). The imagined headings in the JRDs were parallel to the experienced paths. The results showed that participants demonstrated significantly higher pointing accuracy in the wall-aligned path legs than in the wall-misaligned path legs. This pattern suggests that participants established a common allocentric frame of reference, rather than multiple path-aligned reference directions.

(3119)

Differentiating Body- and Head-Based Reference Systems in Spatial Updating. CHRISTOPHER J. TEETER, NIDA LATIF, & HONG-JIN SUN, *McMaster University* (sponsored by Hong-Jin Sun)—We examined the relative contributions of the head and body reference systems for updating spatial relations. Participants were asked to learn features of a room-sized spatial layout. They were then blindfolded and were asked to assume a body orientation (facing direction) that was either aligned or misaligned with learning orientation. Finally, participants were asked to make directional judgments to the learned spatial features whereas adopting an imagined orientation that was either congruent or incongruent with the orientation of their body. In Experiment 1, the head and body axes were always the same, whereas in Experiment 2, participants turned their head to match the imagined orientation. Performance was significantly impaired when participants adopted an imagined orientation that was incongruent with their body orientation. The extent of this impairment was greater in Experiment 1, demonstrating the difficulty in mentally overriding input from body-based cues and the importance of a head-based reference system in updating spatial relations.

(3125–3132)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION IV
Saturday Noon
Exhibit Hall
Viewing 10:00–1:30, Author Present 12:00–1:30

• Animal Cognition •

(4001)
The Perception of Goal-Directed Actions by Cotton-Top Tamarins.
KATE M. CHAPMAN & DANIEL J. WEISS, *Pennsylvania State University* (sponsored by David A. Rosenbaum)—Children and adults readily interpret action sequences with respect to their intended goal, an action perception ability that may have a lengthy evolutionary history. We investigated this ability in cotton-top tamarins, a highly social primate species. In Experiment 1, we replicated previous research (Wood et al., 2007) by presenting tamarins with a 2AFC task in which they chose between two bowls: one contacted in a goal-directed manner by a human experimenter and one contacted incidentally. Subjects preferentially chose the former. In Experiment 2, we used a less canonical hand gesture to contact the bowls. Here, performance was at chance. In Experiment 3, we failed to replicate the second finding of Wood et al., since tamarins did not appreciate rational constraints on actions. Overall, our results question the tamarins' abilities to infer the goal structure of human actions and suggest that such social knowledge likely varies across different primate species.

(4002)
A Comparative Analysis of Decision Making: Choices With or Without Comparisons? MARCO VASCONCELOS, TIAGO MONTEIRO, JUSTINE AW, & ALEX KACELNIK, *University of Oxford* (sponsored by Peter J. Urcuioli)—We often assume that in a choice situation, individuals compare the relative merits of simultaneously present opportunities and integrate the comparison into a decision to act. We contrast this with the sequential choice model (SCM), which postulates that decision makers make no comparison between options at the time of choice. According to the latter, behavior in simultaneous choices reflects adaptations to contexts with sequential encounters, in which the choice is whether to take an opportunity or let it pass. We postulate that in sequential encounters, the decision maker assigns a subjective value to each option, reflecting its payoff relative to background opportunities. This value is expressed as a latency and/or probability to accept each opportunity, as opposed to keep searching. In simultaneous encounters, choice occurs through each option being processed independently, by a race between the mechanisms that generate option-specific latencies. We describe these alternative models and present data supporting the SCM.

(4003)
Call of the Wild: How Tamarins Treat Music and Vocal Stimuli.
JULIE J. NEIWORTH & KATE B. JONES, *Carleton College*—This study examined habituation responses by tamarins to conspecific calls (food and long calls) and to music stimuli, with tests of altered versions of the calls and music (octave change, scrambled notes, or novel examples). Calls were generalized to be similar when raised an octave or at their true pitch, whereas music stimuli were not considered the same when raised an octave. Differences in tamarin processing of calls and music are discussed.

(4004)
Sequential Planning in Rhesus Monkeys (*Macaca mulatta*). DAMIAN K. SCARF, *University of Otago*, PETER D. BALSAM, *Barnard College*, & HERBERT S. TERRACE, *Columbia University* (sponsored by Peter D. Balsam)—Rhesus monkeys learned a five-item list prior to the introduction of switch and mask trials. On switch trials, the on-screen positions of two list items were exchanged after a response to the first list item. For all 4 subjects, performance was worse on trials in which the positions of the second and third list items were exchanged, as compared with normal (nonswitch) trials. When the positions of the third and fourth items were exchanged, only 1 subject showed performance deficits. On mask trials, a response to the first item was followed by the remaining items being covered by opaque white squares. When two

items were masked, all subjects performed at a level significantly different from chance. When three items were masked, however, only 1 subject continued to perform well. The results of the present study suggest that our monkeys planned, at most, two responses ahead.

(4005)
Conditioned Inhibition in CTA Using a Pavlovian CI Training Procedure. TODD R. SCHACHTMAN, STEPHANIE L. WADE, ASHLEY K. RAMSEY, & JENNIFER M. WALKER, *University of Missouri, Columbia*—Conditioned inhibition (CI) using conditioned taste aversion (CTA) and a Pavlovian CI training procedure has been difficult to demonstrate empirically. The present experiments obtained CI using CTA as assessed on a retardation test and a summation test with rats. Performance demonstrating CI using a Pavlovian CI training procedure was compared with CI obtained using other inhibition-generating procedures.

• Action and Perception II •

(4006)
Economy-of-Action Effects in Joint Action. ANDREW KENNING, JIM CLINTON, JUSTIN DURTSCHI, & J. SCOTT JORDAN, *Illinois State University* (sponsored by J. Scott Jordan)—The perceived vanishing point of a moving stimulus is displaced beyond the actual vanishing point. This forward displacement (FD) decreases with implied friction (i.e., the stimulus appears to move across a surface). The effect reverses when participants control stimulus movements (via right and left keypresses) versus observe them. This reversal is consistent with economy-of-action (EOA) effects in which variables such as perceived pitch are influenced by the energy demands implied by a stimulus (e.g., a steeper hill). The present poster presents experiments that reveal EOA effects when 2 participants control stimulus movements together, each having access to one of two control buttons. Specifically, FD increases across implied friction, regardless of who controls the stimulus when it vanishes. Since participants are basically observers as the other participant controls the stimulus, the increase of FD during such observation indicates that participants perceive the other-controlled stimulus movements in terms of implied effort (i.e., EOA).

(4007)
Yes I Can: Dancers Are Overconfident in Their Affordance Judgments. MARGARET R. TARAMPI, MICHAEL N. GEUSS, JEANINE K. STEFANUCCI, & SARAH H. CREEM-REGEHR, *University of Utah* (sponsored by Jeanine K. Stefanucci)—On the basis of dance theory (Laban, 1950) and practice, dancers should be more familiar with their bodies and capabilities for action. We tested this notion by having dancers perform a battery of affordance judgments. Affordances are defined as the perceived potential for action, given the physical limitations of the body and environment (Gibson, 1979). Previous research has shown that average participants are cautious (indicating that they are unable to perform actions that are possible) in judging perceived affordances for passage, for walking under a barrier, for stepping up, and for jumping over an extent. We predicted that dancers would make less cautious affordance judgments because they are more aware of their bodies' capabilities. The results showed that dancers were overconfident (indicating that they could perform actions that they could not) for passing through, stepping on, and jumping, but not walking under a barrier. We discuss these results in the context of views of embodied perception.

(4008)
Social and Spatial Factors Underlying the Interactive Simon Effect. ROBERTA SELLARO & BARBARA TRECCANI, *University of Trento*, SANDRO RUBICHI, *University of Modena e Reggio Emilia*, & ROBERTO CUBELLI, *University of Trento* (sponsored by Sandro Rubichi)—The interactive Simon effect refers to the finding that, when 2 participants, sitting close to each other, respond each to one of the two possible values of a lateralized stimulus (i.e., they perform two complementary go/no-go tasks), responses are faster when the stimulus position corresponds to the response position (i.e., the position of the responding participant). The present study aimed at investigating the social and

spatial factors underlying this effect. Participants performed a go/no-go task first individually, then either imaging themselves responding to the no-go trials or cooperating with another person acting in another room. The Simon effect occurred only when participants could attribute the alternative response to themselves and spatially code it within their own task representation. Conversely, the belief of coacting with another individual, whose position was unknown, induced the implementation of a division-of-labor mechanism, which led participants to ignore the alternative response, thus eliminating the Simon effect.

(4009)

Altered Representation of Peripersonal Space in Older Adults. EMILY K. BLOESCH, CHRISTOPHER C. DAVOLI, & RICHARD A. ABRAMS, *Washington University*—In young adults, objects near the hand or in the hand's action path receive attentional prioritization. The brain regions responsible for this hand-centered attention are also ones thought to be critical in forming representations of peripersonal space. These areas have been shown to change markedly with age, which may affect both peripersonal space representations and action within peripersonal space. We tested older adults on a variation of a selective reaching paradigm in which participants reached to targets in the presence of distractors. We found that, unlike young adults, older adults did not show attentional prioritization for objects near their hand or in their hand's action path. Rather, older adults gave priority to objects closest to their body regardless of hand location. The results show that older adults represent peripersonal space differently than young adults.

(4010)

Performance Influences the Perception of Speed. JESSICA K. WITT & MILA SUGOVIC, *Purdue University*—According to the action-specific perception account, perception is a function of the perceiver's ability to perform the intended action. Although most of the evidence for the action-specific perception account is on spatial perception, in the present experiments, we examined the effect of performance on the perception of speed. Participants played a modified version of Pong in which the size of the paddle was systematically manipulated. When participants played with bigger paddles and, thus, performed better, they judged virtual balls to be moving more slowly than when they played with smaller paddles. These studies suggest that performance influences perceived speed.

(4011)

Observing Painted Brushstrokes Evokes Involuntary Motor Simulation. J. ERIC T. TAYLOR, JESSICA K. WITT, & PHIL J. GRIMALDI, *Purdue University* (sponsored by Dennis R. Proffitt)—According to simulation theory, observing actions invokes motor simulations. Freedberg and Gallese (2007) have argued that even the static trace of a movement, such as a brushstroke, can cause simulation of its parent gesture. We tested this idea by having participants make arm movements to the left or right from a neutral position in response to the color (red or green) of 40 paintings. These paintings were created such that half of them had all of their brushstrokes moving horizontally from left to right (compatible with a right response) and half of them had their brushstrokes moving horizontally from right to left (compatible with a left response). Although brushstroke direction was a task-irrelevant feature of the stimuli, participants responded more slowly when the response movement was incompatible with the movement that created the brushstrokes. This pattern of interference suggests that people automatically simulate the dynamic actions implied by the static brushstrokes in paintings.

(4012)

The Role of Spatial Components for the Social Simon Effect. ANNELIE ROTHE, KERSTIN DITTRICH, & KARL CHRISTOPH KLAUER, *University of Freiburg* (sponsored by Jan De Houwer)—Several studies provide evidence for spatial compatibility or Simon effects when 2 participants work together on a spatial compatibility task. Although most researchers explain social Simon effects with shared task representations, an alternative explanation is provided by the salience of spatial components enhanced under joint versus single go/no-go task conditions. A first experiment intensified the salience of spatial information under single go/no-go conditions by using different response devices. The results showed larger Simon effects for participants responding with a joystick, as compared with standard keypress conditions, indicating that even under go/no-go conditions, salience of space can induce Simon effects. The second experiment manipulated the salience of spatial information by the compatibility of participants' seating alignment and the spatial orientations of the Simon task. The compatible condition showed larger Simon effects than did the incompatible condition, due to higher spatial salience. Overall, results suggest that the salience of spatial components can account for social Simon effects more parsimoniously.

• **DISCOURSE PROCESSING II** •

(4013)

Sensory Contributions to Simulations. RAYMOND B. BECKER, *Bielefeld University*, TODD R. FERRETTI, *Wilfrid Laurier University*, & MONICA GONZALEZ-MARQUEZ, *Cornell University*—We present a novel finding with respect to event saliency and modality-specific differences in event description. Event-related brain potential (ERP) methodology was used to demonstrate that the saliency of a target noun phrase in a situation model is greater when the event is described as being "seen" rather than "heard." This effect was evidenced by a late positivity that was greater for a subsequently presented heard than for a seen referent. We suggest that this difference is due to modality-specific differences in producing a more versus less rich simulation. A linking hypothesis, called the *reference-to-simulation* hypothesis, is presented, which provides a framework to account for these results by spanning the gap between the literature on embodied theories of sentence comprehension, which consider simulation of the events described to be the mechanism for comprehension, and models of discourse comprehension, where the processes of mapping and shifting provide for the saliency of a referent in a situation model.

(4014)

Predicting Reading Strategies: A Multilevel Analysis of Text-Based and Reader-Based Factors. STACEY A. TODARO, *Adrian College*, & JOSEPH P. MAGLIANO, *Northern Illinois University* (sponsored by Joseph P. Magliano)—The goal of this research was to assess the joint (additive and interactive) contributions of text-based and reader-based factors to strategic processing, as revealed by thinking aloud. Several multilevel models, in which sentences are nested within persons, were tested. Sentence-level predictor variables were identified via a discourse analysis and included argument overlap, causal relatedness, number of new-argument nouns, and prior knowledge overlap (as measured by latent semantic analysis). Reading skill served as the person-level predictor variable and was assessed using the Nelson–Denny Reading Skills test. The results of multilevel modeling showed significant additive effects of text-based factors but little support for cross-level interactions. Specifically, causal relatedness was positively correlated with strategic processing, whereas argument overlap and prior knowledge overlap were negatively correlated with strategic processing. It is of interest that readers were less strategic when text sentences overlapped with their prior knowledge of the text topics.

(4015)

Emotional Sentence Processing in Major Depressive Disorder. REBECCA J. LEPPING, RUTH ANN ATCHLEY, NATALIE STROUPE, KEITH YOUNG, LINZI GIBSON, & JONATHAN SCHUSTER, *University of Kansas*—Our research examined how people with major depressive disorder (MDD) process emotional, self-referent sentences (*I am a winner*). Twenty MDD and 20 healthy control participants endorsed or rejected self-statements presented visually one word at a time. The last word in each sentence—that is, the emotional target word—was presented centrally (CVF) in Experiment 1 and to the left (LVF) or right (RVF) visual field in Experiment 2. In both experiments, MDD and control participants were more likely to endorse positive sentences. MDD participants differed from controls in that they were more likely to endorse negative and less likely to endorse positive sentences. With LVF presentation, both groups were more likely to endorse negative sentences

and reject positive sentences, as compared with CVF or RVF trials, consistent with valence theories of emotion laterality. Diagnostic group differences in Experiment 2 also suggest that the right hemisphere is more sensitive to depression history.

(4016)

Interactive Alignment in Simulated Online Computer-Mediated Communication. MONICA A. RIORDAN, ROGER J. KREUZ, & RICK DALE, *University of Memphis* (sponsored by Roger J. Kreuz)—We tested potential interactive alignment in a computer-mediated format, using simulated online conversation. In a pseudointeractive environment, participants were told that they were interacting with another person or seeing examples from a database and must supply 16 responses. The exchange consisted of a game in which the computer supplied a topic and description and the participant described the same topic in one or two words. In both conditions, the verbosity, type of description, and presence of emoticons varied. Recall was tested. The results show that those who believed that they were conversing with another person aligned as much as those who believed that they were seeing examples but recalled more of the prompts. In addition, participants used emoticons only when prompts contained emoticons. We suggest that a more complex theory of alignment is necessary in which different levels of alignment are modulated differentially to account for the flow and drive of conversation.

(4017)

Don't Rush the Navigator: Disambiguation Strategies Require Cognitive Flexibility. JENNIFER M. ROCHE, RICK DALE, & ROGER J. KREUZ, *University of Memphis* (sponsored by Rick Dale)—Cognitive load can be reduced when a speaker's productions are egocentric, although they may be ambiguous for a listener (Rayner, Carlson, & Frazier, 1983). Horton and Keysar (1996) suggested that revision through monitoring and adjustment aids interlocutors in avoiding miscommunication. The present study evaluated disambiguation strategies interlocutors use to prevent miscommunication during a speeded or nonspeeded referential instruction task with a pseudoconfederate. A 2 (unhurried vs. speeded) $\times$ 2 (visual mistake vs. no visual mistake) mixed fixed/repeated effects model was used to evaluate the probability of disambiguating during ambiguous scenarios. The results revealed that when unhurried, the presentation of a visual mistake increased the probability of disambiguated statements from interlocutors. This suggests that a visual mistake is an effective cue to miscommunication. Production time significantly decreased during the unhurried, mistake condition for two-referent ambiguous instructions. This suggests that more cognitive flexibility allowed interlocutors to successfully formulate disambiguation strategies to prevent miscommunication.

• **LETTER/WORD PROCESSING IV** •

(4018)

Effects of Unilateral Versus Bilateral Presentation on Letter-in-String Identification. MYRIAM CHANCEAUX & JONATHAN GRAINGER, *Aix-Marseille University* (sponsored by Jonathan Grainger)—Two experiments manipulated visual field and number of flanking letters (crowding) in a letter-in-string identification task using postcued two-alternative forced choice with brief stimulus exposures and backward masking. In Experiment 1, target letters were presented left or right of fixation in isolation or as the central letter of a string of three or five letters. Stimuli were presented unilaterally or accompanied by the contralateral presentation of the same number of letters (bilateral presentation). Performance dropped as a function of the number of flanking letters and was worse in bilateral than in unilateral presentation conditions. Experiment 2 contrasted unilateral and bilateral presentation while holding constant the total number of letters in the display. Identification was best for targets in the right visual field under bilateral presentation conditions (two strings of three letters presented left and right of fixation), as compared with the unilateral presentation of a single string of six letters.

(4019)

Challenging Feedback Mechanisms From Lexico-Semantics to Orthography. JON ANDONI DUÑABEITIA & MANUEL CARREIRAS, *Basque Center on Cognition, Brain, and Language,* & ALBERT COSTA, *Universitat Pompeu Fabra* (sponsored by Albert Costa)—We investigated feedback mechanisms from lexico-semantic levels of processing to orthography. In particular, we examined two orthographic effects: the masked transposed-letter (TL) similarity and the masked consonantal relative-position (RP) priming effect. Experiments 1A and 1B showed similar TL and RP effects for taboo and for neutral words and no interaction with the type of word. In Experiments 2A and 2B, similar orthographic manipulations were carried out with a group of abstract and concrete words. Again, no interaction was found between the TL and RP effects and the type of word. Experiments 3A and 3B explored the same TL and RP manipulations with high- and low-frequency words. In addition to a prominent lexical frequency effect, no differences were observed in the magnitudes of the TL and RP priming effects. These results challenge models assuming interactivity and feedback mechanisms from lexico-semantics to orthography.

(4020)

Grt is Great, But gr8 is Not: Abbreviation Type Affects the Processing of Texting Conversations. MICHAEL J. TAT & TAMIKO AZUMA, *Arizona State University* (sponsored by Tamiko Azuma)—Recent research has shown that sentences containing text message abbreviations take additional time to process, relative to correctly spelled sentences (e.g., Perea, Acha, & Carreiras, 2009). The present experiment investigated the processing of text message abbreviations. Participants were shown texting conversations on a computer. The sentences contained different types of abbreviated words: Text-consistent items were consistent with standard texting rules (e.g., *tmrw*), text-inconsistent items were inconsistent with standard texting rules (e.g., *toorow*), and substitution items included phonological substitutions (e.g., *2mrw*). Conversation reading times were recorded. Later, the participants were given a recognition memory test. On the basis of the results, text-consistent items are initially processed more fluently than the other abbreviation types, and the resulting memory representations seem to overlap with, or coactivate, the words' canonical (i.e., full-spelling) representations.

(4021)

Letters in Time and Retinotopic Space. JAMES S. ADELMAN, *University of Warwick*—Several contemporary models of letter processing and letter order information assume a deterministic process in which the bottom-up input to lexical unit (or the equivalent) is characterized by the overlap or match of the completely specified representations of the stimulus and that unit's representation. The new letters in time and retinotopic space (LTRS) model alternatively supposes that (1) information about letters is extracted stochastically and (2) retinotopic letter detection, in concert with the properties of text as usually experienced, limits inferences about letter position. I detail the model and show that it accounts for data regarding (1) the manipulation of display duration (with a few different target–foil relationships) in tachistoscopic two-alternative forced choice word identification, (2) the manipulation of target–foil relationship in tachistoscopic two-alternative forced choice nonword identification, and (3) the manipulation of prime duration in form priming.

(4022)

Transitions From Positive to Negative Short-Term Word Priming: Familiarity, Directionality, and Expectation. CORY A. RIETH & DAVID E. HUBER, *University of California, San Diego* (sponsored by David E. Huber)—Short-term repetition priming in a perceptual word identification task typically produces a transition from positive to negative priming as a function of increasing prime duration. We tested the determinants of this phenomenon by manipulating familiarity, directionality, and expectation. Familiarity was manipulated by comparing repetition priming of words versus repetition priming of nonwords. Nonwords were slower to produce a transition toward negative priming. Directionality was manipulated by comparing forward-only versus backward-only associatively related primes. Forward-only associations were slower to produce a transition toward negative priming, even though forward-only associations produced larger priming effects. Expectation was manipulated by comparing repetition priming that might be expected on the basis of common usage (e.g., "walk the walk") versus unexpected

repetitions and expected nonrepetitions. Expectations produced a bias effect that did not interact with the presence/absence of repetition priming. Furthermore, the transition toward negative priming was slower for nonnative English speakers.

(4023)

Co-Occurrence Measures Predict Human Concreteness Judgments. CHRIS WESTBURY & CYRUS SHAOUL, *University of Alberta*—The meaning of concrete words can be contextualized by the real world, but abstract words must rely on their relationship to other words for their meaning. Abstract words should, as a result, have fewer and closer co-occurrence neighbors than should concrete words. We tested this by using HiDEx (Shaoul & Westbury, 2010) to measure the size and density of the co-occurrence networks for 6,195 words (frequency < 100/million) for which we have human concreteness judgments. There are reliable correlations between averaged concreteness judgments and measures of co-occurrence neighborhood distance and density (average radius of co-occurrence, $r = .40$ [abstract words have closer co-occurrence neighbors], $p = 1.04\text{E-}20$; inverse N count; $r = -.51$ [abstract words have fewer co-occurrence neighbors], $p = 2.30\text{E-}34$). Of the variance in average lexical decision RTs that is attributable by linear regression to human concreteness judgments, 45% can be accounted for by these two empirical measures.

(4024)

The Influence of Emotion Word Type on the Repetition Blindness Effect. HUGH KNICKERBOCKER & JEANETTE ALTARRIBA, *University at Albany* (sponsored by Jeanette Altarriba)—The repetition blindness (RB) effect (the finding that under rapid serial visual presentation, repeated words are perceived and recalled with poorer accuracy than are unrepeated words) was investigated with emotion words (labeling a specific emotional state that can be experienced—e.g., *hate* or *sadness*), emotion-laden words (labeling concepts, objects, or events that have an association with an emotional state—e.g., *coffin* or *disaster*), and neutral words (words with no obvious emotional associations—e.g., *cabinet* or *lantern*) to determine whether the RB effect is influenced by emotion word type. The study also served as an investigation into whether emotion and emotion-laden words are qualitatively different word types. The three word types were embedded within symbol strings and complete sentences. Consistently, differences in performance between the emotion, emotion-laden, and neutral word types were found. This grouping of studies provides evidence that emotion and emotion-laden words are separate word types with differing effects on processing.

• PSYCHOLINGUISTICS IV •

(4025)

Cognate Type and Bilingual Visual Word Recognition: More Evidence of Language-Nonselective Access. SITI SYUHADA FAIZAL, *Washington University*, & MELVIN J. YAP & SUSAN J. RICKARD LIOW, *National University of Singapore* (sponsored by Rebecca Treiman)—According to Dijkstra et al.'s (1998) nonspecific lexical access hypothesis, dual lexical access during word recognition by bilinguals can result in either cognate inhibition or cognate facilitation effects, depending on the task language. With low- and high-proficiency Malay–English bilinguals, we found support for a modified version of this hypothesis, using both language-specific (Malay) and language-neutral (Malay or English) lexical decision tasks (LDTs). We examined the effect of cognate type, operationalized as degree of overlap in orthography (O) and/or phonology (P): O+P+, O+P−, O−P+, O−P− cognates, FF (false friends sharing O or P but not meaning), and control words (one language only). For language-specific LDT, FF, and O−P−, but not O+, latencies were significantly slower than those for control words. For the language-neutral LDT, O− latencies were also significantly slower than those for control words, but importantly, this was moderated by P overlap and by Malay language proficiency.

(4026)

Eye Guidance in Chinese Reading. XINGSHAN LI & PINGPING LIU, *Institute of Psychology, Chinese Academy of Sciences*, & KEITH RAYNER, *University of California, San Diego*—In this study, we examined whether word processing could affect eye movement guidance in Chinese reading. We embedded either a two-character word or a four-character word in the same sentence frame in two conditions and observed the eye movements of Chinese readers when they read these sentences. We found that Chinese readers did not send their eyes to the center of the words, as English readers do, nor did they send their eyes to the beginning of the words. However, the length of saccades leaving a long target word was greater than the length of those leaving a short word, suggesting that word processing does affect the next eye movement.

(4027)

Automatic Transliteration Effects in Biscriptal Readers: The Case of Greeklish. MARIA DIMITROPOULOU, JON ANDONI DUÑABEITIA, & MANUEL CARREIRAS, *Basque Center on Cognition, Brain, and Language* (sponsored by Manuel Carreiras)—Masked priming studies have shown that two words presented with extensively overlapping formal representations influence each other's recognition. However, the pattern of masked priming effects obtained when the degree of formal overlap between two words varies has not been examined. This issue was addressed by presenting Greek target words preceded by their Roman transliterations (Greeklish) to native Greeks with extensive exposure to this writing system. These transliterations varied in the degree of orthographic overlap with their Greek versions. Our results showed that Greeklish primes were effectively processed. However, a larger masked priming effect was found for targets preceded by their highly overlapping Greeklish repetitions, as compared with targets primed by their low overlapping Greeklish repetitions. In contrast, when the Greeklish–Greek visual overlap was further limited, the effect disappeared, despite the fact that the underlying lexico-semantic representation was identical, and despite the extensive phonological overlap between prime and target.

(4028)

Malleability of Language Comprehension Mechanisms Via Task Demands. EDWARD W. WLOTKO & KARA D. FEDERMEIER, *University of Illinois, Urbana-Champaign*, & MARTA KUTAS, *University of California, San Diego*—Behavioral and electrophysiological studies have provided different evidence for the effect of sentential constraint on unexpected words semantically related to expected ones. Findings from event-related potential (ERP) studies have emphasized the facilitative effects of strong contexts for related words, whereas lexical decision times have suggested a narrowed scope of facilitation in strong contexts that eliminates priming for unexpected related words. In addition, prior ERP work has implicated multiple mechanisms in the use of sentential constraint, which cannot be examined separately in reaction time studies. Here, we investigated the role of methodology and task demands in producing the discrepant findings. We find that lexical decision times are not a simple summation of the differing patterns found in the ERPs and, as such, that comprehension mechanisms are importantly modulated by task demands. These results support the idea that language mechanisms can be flexibly allocated depending on situational context.

(4029)

An Onset Is an Onset: Abstraction of Newly Learned Phonotactic Constraints. AMÉLIE BERNARD & CYNTHIA FISHER, *University of Illinois, Urbana-Champaign* (sponsored by Gary S. Dell)—Adults learn new phonotactic constraints (e.g., /f/ is an onset, /p/ is a coda) when the word structure remains constant from training to test. Can they also generalize across word structures (CVC vs. CVC.CVC) and word positions (word edge vs. word medial)? In a continuous recognition memory task, participants heard training nonwords with particular consonants restricted to either onset or coda position, mixed with test nonwords that followed (legal) or violated (illegal) those restrictions. Participants false-alarmed more often to legal than to illegal test nonwords, whether or not they matched the training items in word structure or position of the restricted consonants. For example, having learned that /f/ is an onset and /p/ is a coda, participants generalized from one- to two-syllable items and from word-edge to word-medial positions (or the reverse). These results suggest abstract representations of newly learned phonotactics: An onset is an onset and a coda is a coda, regardless of word position.

• LANGUAGE PRODUCTION/WRITING •

(4030)

Semantic Picture–Word Interference Is a Postperceptual Effect.
TATIANA T. SCHNUR & RANDI C. MARTIN, *Rice University*—
Naming a picture is slower while ignoring a semantically related versus unrelated distractor word (semantic picture–word interference, PWI). To locate the PWI effect in the word production processing stream (during perceptual encoding, response selection, or afterward), we used the psychological refractory period paradigm where subjects identified a tone and then, at varying SOAs, named a picture while ignoring a semantically related/unrelated word (following Dell'Acqua, Job, Peressotti, & Pascali, 2007). Similar to results for the Stroop paradigm (Fagot & Pashler, 1992), we found equivalent PWI effects at short and long SOAs following tone identification in two experiments, indicating that semantic competition occurs at response selection or later. Our results suggest that it is premature to assume that competitive selection occurs at multiple levels in the word production system (van Maanen, van Rijn, & Borst, 2009) or that the Stroop and semantic PWI effects are fundamentally different effects (Dell'Acqua et al., 2007).

(4031)

Deficit in Semantic Clustering of Category Examples Generated By People With Bipolar Disorder. KYONGJE SUNG, KERRY LEDOUX, ERIN J. PICKETT, TRACY D. VANNORSDALL, SHAINA C. FIELDSTONE, BARRY GORDON, & DAVID J. SCHRETLEN, *Johns Hopkins University*—Semantic fluency tasks have been used to assess the functioning and content of one's semantic system. Impairments of productivity or semantic clustering are thought to reflect dysfunction of the semantic system. The productivity of individuals with bipolar psychosis (BP) is much less impaired, as compared with those with schizophrenia (Schretlen et al., 2007). However, clustering patterns have not been investigated in BP. We adapted singular value decomposition methods to examine semantic clustering in 98 stable adult outpatients with BP and 98 matched healthy controls on two semantic fluency tasks (naming animals and supermarket items). Patients with BP showed mildly impaired productivity for supermarket item naming and normal productivity on animal naming. In contrast, they showed clearly abnormal semantic clustering patterns in both tasks. Details of their word-clustering patterns suggest that the semantic knowledge of patients with BP may be intact but that the way it is utilized (retrieval/access) may be compromised.

(4032)

Timing Is Everything: Exploring Competition for Lexical Selection During Picture Naming. MEAGAN T. FARRELL, SABRA D. PELHAM, & LISE ABRAMS, *University of Florida* (sponsored by Lise Abrams)—Phonological facilitation occurs in picture–word interference tasks, where phonologically related distractors decrease naming latencies, relative to unrelated distractors. Two experiments examined the effects of distractor grammatical class and target frequency on phonological facilitation. Participants named high- and low-frequency target pictures presented with a visual distractor word that (1) contained the target's first syllable or was phonologically unrelated, (2) shared or differed in part of speech from the target, and (3) was presented simultaneously with the target (Experiment 1) or preceded the target by 1,000 msec (Experiment 2). In Experiment 1, distractor part of speech influenced phonological facilitation, where same part-of-speech distractors resulted in less phonological facilitation than did different part-of-speech distractors. Target frequency also interacted with phonological facilitation, with low-frequency targets having less facilitation than did high-frequency targets. Neither effect occurred in Experiment 2. These findings identify specific syntactic and lexical factors that promote competition from phonologically related distractors, depending on when the distractor is encountered during lexical selection.

(4033)

Producing the Past Tenses for Present Tense Verbs: A Megastudy.
EMILY R. COHEN-SHIKORA & DAVID A. BALOTA, *Washington University*, & MELVIN J. YAP, *National University of Singapore* (sponsored by Melvin J. Yap)—Studies of past tense verb generation have primarily emphasized accuracy measures on a limited set of items in adjudicating among extant models. We present the first megastudy of past tense verb generation that affords response latency, accuracy, and error analyses in the generation of the past tense form from the present tense form of over 2,000 verbs. In addition to standard lexical variables (such as word frequency, length, orthographic and phonological neighborhood metrics) we also investigate the extent to which past tense rules (e.g., add /ed/ to present tense stem), consistency (most /eep/ rimes produce past tense forms of /ept/) and a recent hybrid computational model developed by Albright and Hayes (2003, *Cognition*) account for variance in the dependent measures. Discussion focuses on current models of past tense verb generation.

(4034)

Flexible Planning in Word Production. ALEXANDRA K. FRAZER & PADRAIG G. O'SEAGHDHA, *Lehigh University*—Speakers appear to behave fastidiously in word preparation. For example, they fail to benefit when a set of words spoken in random order share the initial sound segment but one of them differs in spelling (Damian & Bowers, 2003). Thus, speakers, and perhaps action planners more generally, may categorically fail to plan when there is a "rotten apple" in the preparation basket. However, most previous research has used an indirect cuing procedure and has not segregated responses to exception items from those to the majority. Using picture-naming and word-reading formats, we show a form preparation benefit when three of four words in a production set share the first segment. The benefit is smaller than with unanimous sets but tends to increase over blocks. Directing attention to the majority characteristic is not helpful. We show both why speakers may appear to be categorical in preparation and that they are not.

(4035)

Interactive Effects of Orthography and Semantics in Chinese Picture Naming. I-FAN SU, CYNTHIA S. T. YEUNG, BRENDAN S. WEEKES, & SAM-PO LAW, *University of Hong Kong* (sponsored by Sam-Po Law)—Picture-naming performance in English and Dutch is enhanced by presentation of a word that is similar in form to the picture name. However, it is unclear whether facilitation has an orthographic or a phonological locus. We investigated the loci of the facilitation effect in Cantonese Chinese speakers by manipulating—at three SOAs (-100, 0, and $+100$ msec)—semantic, orthographic, and phonological similarity. We identified an effect of orthographic facilitation that was independent of and larger than phonological facilitation across all SOAs. Semantic interference was also found at SOAs of -100 and 0 msec. Critically, an interaction of semantics and orthography was observed at an SOA of $+100$ msec. This interaction suggests that independent effects of orthographic facilitation on picture naming are located either at the level of semantic processing or at the lemma level and are not due to the activation of picture name segments at the level of phonological retrieval.

(4036)

An Analysis of Working Memory in Audience Design. BENJAMIN SWETS, *Grand Valley State University*, EMILY L. PATZELT, *Beckman Institute for Advanced Science and Technology*, & MATTHEW E. JACOVINA & RICHARD J. GERRIG, *Stony Brook University*—Speakers in conversations must often keep track of which referents in the world they share with which conversational partners and must implement this knowledge into utterance plans. On the basis of past language production research, we expected that working memory would affect this process of audience design. In a referential communication task, speakers provided descriptions of some objects to one partner and other objects to a different partner. We measured whether speakers adjusted their utterances and eye movement patterns when providing descriptions to partners with whom they shared common ground. We also measured individual differences in verbal and spatial working memory. The results indicate that speakers adjusted their utterances and eye movements according to the needs of their particular addressees. However, working memory did not predict the extent to which speakers made such adjustments. We discuss why individual differences in working memory may not affect the type of audience design required by our task.

• BILINGUALISM II •

(4037)

Language Attrition at the Phonological and Lexical Levels. CARO-LINE ENGSTLER, *Northwestern University* (sponsored by Matthew Goldrick)—When language learners stop using a second language (L2), they experience language attrition (i.e., their linguistic skills almost invariably decrease). The present study extends previous work by examining patterns of both phonological and lexical attrition in English-native learners of French. We document attrition by examining the performance of these learners at multiple time points following their return from a study-abroad program (both immediately after their return from France and after 6 months in the U.S.). In Experiment 1, we investigate attrition in the perception of L2-sounds that are acoustically similar to native-language sounds (e.g., French /u/ is similar to English /u/) versus sounds that only exist in the L2 (e.g., French /y/). In Experiment 2, we test whether lexical status of words (cognate vs. noncognate) influences attrition of both lexical and phonological knowledge.

(4038)

Cross-Language Lexical Interaction in Object Naming. BENJAMIN ZINSZER & PING LI, *Pennsylvania State University* (sponsored by Ping Li)—Different languages often have different naming patterns for the same objects or actions. This can pose difficulty to bilinguals who need to activate these incongruent representations in first-language (L1) versus second-language (L2) naming situations. Previous research has documented negative transfer from the L2 lexicon to L1. In this study, participants are tested twice in their naming of archetypal images in their L1 before and after intensive lexical training in an L2. The L2 training consists of several sessions rehearsing picture–word pairs with intermittent monitoring trials. Training and testing stimuli are organized into two conditions on the basis of their naming pattern congruency between the two languages. Responses in the incongruent conditions are expected to be slower than the congruent trials, with no significant difference for congruent trials between pre- and posttest results. These data quantify the vulnerability of the L1 lexicon to interference from incongruent L2 naming patterns.

(4039)

Does Language-Specific Syntax Modulate Cross-Language Lexical Processing? JASON W. GULLIFER, PAOLA E. DUSSIAS, & JUDITH F. KROLL, *Pennsylvania State University* (sponsored by Judith F. Kroll)—A finding in recent studies of bilingual word recognition is that it is impossible to restrict activation to one language alone, even when one reads in sentence context. The activation of the language not in use persists under almost all conditions, except when sentences are highly constrained semantically. Here, we asked whether a similar effect of constraint would be observed when sentences were syntactically specific to one of the bilingual's two languages. Proficient Spanish–English bilinguals read sentences in each language that contained a to-be-named cognate or a matched control word. Half of the Spanish sentences contained syntax that was structurally specific. English sentences were translations of the Spanish sentences but were not syntactically unique to English. The results indicate that the cognate effect in word naming was reduced following syntactically specific sentence context in Spanish. We examine the implications for claims about bilingual word recognition and for models of code switching between languages.

(4040)

Are Bilinguals Better Language Learners Than Monolinguals? It Depends on How They Learn. CARI A. BOGULSKI & JUDITH F. KROLL, *Pennsylvania State University* (sponsored by Dorothee J. Chwilla)—Although bilinguals have been shown to possess superior abilities in the domain of executive function, the evidence on lexical processing is mixed. Some studies have demonstrated a bilingual disadvantage for vocabulary size and retrieval speed, but others have shown that bilinguals are better able to acquire new vocabulary than are monolinguals. In the present study, we sought to determine whether the bilingual advantage in vocabulary acquisition was a universal consequence of bilingualism or a specific advantage when bilinguals learn new words via their native language. Three bilingual groups (English–Spanish, Spanish–English, and Chinese–English) were taught unfamiliar Dutch words by associating them to their English translations. Performance on immediate tests of comprehension and later retention was compared with that of a group of monolingual English speakers. Only bilinguals who had learned the new vocabulary via their native language outperformed monolinguals. We argue that specific experience in inhibiting the dominant language provides a strategic advantage to vocabulary learning.

(4041)

Partial Phonological Overlap Causes Cross-Language Activation in Native-English Learners of Arabic. ALIA K. BILLER, WILLIAM H. LEVINE, & WILLIAM R. BATTINICH, *University of Arkansas*—For bilinguals, both languages are active during the processing of either language. Studies demonstrating this typically have relied on cognates or words that are otherwise similar across languages. Even with languages that do not share scripts (e.g., Hebrew–English), there is evidence of cross-language activation (e.g., Gollan et al., 1997). In the present research, we extended these findings by investigating whether partial phonological overlap would lead to cross-language activation. Subjects read Arabic words and decided whether subsequent English words were correct translations. On critical trials, the English word was an incorrect translation but overlapped phonologically with the beginning, middle, or end of the Arabic word. Native-English subjects (with two to five semesters of Arabic course experience) were slower to reject beginning- and middle-overlap words, relative to controls. Furthermore, the amount of difficulty experienced from this overlap was positively correlated with Arabic proficiency. The results are discussed with respect to the development of bilingual lexical representation and processing.

(4042)

A Longitudinal ERP Study of Language Effects in Beginning Second Language Learners. KATHERINE J. MIDGLEY, *Tufts University and Laboratoire de Psychologie Cognitive, Marseille*, LAURA N. SOSKEY & PHILLIP J. HOLCOMB, *Tufts University*, & JONATHAN GRAINGER, *Laboratoire de Psychologie Cognitive, Marseille*—In order to explore whether the mechanisms involved in word recognition in beginning second-language (L2) learners differ from those of more proficient L2 users and how these mechanisms evolve during beginning learning we conducted three experimental ERP sessions at intervals throughout a semester with participants who were first-language (L1) monolingual English speakers enrolled in an introductory Spanish course. Our results show greater negativities in the N400 epoch to L1 items than to L2 items. Additionally, the differences varied significantly across sessions, in that amplitudes in the traditional N400 epoch to L2 items became more negative over the course of the semester. We propose that the increasing N400 amplitude to L2 items results from an increase in L2 orthographic and semantic connectivity in the mental lexicon due to L2 learning. Our results suggest that these changes happen quickly and early on in L2 acquisition.

• REASONING AND PROBLEM SOLVING •

(4043)

What Box?! Unconstrained Creative Thinking in Adults with ADHD. HOLLY A. WHITE & ERIN C. MAHONEY, *Eckerd College*, & PRITI SHAH, *University of Michigan*—Attention-deficit/hyperactivity disorder (ADHD) is characterized by inattentiveness and poor inhibitory control, but also by divergent creative thinking and a think-outside-the-box creative style. Preliminary research suggests that individuals with ADHD may be less influenced by examples in creative generation tasks. Hypothetically, by virtue of poor inhibitory control and fluctuating attention, individuals with ADHD may be resistant to conformity effects (Smith et al., 1993). The present study explored this possibility using two creative generation tasks: a label creation task with salient examples (Rubin et al., 1991) and an alien fruit creation task that relied on preexisting knowledge for imaginative context (Ward et al., 2002). As was expected, adults with ADHD created labels with fewer example components and fruits with fewer attributes typical of Earth fruit (and more atypical attributes), as compared with non-ADHD adults. Findings are

discussed in terms of unstructured imagination in ADHD and implications for real-world creative problem solving.

(4044)

Shifting Focus: The Benefits of Flexible Control and Diffuse Attention. PATRICK J. CUSHEN, ANDREW F. JAROSZ, DANIEL AIELLO, & JENNIFER WILEY, *University of Illinois, Chicago*—Despite being a highly popular topic of research, the mechanisms underlying creative processes are still poorly understood. The present work provides evidence for an emerging theme in creativity research: that one's attentional state has a profound effect on creative performance. Across multiple studies, it was demonstrated that both individual differences in and experimental manipulations of attentional control can alter performance on creative-problem-solving tasks. The results suggest that flexible control of attention and a diffuse attentional state aid in creative problem solving, whereas a lack of flexibility and overly focused attention can harm performance on creative-problem-solving tasks.

(4045)

That's So Raven's: The Role of Distraction on the RAPM. ANDREW F. JAROSZ & JENNIFER WILEY, *University of Illinois, Chicago* (sponsored by Jennifer Wiley)—Although the relationship between working memory capacity (WMC) and the Raven's advanced progressive matrices (RAPM) has long been the subject of scrutiny, it remains unclear what drives the correlation between these two common cognitive tasks. The present work proposes that a common determinant of performance on both WMC and RAPM tasks is susceptibility to distraction. This account was tested by manipulating the presence of distracting items among the response options in RAPM problems. RAPM problems containing salient, incorrect response options were predictive of WMC, whereas problems without these distractors were not. Additionally, only problems with distractors predicted performance on an additional test of general fluid intelligence.

(4046)

The Role of Causal Schemas in Inductive Reasoning. RALF MAYRHOFER, JONAS NAGEL, & MICHAEL R. WALDMANN, *University of Göttingen* (sponsored by Michael R. Waldmann)—Inductive reasoning allows us to go beyond the target hypothesis and capitalize on prior knowledge. Past research has shown that both the similarity of categories and specific knowledge about causal relations affect inductive plausibility. We go one step further and focus on the role of abstract causal schemas about main effects and interactions. Two experiments show that both prior assumptions about abstract causal schemas and the similarity of the corresponding causal effects affect inductive judgments. Reasoners have different prior beliefs about the likelihood of main-effect versus interactive schemas and rationally combine these prior beliefs with new evidence in a way that can be modeled as Bayesian belief updating.

(4047)

Conceptual Integration in Arithmetic Word Problems: ERP Responses to Semantic (N400) and Structural (P600) Violations. KRISTIE J. FISHER, MIRIAM BASSOK, & LEE OSTERHOUT, *University of Washington* (sponsored by Miriam Bassok)—Studies recording event-related potentials (ERPs) during sentence processing have established that errors of meaning elicit an N400 effect, whereas errors of structure elicit a P600 effect. We found similar effects when people made acceptability judgments about arithmetic word problems that varied in mathematical correctness and in the analogical alignment of object relations with arithmetic operations. Mathematically incorrect answers (twelve roses plus three tulips equals *four*), which violated people's knowledge of arithmetic facts, elicited an N400 effect. Analogically misaligned object relations (twelve roses plus three *vases* equals fifteen) elicited a P600 effect. Interestingly, unlike in typical sentence processing, we observed individual differences in people's acceptability judgments and corresponding ERP effect magnitudes. This suggests that conceptual integration in word problems may be more complex, as compared with sentences, and may be affected by differences in mathematical and analogical reasoning abilities. We discuss the domain generality of the processes that modulate conceptual integration.

(4048)

Does Color Influence Anagram Solution Speed? KENNETH M. STEELE, EVA PUTNAM, ANGELA AYERS, SAMANTHA TRACY, & EMILY ANTOLIC, *Appalachian State University*—Mehta and Zhu (2009) reported that the colors red and blue induced different motivational states that affected performance across a series of cognitive tasks. Red was hypothesized to induce an avoidance motivational state, and blue an approach state. In one study, participants were presented with anagrams. Mehta and Zhu reported that solution times of the anagrams were faster when approach-related (or avoidance-related) anagrams were presented on a color background that induced the same state. The purpose of our study was to replicate the procedure of that study and confirm their finding. Participants were exposed to the 12 anagrams used in the Mehta and Zhu study on red, white (neutral), or blue backgrounds. Solution times, accuracy, and speed–accuracy strategy were recorded. The results showed no significant effect of color on these measures. Additionally, the results showed that solution difficulty of an anagram was confounded with motivational classification of the word.

(4049)

Logic, Information, and Paradoxical Inferences. ISABEL ORENES, *University of La Laguna*, & PHILIP N. JOHNSON-LAIRD, *Princeton University* (sponsored by Philip N. Johnson-Laird)—This paper reports an investigation of "paradoxical inferences" of two sorts: *B; therefore, if A then B; and not-A; therefore if A then B*. Analogs of these inferences in logic are valid, but most individuals reject, say, *Peter played soccer; therefore, if Peter laughed then he played soccer*. Hence, many psychological theories, including those based on probabilistic considerations, treat these inferences as unacceptable. But our results demonstrated that individuals accepted these inferences in conditions that the theory of mental models predicts. Experiment 1 showed that the inferences are accepted if the premise holds in the possibilities to which the conditional conclusion refers—for example, *Peter didn't play soccer; therefore, if Peter played a game then he didn't play soccer*. Experiment 2 corroborated this result and extended it to disjunctive inferences of the form *B; therefore, A or B*, which individuals also normally reject. These results corroborate the model theory.

• HUMAN LEARNING IV •

(4050)

Embodied Interaction: Utilizing Gestural Interfaces Promotes Learning. AYELET SEGAL, JOHN B. BLACK, & BARBARA TVERSKY, *Teachers College, Columbia University* (sponsored by John B. Black)—From a grounded/embodied cognition perspective, the use of gestural interfaces (such as multitouch, like iPhones) versus a traditional interface (such as a monitor–keyboard-mouse) should yield better learning. Young children performed two tasks. One of the tasks was counting and addition, and the other task was solving a tangram puzzle. Children who used gestural interfaces that integrated a higher level of direct manipulation outperformed children who used traditional interfaces because (1) mapping the gesture to the learned concept resulted in better learning by establishing compatibility between gestures and digital representations of the learned concepts and (2) adding the haptic channel (physical manipulation of objects) to perform these tasks resulted in better learning.

(4051)

Examining the Effects of Differently Timed Warnings on Retrieval-Induced Forgetting. LAUREN W. JONES, MICHAEL L. MUELLER, MELISSA S. CAVINS, & JODI PRICE, *University of Alabama, Huntsville*—Retrieval-induced forgetting (RIF) is a memory phenomenon in which practicing recalling some items reduces the likelihood of recalling semantically related items on a later recall test (Anderson, Bjork, & Bjork, 1994). We examined whether explicitly warning participants about RIF (1) before encoding, (2) before retrieval practice, or (3) before the final recall test would serve to reduce RIF, relative to (4) a no-warning control condition. Younger adults ($n = 107$) completed two study–test trials of the retrieval practice paradigm, with warning subjects receiving the warning on both trials. Recall of practiced items increased across trials more for control than for warned participants.

RIF rates were initially lowest for those warned before retrieval practice but increased across trials for all groups, except those warned before encoding. That many of these differences were not reliable suggests that individuals may not be able to overcome RIF, which supports an inhibitory mechanism underlying RIF.

(4052)

When Does Initial Retrieval Failure Lead to Later Success? BARBIE J. HUELSER & JANET METCALFE, *Columbia University* (sponsored by Janet Metcalfe)—Kornell, Hayes, and Bjork (2009) found that producing an incorrect answer led to better retention of correct answers than did simply studying the correct material. We sought to replicate and determine boundary conditions for this surprising finding. In three conditions, participants studied low-associate word pairs for 5 or 10 sec or guessed the second word of the low-associate word pair (5 sec) and then received feedback (5 sec). Even when incorrect, guessing led to the highest proportion correct on the retention test. We found, additionally, that metacognition was poor for the condition that produced the highest correct answer retention. Most participants believed that performance was best after reading the word pairs for 10 sec, rather than in the incorrect guessing condition. In our second experiment, we used unrelated word pairs, instead of related pairs. In this case, providing an incorrect guess led to worse memory for correct answers. This pattern of results was replicated using a within-participants design.

(4053)

When Less Is More: The Benefits of Alternating Fewer Diagrams in Multimedia Learning. FRANCESCA R. FLORES & MICHAEL J. SERRA, *Texas Tech University*—Including diagrams with expository text passages typically increases retention and understanding, relative to studying just the text. The present experiments tested whether including fewer diagrams—that is, one for every other paragraph—would produce better learning than would including a diagram with every paragraph. Across multiple experiments, college students studied a science passage that had no diagrams (control group), diagrams for every paragraph (standard group), or diagrams for every other paragraph (alternating group). Test questions measured retention and understanding for the text. Overall, the alternating and standard diagram groups had equally high retention, which exceeded that of the control group. More important, the alternating group typically understood the text at a level that matched—or even exceeded—that of the standard diagrams group. Therefore, the presentation of diagrams is important in changing how the text is processed, which, in turn, causes the learning advantages associated with diagrams—not the diagrams themselves.

(4054)

Metacognition in College Students: Predicting the Outcomes of Learning Scenarios. JENNIFER A. McCABE, *Goucher College*—Research has demonstrated the mnemonic advantages of testing, spacing, and generation, in both laboratory and educational contexts; however, students may not have metacognitive awareness of these strategies. In the present research, undergraduates read and made predictions about learning scenarios derived from published research on testing, spacing, and generation effects. Study 1 showed low awareness of the benefits of testing and spacing; in fact, the opposite strategy (i.e., restudying and massing, respectively) was most frequently endorsed. There was, however, weak endorsement of generating one's own study materials as a memory strategy. Study 2 showed that scenario predictions were more accurate among undergraduates who received targeted instruction on empirically supported learning and memory strategies. In sum, this research suggests that undergraduates are largely unaware of strategies that could improve memory for course information; furthermore, training in specific learning and memory topics may improve metacognition.

(4055)

Reducing Guessing in a New Computerized Testing System. JOOYONG PARK, *Seoul National University*, & KI EUN LEE, *Sejong University*—To improve learning in the classroom, researchers are trying to apply the principles from studies of human memory. One of the principles is to use quizzing to bring about active retrieval of information. In this context, a new computerized testing system, called the computerized modified multiple-choice testing (CMMT) system, was introduced. In this system, questions of multiple-choice (MC) items are presented first without options, so that students must generate answers for themselves. They can click for the options when they are ready and can respond within a brief, specified time period. The present study was performed to examine whether this system is effective in reducing guessing when there is a penalty for the attempted wrong answer. College students took a test where half of the items were presented in the MC format and the other half in the CMMT format. It was found that the number of unanswered items was significantly greater in the CMMT format than in the MC format. This result suggests that the CMMT system is effective in reducing guessing using the options.

• ASSOCIATIVE LEARNING •

(4056)

Learning From Success or Failure: Transfer Effect of Positive/Negative Outcome in Older Adults. KOSUKE SAWA, *Senshu University*, & YUKO HIBI, *Shizuoka Eiwa Gakuin University*—Most organisms can learn a correct choice in order to receive reinforcement and to avoid punishment. However, recent studies have reported that patients of Parkinson disease show difficulty in learning from positive outcomes and that dopamine-related medication improves these tendencies. In present research, we investigated the effect of aging on learning from positive and negative events. In the training phase, older participants were required to make response by keypressing on the basis of instructed cue–target relationship. Correct responses on positive cue–target trials were followed by positive outcomes (adding points), and incorrect responses on negative cue–target trials were followed by negative outcomes (reducing points). In the test phase, two target stimuli used in the training phase were presented simultaneously. Participants were required to choose one of them when learning new contingencies between targets and outcomes. The transfer effects of positive and negative experience on subsequent decision making were discussed.

(4057)

Age-Related Advantage in Visual Statistical Learning. KAREN L. CAMPBELL, *University of Toronto*, SHIRA ZIMERMAN, *Hebrew University*, & MICHELLE M. S. LEE & LYNN HASHER, *University of Toronto* (sponsored by Lynn Hasher)—Recent work has shown that older adults' lessened inhibitory control leads them to encode both target and distracting information. In the present study, we asked whether this hyperencoding effect extends to visual statistical learning, in that older adults may learn the statistical regularities present in both to-be-attended and to-be-ignored information. Older and younger adults viewed a series of red and green shapes and performed a one-back task on one of the colors. Unbeknownst to participants, both the red and green shapes were organized into triplets that always appeared together sequentially. Implicit memory for the triplets from both the attended and ignored streams was later tested, using a reaction time task. Replicating previous work, younger adults demonstrated learning only for the previously attended color. Older adults, however, demonstrated learning for both the attended and ignored colors, suggesting that contrary to popular belief, older adults may encode more information than do younger adults.

(4058)

The Effect of Study Time Distribution on the Learning and Retention of Paired Associates. MARIO O. DE JONGE, DIANE PECHER, JAN W. VAN STRIEN, HUIB TABBERS, & RENÉ ZEELENBERG, *Erasmus University Rotterdam* (sponsored by Jan W. van Strien)—Two experiments investigated the effect of study time distribution on both immediate (5 min) and delayed (48 h) cued recall of paired associates. Word pairs were presented for a total of 16 sec per pair, with presentation duration of individual presentations varying from 1 to 16 sec. In Experiment 1, participants studied word pairs with presentation durations of 1, 2, 4, 8, or 16 sec per presentation. A nonmonotonic relationship was found between presentation rate and cued recall performance. Both relatively short (e.g., 1 sec) and relatively long (e.g., 16 sec) presentation durations resulted in poor immediate and delayed recall, as

compared with intermediate presentation durations. In Experiment 2, we replicated these general findings. Moreover, we showed that the 4-sec condition resulted in a lower rate of forgetting than did the 1- and 16-sec conditions.

(4059)

Comparison of Procedural and Contextual Learning Using fMRI and Eyetracking. ANNA MANELIS & LYNNE M. REDER, *Carnegie Mellon University*—We used fMRI and eyetracking to compare procedural learning and the acquisition of spatial contextual associations, using the visual search task of Chun and Jiang (1998). With practice at the task, subjects became faster with fewer eye fixations, especially for displays that were repeated across blocks. The fMRI analysis revealed that the contextual-cuing effect in cortical and subcortical regions includes the left hippocampus and right thalamus. Linear discriminant analyses demonstrated that neural activity in the hippocampus, perirhinal cortex, thalamus, precentral gyrus, superior parietal lobule, and posterior cingulate cortex, along with both behavioral measures of learning (RT, eye fixations), were important for discriminating repeated from novel arrays. It is noteworthy that neural activity in the superior parietal lobule, inferior temporal gyrus, precuneus, and posterior cingulate cortex changed parametrically during procedural learning but were also modulated by repetition of spatial context. These results suggest that the neural correlates of procedural and contextual learning are not completely dissociable.

(4060)

The Role of Encoding Strategies in the Age-Related Associative Deficit: New Insights From a Source-Monitoring Task. BEATRICE G. KUHLMANN & DAYNA R. TOURON, *University of North Carolina, Greensboro*—Older adults are less likely to spontaneously use effective mediator-based encoding strategies (interactive imagery and sentence generation), which contributes to associative deficits in noun–noun memory tasks (e.g., Naveh-Benjamin, Brav, & Levy, 2007). Little is known about older adults' strategy use in other types of associative memory tasks. We examined younger (18–25) and older (60–75) adults' strategy use and effectiveness in a source-monitoring task. Older adults were as likely as younger adults to spontaneously use mediator-based strategies; both ages' spontaneous use of mediator-based strategies was higher for more concrete sources (e.g., persons). Overall, mediator-based strategies were effective in improving both younger and older adults' source memory. However, for abstract sources (e.g., text types), people appeared less adept at spontaneously creating good mediators, and this deficit was tentatively larger in the older age group. Implications for understanding previous demonstrations of an age-related strategy production deficiency are discussed.

• COGNITIVE CONTROL IV •

(4061)

Role of Executive Functions and Processing Speed in the Age-Related Difference in Episodic Memory: A Life Span Study. LAURENCE TACONNAT, *University of Tours and CNRS*, STÉPHANIE BILLY & CEDRIC BOUQUET, *University of Poitiers and CNRS*, AGNÈS BLAYE, *University of Provence and CNRS*, BADIÂA BOUAZZAOUI, *University of Tours and CNRS*, & PASCALE LARIGAUDERIE, *University of Poitiers and CNRS*—Decline in executive functions (West, 1996) and in processing speed (Salthouse, 1996) are hypotheses that have been extensively confirmed to account for age-related alteration of episodic memory in older adults. The aim of this study was to explore these hypotheses in a developmental context in order to explain increases in memory from childhood to adulthood. Six groups of participants (from 8 to 80 years of age) learned a categorizable word list that they had to recall. The number of words recalled (episodic memory) and the organizational strategy (ARC; Roenker et al., 1971) were the dependent variables. Participants also completed tasks measuring processing speed and executive functions. An index was computed to assess separately these two cognitive functions. The results corroborated our hypotheses, showing that age-related difference in recall was accounted for by processing speed and the organization index, whereas age-related

difference in the use of the organizational strategy was explained mainly by executive functions.

(4062)

Voluntary Hand Switching. JELLE DEMANET, FREDERICK VERBRUGGEN, BAPTIST LIEFOOGHE, & ANDRÉ VANDIERENDONCK, *Ghent University* (sponsored by André Vandierendonck)—The present study was designed to investigate two hypotheses about choice behavior in the voluntary task-switching procedure. A first hypothesis states that the generally observed tendency to keep repeating the same task is related to the fact that when tasks are selected on a voluntary basis, it is more difficult to switch than to repeat tasks. A second hypothesis states that stimuli can affect choices through associative priming of responses by stimuli (see Demanet et al., in press). In two experiments, where not tasks but hands were selected voluntarily, we confirmed both hypotheses by observing a tendency to alternate hands (in contrast with a tendency to repeat tasks) and by observing that stimulus repetitions can affect hand choices in a similar way as task choices. In addition, we found that stimuli affected only the choice of hands when a task was executed with the chosen hand.

(4063)

Across-Task Priming Revisited: Response and Task Conflicts Disentangled Using Ex-Gaussian Distribution Analysis. FLORIAN WASZAK & KAROLINA MOUTSOPOULOU, *CNRS*—The differential effects of task and response conflict in priming paradigms where associations are strengthened between a stimulus, a task, and a response have been demonstrated in recent years using neuroimaging methods. However, such effects are not easily disentangled using only measurements of behavior, such as reaction times (RTs). Here, we report the application of ex-Gaussian distribution analysis on task-switching RT data and show that conflict related to stimulus–response associations retrieved after a switch of tasks is reflected in the Gaussian component. By contrast, conflict related to the retrieval of stimulus–task associations is reflected in the exponential component. Our data confirm ex-Gaussian distribution analysis is a useful tool for pulling apart different levels of associative priming.

(4064)

Introducing a Special Partial Trial Design to the Stroop Task: Conflict-Induced Adjustments in Cognitive Control Achieved Through Differential Temporal Dynamics in Dorsolateral PFC? STEFANIE M. BECK, HANNES RUGE, & THOMAS GOSCHKE, *Dresden University of Technology* (sponsored by Thomas Goschke)—Empirical evidence for conflict-induced adjustments of cognitive control, as proposed by the conflict-monitoring hypothesis, has shown a correlation between conflict-related ACC activation and dlPFC activation on the subsequent trial, as well as elevated dlPFC engagement following conflict. However, using a standard Stroop task embedded in a special partial trial design, we show that these effects can alternatively be explained by confounding BOLD responses on successive trials. The results indicate that our special version of the partial trial design allows disentangling event-related bold responses on the current trial from BOLD signals on the preceding trial that are sustained throughout an intertrial interval. Moreover, future analysis using this design will show whether the critical effect leading to improved conflict resolution following high conflict might be implemented through differential temporal dynamics of proactive and reactive control modes.

(4065)

Item-Specific Control in the Stroop Task Is Better in the First Language: Evidence From Turkish–English Bilinguals. NART B. ATALAY, *Selçuk University*, & MINE MISIRLISOY, *Middle East Technical University* (sponsored by Hasan Gurkan Tekman)—The item-specific proportion congruence (ISPC) manipulation (Jacoby et al., 2003) produces larger Stroop interference for mostly congruent items and smaller interference for mostly incongruent items. This effect has been attributed to dynamic control over word-reading processes. However, the proportion congruency of an item in the ISPC manipulation is completely confounded with response contingency (Schmidt & Besner, 2008).

According to this alternative hypothesis, the ISPC effect is a result of learning response contingencies. In the present study, we investigated the ISPC effect and stimulus–response contingency learning with Turkish–English bilinguals. In Experiment 1, we observed a higher ISPC effect with Turkish color words than with English color words. In Experiment 2, we compared response contingency learning with Turkish and English noncolor words and observed no difference. Since item-specific control was better in the first language and stimulus–response contingency learning was comparable in both languages, our findings support the control account of the ISPC effect.

(4066)

Deactivation and Reactivation of Task Goals Preempt Vigilance Decrements. ATSUNORI ARIGA & ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign*—We propose a new mechanism for accounting for the vigilance decrement, hypothesizing that it occurs because the cognitive control system fails to maintain active the goal of the vigilance task over prolonged periods of time (goal habituation). Furthermore, we hypothesized that momentarily deactivating this goal (via a switch in tasks) would prevent the activation level of the vigilance goal from ever habituating. We asked observers to perform a visual vigilance task while maintaining four digits in memory. When observers retrieved the digits at the end of the vigilance task, their vigilance performance steeply declined over time. However, when observers were asked to sporadically recollect the digits during the vigilance task, the vigilance decrement was prevented. Our results present a direct challenge to the pervasive view that vigilance decrements are due to a depletion of attentional resources and provide a tractable mechanism for averting this insidious phenomenon in everyday life.

(4067)

Effects of Articulatory Suppression on Voluntary Action Selection. CHRISTINA R. WEYWADT & KARIN M. BUTLER, *University of New Mexico*—Language can guide actions and control behavior. However, in task-switching procedures, the role of language is less clear. Voluntary action selection was measured with the voluntary task-switching procedure, under instructions to complete each of two tasks in a random order and equally often. Cognitive control in this procedure was assessed with and without concurrent articulatory suppression. Switching probability declined under the articulatory suppression, suggesting that phonological loop processing can guide voluntary action selection.

• **WORKING MEMORY IV** •

(4068)

Predicting Object Location Memory From Simple and Complex Working Memory Spans. PAULA J. WADDILL, CASEY MITCHELL, & RYAN LEACH, *Murray State University*—We investigated the relationship of working memory span to object location memory, including the relative contributions of working memory, verbal short-term memory (STM), and visuospatial STM to the recall of locations and object-to-position assignments. Participants completed a variety of complex (working memory) and simple (STM) span tasks. They also viewed and later reconstructed two different object grids. In addition, participants either were warned at encoding to be careful to avoid incorrect placement of the objects at recall or were not warned. When shared variance among working memory, verbal STM, and visuospatial STM was taken into account, location memory in the unwarned participants was primarily a function of short-term memory (storage components), rather than working memory (executive components). For the warned participants, however, working memory was significant. The results are discussed in relation to resource models of individual differences as they apply to object location memory.

(4069)

Action Memory and Directed Forgetting. DANIEL J. PETERSON, MIRI BESKEN, & NEIL W. MULLIGAN, *University of North Carolina, Chapel Hill* (sponsored by Neil W. Mulligan)—Three experiments explored the relationship between enactment and list-method directed forgetting. In the study portion of Experiment 1, participants enacted

some phrases and listened to others. Each item was followed by a remember or a forget cue. Participants were later asked to recall all of the study phrases. Recall results showed (1) the typical enactment effect (enact greater than listen), (2) the typical directed-forgetting effect (remember greater than forget), and (3) no interaction (both the enact and listen conditions exhibited similar directed forgetting). Experiment 2 demonstrated the same results when the enact condition was compared with an observe condition, in which the participant watched the experimenter carry out the action. Experiments 1 and 2 used mixed-list, within-subjects designs. Experiment 3 demonstrated that in a between-subjects design, enactment produced no directed forgetting. The results demonstrate that action memory is subject to directed forgetting but that the experimental design can limit the observation of this effect.

(4070)

Cross-Domain Interference Between Serial Working Memory Tasks. CANDICE C. MOREY & JONATHAN T. MALL, *University of Groningen*—Many studies have examined whether verbal and spatial lists are impaired by rehearsal suppression, but these have yielded conflicting results. Instead, we ask whether there is a cost for simultaneously maintaining verbal and spatial lists, over and above ignoring an irrelevant presentation. When items from both lists were to be remembered, accuracy for reconstructing the order of the tested list was low, as compared with conditions in which only one list was presented and conditions in which one of the two lists was cued prior to stimulus presentation. Interference was larger for early positions in the lists, suggesting that consolidation of early items was impaired by the concurrent memory task, whereas less interference for late positions might reflect some domain-specific storage or activation in long-term memory, but only for the verbal representations. These results suggest that memory for spatial and verbal materials depends on general-purpose resources.

(4071)

A Bayesian Hierarchical Model for Estimating Working Memory Capacity. RICHARD D. MOREY, *University of Groningen*—Change detection tasks are commonly used to study working memory. Pashler (1988) and Cowan (2001) suggested simple formulas for estimating working memory capacity in change detection tasks, based on simple multinomial tree models. The use of these formulas in traditional ANOVAs, however, is prone to bias and incomplete use of information. A Bayesian hierarchical model is presented that mitigates these issues, along with an easy-to-use graphical software interface for model comparison and capacity estimation.

(4072)

Strategy Use in Working Memory Tasks. ALEXANDRA B. MORRISON, NAOMI L. STREETER, INGRID R. OLSON, & JASON M. CHEIN, *Temple University* (sponsored by Ingrid R. Olson)—In studies of working memory, researchers often make assumptions about the particular strategies that subjects utilize. Yet, despite the relevance of these assumptions for interpreting findings, few studies directly assess subjects' strategy use, and little is known about the range of strategies that subjects employ in different task contexts. We administered seven common working memory tasks (e.g., delayed serial recall, operation span) to subjects in a single session and assessed, through self-report questionnaires, subjects' primary and secondary strategies. Overall, results indicated that strategy choice and strategy effectiveness vary considerably by task. Unsurprisingly, rehearsal was the most commonly reported strategy; however, the prevalence and effectiveness of rehearsal fluctuated substantially across tasks. Findings regarding the varied distribution of strategies used in specific task contexts inform many central issues in working memory research and raise important questions regarding the homogeneity and stability of subject strategies.

(4073)

The Fractionation of Working Memory in High-Stakes Situations. JAY TODD & SIAN L. BEILOCK, *University of Chicago*—Performance on working memory (WM) demanding tasks can be significantly impaired when there is strong pressure to perform well. Although WM capacity is related to choking under pressure (e.g., Beilock et al., 2004;

Eysenck, 1979; Tohill & Holyoak, 2000), it is unknown which component processes of WM are susceptible to high-pressure performance situations. We used an alphabet arithmetic task and manipulated both the WM processes being tested and the level of performance pressure experienced by subjects. Overall, encoding, maintenance, and retrieval WM processes were insensitive to increases in performance pressure. In contrast, relative to a low-pressure control condition, the greater the demands on transforming content in WM, the worse subjects performed under high pressure. Pressure hinders performance when the transformation of information in WM is required. Later experiments further explicated the relationship between WM processes and their susceptibility to high-stakes situations.

(4074)

Novelty and Presentation Rate Influence Anticipation of List Items. JOHN P. TAYLOR & KAYLA O'CONNELL, *University of Minnesota, Duluth*—Whereas pure chaining models of order memory predict a fragile ability to remember list order, compound chaining models offer a robustness that is still prone to specific transposition and omission errors. We posit that these errors may represent a general anticipatory bias within memory for list order that can be predicted by compound chaining models. Two studies explored the nature of anticipatory errors, using a *Simon says* order repetition task in which a list of eight items was presented and then tested for order, with all eight items displayed in a random array. The results indicate a strong tendency toward anticipation of future items that is made more extreme with a fast study presentation rate. Novel items within the list may also sometimes influence the position at which an anticipation error will occur. Positional accounts of order memory may have difficulty with these findings, whereas compound chaining accounts may not.

(4075)

Voluntary Control Over the Temporal Distribution of Attention in Scanning Short-Term Memory. MARIO FIFIC, *Max Planck Institute for Human Development* (sponsored by Konstantinos Katsikopoulos)—We propose the existence of an attention-gating mechanism that scans items in short-term memory in a way similar to the scanning of information outside the cognitive system during visual object recognition. We tested this in an experiment in which subjects determined whether a target item was a member of a sequentially presented list of items. We manipulated subjects' temporal distribution of attention across items in the list in three conditions: Subjects responded very quickly if the target appeared in (1) the first half, (2) the second half, or (3) any part of the list. The results support the idea that the scanning of items in short-term memory is guided by voluntary control over the distribution of strictly limited attentional resources across time. The effects of set size, capacity limitation, and serial position are captured by the exemplar-based random walk model, which relates retrieval speed and accuracy to attention gating.

• EXPLICIT MEMORY IV •

(4076)

A Distinctiveness Explanation of the Sequential Lineup Advantage. CURT A. CARLSON, *Texas A&M University, Commerce*, & SCOTT D. GRONLUND, *University of Oklahoma*—We tested a novel distinctiveness explanation for why the sequential lineup advantage was found with earlier eyewitness identification research but is rare in recent studies. We manipulated the distinctiveness of the perpetrator, together with lineup fairness and suspect position in the sequential lineup, which have been shown to be potentially important factors. Computer-generated faces were utilized in the first two experiments to tightly control these variables. There was a sequential lineup advantage only when the perpetrator was distinctive and fair lineups were used. In two additional experiments using real faces, again the sequential advantage occurred only when there was a distinctive perpetrator, but it occurred for both biased and fair lineups. Suspect position effects were rare, with accuracy slightly higher when nondistinctive suspects were presented earlier in the sequential lineup. Remember–know–guess results were used to assess the likelihood of a recall-to-reject interpretation of the sequential lineup advantage.

(4077)

Effects of Featural Versus Holistic Verbalization on Memory for Faces. DAWN R. WEATHERFORD & CURT A. CARLSON, *Texas A&M University, Commerce* (sponsored by Gary Bradshaw)—We compared theoretical predictions from the criterion shift, semantic-processing, and transfer-appropriate processing accounts of verbal overshadowing/facilitation, using conjunction faces and assessing contributions of recollection and familiarity. Participants viewed several faces sequentially and described each featurally, holistically, or not at all. Subsequently, participants discriminated between three types of faces (studied, conjunction, or novel) by making yes/no recognition decisions and remember/know/guess (RKG) judgments. Preliminary results show verbal facilitation, as evidenced by significantly higher hit rates for verbalizers, regardless of description condition. However, verbalizers also had slightly higher conjunction false alarm rates and equivalent false alarm rates (to novel faces), relative to nonverbalizers. These results do not support the criterion shift account. However, further data collection should distinguish between the transfer-appropriate and semantic-processing accounts. In addition, analysis of the RKG results will shed some light on the relative contributions of recollection and familiarity to verbal facilitation.

(4078)

Effects of Mediated Word Lists on False Recall and Recognition. MARK J. HUFF & KEITH A. HUTCHISON, *Montana State University* (sponsored by Keith A. Hutchison)—False memory effects were explored using unrelated list items (LI; e.g., *slope*, *reindeer*, *corn*) that were related to mediators (e.g., *ski*, *sleigh*, *flake*) that converged upon a single nonpresented critical item (CI; e.g., *snow*). In Experiment 1, after each list, participants completed initial recall or arithmetic problems, followed by a final recognition test. Participants did not falsely recall mediated CIs; however, these CIs produced later false recognition, but only following initial testing. In Experiment 2, participants were instructed to simply guess the CI following each list. Final recognition mimicked that following initial recall, with elevated false alarms despite near-zero initial guessing accuracy. Experiment 3 controlled for item effects by replacing unrelated recognition items with CIs and LIs from nonpresented lists. An item effect (nonpresented CI vs. nonpresented LI) emerged, as did false recognition (CI from presented vs. nonpresented lists), demonstrating that mediated false memory is not due simply to item differences.

(4079)

Zombies on the Grasslands: Are Survival-Processing Advantages Based on Ancestral Priorities? NICHOLAS C. SODERSTROM & DAVID P. MCCABE, *Colorado State University* (sponsored by David P. McCabe)—Recent research suggests that our memory systems evolved to facilitate the retention of survival-relevant information and, more specifically, that inducing problems of "ancestral priorities" faced by our ancestors should lead to optimal memory performance (Nairne, 2010). The present study investigated this idea by comparing typical ancestral priority scenarios and modern survival scenarios with scenarios that involved threats from fictitious creatures (i.e., zombies). Subjects read one of four survival scenarios in which the environment and the explicit danger were either consistent or inconsistent with ancestrally based problems (i.e., grasslands–predators, grasslands–zombies, city–attackers, city–zombies). After rating words on the basis of their survival relevance, subjects performed a free recall task. All survival scenarios led to better performance than did a control condition (pleasantness ratings), but recall was greater for the both zombie scenarios than for the ancestor-consistent scenario (i.e., grasslands–predators). These data challenge the specificity of ancestral priorities in survival-processing advantages in memory.

(4080)

Contributions of Memory and Decision Processes to Lineup Identifications Following Mugshot Exposure. CHARLES A. GOODSELL, *Canisius College*, SCOTT D. GRONLUND, *University of Oklahoma*, & JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville* (sponsored by Scott D. Gronlund)—We manipulated mugshot search instructions to reveal when witnesses make commitment- or familiarity-based lineup errors. We examined the memory and decision-making processes

underlying these lineup choices, using an extension of Clark's (2003) WITNESS computational model: WITNESS-ME (Mugshot Exposure). In support of previous research, we found a robust commitment effect that resulted in the reduced ability to find the perpetrator in a lineup, relative to the no-mugbook control condition. Commitment is due to the strong encoding of the committed foil and the differentiation of that foil from the other lineup members. When participants, instead, were required to choose several foils that resembled the perpetrator (rather than searching for the perpetrator), the ability to find the perpetrator was preserved, relative to the no-mugbook control condition. Modeling these data supported the hypothesis that the number of plausible choices in the lineup influences witness' decision strategies. Theoretical and practical implications are discussed.

(4081)

Word Frequency Effects in True and False Recognition: Evidence for Recollection? TROY A. SMITH & DANIEL R. KIMBALL, *University of Oklahoma*, & MARTHA MANN, *University of Texas, Arlington*—Estes and Maddox (2002) showed that the word frequency mirror effect in item recognition is moderated by the magnitude of the disparity in relative frequency. In two experiments, we extended these findings and examined the effects of word frequency and semantic association on true and false recognition. Participants studied associative lists and nonassociative lists that varied systematically across four levels of normative word frequency (low, moderate, high, and very high). Experiment 1 used a recognition test with confidence judgments, whereas Experiment 2 used a modified remember–know procedure. In both experiments, there were differences in the effects of word frequency on old/new judgments for targets, noncritical lures, and critical lures to associative lists. Analysis of ROC curves and remember/familiar judgments revealed systematic differences in recollection and familiarity as a function of word frequency and semantic association. Implications for theories of memory, including Bayesian likelihood and dual-process models, are discussed.

(4082)

Memory for Details About People: Familiarity, Relatedness, and Gender Congruency. JAMES A. KOLE & ALICE F. HEALY, *University of Colorado, Boulder*—Several recent studies have demonstrated that processing information in terms of survival value improves retention over short delays. These findings are interpreted within a functionalist framework, which posits that modern cognitive processes reflect ancient selection pressures. The present study examined factors that influence memory for details about people. In two experiments, subjects learned fictitious details about familiar (friends, relatives) and/or unfamiliar individuals and were tested both immediately and after a 1-week delay. To control for a confounding between familiarity and genetic relatedness in Experiment 1, in Experiment 2, specific relationships (identical twin, first cousin, acquaintance) were assigned to unfamiliar individuals. Across experiments, retention was enhanced for familiar, as compared with unfamiliar individuals, for friends/acquaintances, as compared with relatives, for more closely related, as compared with more distantly related, individuals, and for individuals of the gender opposite to that of the subject. The results are consistent with a functionalist framework when both mate selection and kin are considered.

(4083)

Evidence for an Own-Race Bias in a Change Blindness Paradigm. JENNIFER L. WESLEY, ROBERT L. WOODERSON, BRITTIANY A. JEFFERSON, JEFFREY S. ANASTASI, & CHRISTOPHER WILSON, *Sam Houston State University*—Previous studies have demonstrated that individuals are better able to recognize faces of members of their own race than faces of other races (own-race bias). Other studies have shown that individuals often fail to notice major changes to visual scenes (change blindness). The purpose of the present study was to combine these research areas. In the present study, white, black, and Hispanic participants were presented with pairs of photographs, using a flicker paradigm. These photographs included 30 scene changes, as well as 15 face changes. The face changes consisted of altering five white, five black, and 5 Hispanic faces to another same-race face. An own-race bias was observed, since participants were generally more likely to recognize

face changes of members of their own race than face changes of other races. These results are discussed with reference to Sporer's in-group/out-group model.

(4084)

Rethinking Buffer Operations in a Dual-Store Framework. MELISSA LEHMAN & KENNETH J. MALMBERG, *University of South Florida* (sponsored by Douglas L. Nelson)—Atkinson and Shiffrin's (1968) dual-store model of memory includes a structural memory store, along with a control process conceptualized as a rehearsal buffer. We present a variant of Atkinson and Shiffrin's buffer model within a global memory framework that accounts for findings previously thought to be difficult for it to explain. This model assumes a limited capacity buffer where information is stored about items, along with information about associations between items and between items and the context in which they are studied. The strength of association between items and context is limited by the number of items simultaneously occupying the buffer. New findings that directly test the dual-store assumption are presented, including serial position effects, and conditional and first-recall probabilities in immediate and delayed free recall, in single- and paired-item study lists, and in a continuous distractor paradigm.

(4085)

The Role of Processing Fluency in Source Memory. BRIAN P. KURILLA, *University of Illinois, Urbana-Champaign* (sponsored by Deanne L. Westerman)—Five experiments were conducted to determine whether perceptual fluency contributes to source discrimination, which is typically thought to depend on conscious recollection. Participants in Experiments 1A and 1B studied a mixed list of auditory and visual words, and participants in Experiment 2 studied a mixed list of words in different font styles. In Experiments 1A and 1B, participants received a visual source memory test, and in Experiment 2 they received a source memory test printed in one of the two styles of font seen at study. In all three experiments, enhanced fluency was interpreted as evidence that test stimuli were studied in the form that matched presentation in the test phase. A manipulation of conceptual fluency affected source attributions in much the same way, suggesting that fluency is generically interpreted as evidence that a stimulus was presented in the same form during study and test.

(4086)

Social Contagion of Memory for Young and Older Adults. SARA D. DAVIS, KATYA T. NUMBERS, & MICHELLE L. MEADE, *Montana State University*—We examined age differences in the social-contagion-of-memory paradigm (Roediger, Meade, & Bergman, 2001). Young and older adults were asked to recall previously viewed household scenes in collaboration with a young or older adult confederate who falsely suggested that certain items had been present in the scenes. Presentation rate was manipulated to equate original learning across age groups. The results showed that on a subsequent individual memory test, both young and older adults incorporated the confederate's misleading suggestions into their memory reports, demonstrating social contagion effects. Importantly, social contagion effects were reduced with older adult confederates, because both young and older adults discounted older adult confederate suggestions. Furthermore, young adults were less likely to report "remembering" suggestions from older adult confederates. On a final recognition test, young and older adults demonstrated equivalent levels of false recognition.

(4087)

Initial Planning and Complex Prospective Memory in a Virtual Environment. DEBORAH M. CLAWSON, JILL R. SETTLE, & MARC M. SEBRECHTS, *Catholic University of America*—The effects of initial planning on complex prospective memory were examined in a virtual environment, using a set of real-world tasks. Subjects were given challenging errands to run in a virtual town, including numerous subtasks and order constraints (e.g., acquiring an ATM card before using the ATM). After reading a letter describing the errands, subjects either wrote an initial plan for completing the tasks or were directed to simply begin executing the tasks. The plan was removed from view during the

experiment, although all subjects had access to a map and the original letter. In carrying out the tasks, subjects made a variety of errors: omissions, tardiness, order errors, and rule violations. The initial-planning group committed fewer errors overall and fewer order errors than did the control group, regardless of everyday preference for planning. Generating an initial plan for errand execution improved accuracy and, therefore, the efficiency of those tasks completed.

(4088)

Reward Anticipation Enhances Recollection of Visual Details. JULIA SPANIOL & HOLLY J. BOWEN, *Ryerson University*—Reward anticipation during learning activates the dopaminergic midbrain (e.g., Knutson et al., 2001) and has been shown to improve recognition memory in younger and older adults (Spaniol et al., 2009). An open question is whether the reward effect on recognition reflects enhanced memory for details or enhanced memory for gist. The present experiment addressed this question with a modified incentive-encoding task (Adcock et al., 2006). Young participants studied 120 color pictures of common objects. Each picture was preceded by a cue indicating the reward value of the picture (high, $1; low, $0.01). The recognition test (24 h poststudy) required participants to discriminate targets and high-similarity lures. Hit rates were higher and false alarm rates were lower for high-reward pictures than for low-reward pictures. This finding suggests that reward anticipation enhances memory for visual details, rather than gist, and converges with previous reports of reward-based modulation of hippocampus-dependent recollective processes.

(4089)

Does Executive Functioning Act As a "Working-With-Memory Process" at Any Age? BADIÂA BOUAZZAOUI, LUCIE ANGEL, SÉVERINE FAY, LAURENCE TACONNAT, SANDRINE VANNESTE, & MICHEL ISINGRINI, *University François Rabelais of Tours, UMR CNRS 6234 CeRCA* (sponsored by Michel Isingrini)—In the framework of the executive decline hypothesis of cognitive aging, recent imaging data suggest that memory high-performing older adults exhibit significant activation of the prefrontal cortex not recruited by young or low-performing older adults. Using a correlational approach, our objective was to specify the link between episodic memory and executive performance in young and older adults. Five experiments were performed in which we used various memory tasks (free recall, cued recall, recognition, logical memory) and executive tasks (WCST, Stroop, *N*-back, SOPT, ELFT, FAS, number–letter, category generation). The results showed that memory and executive performance were consistently positively correlated in older adults, whereas the correlations were globally not significant in younger adults. This finding seems to parallel the prefrontal overactivation observed in certain older adults and supports the view that memory performance is linked to executive functioning specifically in older adults, suggesting that this is a functioning of brain aging that could be compensatory.

(4090)

Influence of the Thematic Congruence Program/Advertisement, Typicality, Divided Attention, and Confidence on Radio Ads' Memory. BEATRIZ MARTÍN-LUENGO & MALEN MIGUELES-SECO, *University of the Basque Country* (sponsored by Malen Migueles-Seco)—The influence on memory for ads of the thematic congruence between program and advertisement was examined. Other interests were the effect of schemata (high- and low-typicality elements) and the performance of other activities while one listens to the radio. Participants listened to four short radio programs with thematically congruent and incongruent ads embedded. After a distractor task, participants completed a true/false test and rated confidence in the answer. The results showed that congruent programs promote more distortions than do incongruent ones. Memory for the ad is enhanced if it is embedded in an incongruent program, because it entails a cognitive break in the flow of information. On the other hand, memory is better with low- than with high-typicality contents, because the use of schemata favors intrusions of high-typicality contents. Finally, the metamemory evaluations are influenced by the inference that memory will be worst if we conduct several tasks at the same time.

(4091)

Consistency of Hand Preference, Regardless of Direction, Predicts Baseline Memory Performance and Potential for Enhancement. KEITH B. LYLE, JAMES M. EDLIN, SHELLEY D. HANAVER-TORREZ, & RYAN P. HACKLAENDER, *University of Louisville*—Hand preference has emerged as an important individual difference in memory. Individuals reporting highly consistent right-handedness exhibit poorer memory, as compared with heterogeneous groups consisting of inconsistent right-handers, inconsistent left-handers, and, in some studies, consistent left-handers. Also, consistent right-handers, versus individuals with other preferences, more reliably exhibit a form of memory enhancement called saccade-induced retrieval enhancement (SIRE). Prior research has not permitted drawing strong conclusions about whether memory depends on consistency of hand preference, direction (left or right), or both factors. Here, we crossed consistency and direction of subjects' hand preference and tested for SIRE in an associative recognition procedure. Regardless of direction of hand preference, inconsistent handers outperformed consistent handers under baseline conditions. Also, regardless of direction, consistent handers exhibited SIRE, whereas inconsistent handers showed saccade-induced retrieval impairment. Hence, consistency of hand preference, regardless of direction, is an important individual difference in memory.

(4092)

Recollection and Familiarity in Long-Term Memory, Perception, and Everything in Between. MARIAM ALY & ANDREW P. YONELINAS, *University of California, Davis* (sponsored by Andrew P. Yonelinas)—We investigated whether processes analogous to recollection and familiarity in long-term recognition memory operate in perception and short-term memory tasks. The dual-process signal detection model was used to estimate recollection and familiarity from observed receiver operating characteristics (ROCs). The model fit the perception and short-term memory ROCs well, but in contrast to long-term memory, recollection supported the detection of "newness," not "oldness." The model was tested by manipulating whether discrete or global similarity information was more useful. Discrete, as compared with global, changes increased recollection and decreased familiarity. Insights about recollection and familiarity from these experiments led to predictions about how these processes should operate in long-term memory, which were tested using a novel memory change detection task. We found that participants no longer recollected oldness but, rather, recollected newness in item recognition. Thus, the same theoretical framework is useful in integrating phenomena across both memory and perception paradigms.

(4093)

Binding of Context Dimensions is Eliminated in Older Adults Even for "Remember" Responses. CHRISTIAN D. BOYWITT, *University of Mannheim*, BEATRICE G. KUHLMANN, *University of North Carolina, Greensboro*, & THORSTEN MEISER, *University of Mannheim* (sponsored by Edgar Erdfelder)—The "binding" account of remember judgments (Meiser & Bröder, 2002; Meiser, Sattler, & Weißer, 2008) suggests that stochastically dependent retrieval of context attributes is a characteristic of "remember" judgments, whereas "know" responses are accompanied by the independent retrieval of context attributes. The associative deficit hypothesis (Naveh-Benjamin, 2000), on the other hand, suggests that older adults should be less likely to "bind" context attributes into an integrated memory trace. In two experiments, we tested the implications of both accounts by equating overall source memory across age groups (Experiment 1) and introducing a perceptual-orienting task (Experiment 2). The results suggest that the relation between integrated retrieval of context attributes and subjective retrieval experience holds for younger adults, but not for older adults, even under conditions of very similar levels of overall source memory and when the encoding operations are held constant across age groups.

(4094)

Associative Facilitation in AB/AC Learning. RACHEL L. BURTON & JEREMY B. CAPLAN, *University of Alberta* (sponsored by Jeremy B. Caplan)—Associative independence is a surprising, yet highly robust finding in AB/AC learning. This refers to the result that

when participants are shown the A item and asked to recall the B and C associates in any order after studying overlapping AB/AC pairs (i.e., *castle–ocean*; *castle–spider*), B and C are recalled independently (e.g., Martin, 1971). Alternatively, due to subject variability, this might reflect a negative correlation, relative to a control (Hintzman, 1980; Riefer & Batchelder, 1988). For the first time, we report that recall of B and recall of C can be positively correlated; participants tend to recall both B and C or miss both. These results are incompatible with existing theories of AB/AC learning. Our associative facilitation findings suggest that there are mechanisms for resolving associative interference that include directly linking overlapping associations.

• METAMEMORY IV •

(4095)

Confidence and Accuracy in Recognition Memory: Positive, Negative, and Zero Correlations. KURT A. DeSOTO & HENRY L. ROEDIGER III, *Washington University* (sponsored by Henry L. Roediger III)—The relation between confidence and accuracy in recognition memory is complex, with some studies reporting strong positive correlations and others little or no correlation. These outcomes are often ascribed to materials differences. However, using the same general materials (categorized lists), we obtained positive, negative, and zero correlations, depending on the type of responses (hits, false alarms) and the type of analysis (averaging across items or across subjects). In general, probability of hits is positively correlated with confidence across items and subjects, whereas lures similar to the targets are negatively correlated (i.e., subjects display the most confidence for items most likely to be falsely recognized). A second experiment showed that false recognition is inversely related to ranking of items in the category norms, with most frequent items (e.g., *robin* for *birds*) more likely to be falsely recognized than less frequent items (*canary*). Blanket generalizations about confidence and accuracy are unwise.

(4096)

Predicted Learning Rate Is Not Influenced by Allotted Study Time. CORINNE TOWNSEND & EVAN HEIT, *University of California, Merced* (sponsored by Evan Heit)—Does length of allotted study time serve as a cue to subjects about learning rate? If allowed more study trials, subjects might anticipate a harder task and predict a slower learning rate than those allowed fewer trials. Students participated in an experiment with multiple study trials (each subject experiencing from one to six trials) and one test trial. Subjects predicted the amount they would learn prior to each study trial, making a judgment of improvement (JOI). Also, in a survey, subjects predicted the performance of other students. JOIs were not influenced by how many study trials were allowed. The JOIs in the survey were poor matches for actual performance in the experiment: Survey JOIs overpredicted the amount of learning and predicted that learning would accelerate over trials, whereas the trend in the experiment was for a decrease in learning rate over time. Implications for theories of metamemory are discussed.

(4097)

Effects of Aging on Nostalgic Tendencies, Déjà Vu Experience, and Regret. TAKASHI KUSUMI, *Kyoto University*—Using a questionnaire, we examined the effects of aging on nostalgic tendency, and how it relates to déjà vu and regret as experiences of normal adults (in their 20s, 40s, and 60s) in the U.S. (*n* = 504) and in Japan (*n* = 900). The participants answered a Web-based survey questionnaire assessing their incidence of having experienced (1) déjà vu for a person and for a place, (2) regrets in seven domains (relationships, romance/marriage, family, work, health, money/buying, and general), and (3) nostalgic experiences in three situations (remembering the past, wishing to return to the past, and listening to old music). The results indicated that the incidence of déjà vu, regret, and nostalgia decreased with age. Structural equation modeling revealed that nostalgic tendencies facilitate the incidence of déjà vu and regret. This pattern of results was the same for participants of both genders and nationalities.

(4098)

Quitting a Memory Search Despite a Lingering Feeling of Knowing. CAROLE J. YOUNG, *Bethel University*—People searching their semantic memory to retrieve members of natural categories use their feeling of knowing as a reasonably accurate guide for how long to work on a category. However, they consistently quit working on the richest categories sooner than would be expected on the basis of the number of items they could yet retrieve. To explore why this happens, 15 undergraduates were motivated to retrieve members of 15 categories as efficiently as possible and were allowed to quit whenever they wished. After quitting each category, participants were asked to judge how many more members in that category they thought they knew but were unable to retrieve. The results replicated the previous findings that participants retrieved more items from and spent more time on the richer categories. Participants also underutilized the richest categories, in spite of indicating some awareness that there were still many more category members to be retrieved.

(4099)

Study Time Is Influenced by Students' Understanding of Probability Information. TYLER M. MILLER, LISA GERACI, STEVE SMITH, & ANNA ANTONY, *Texas A&M University*—We tested the hypothesis that low-performing students stop studying prematurely because they erroneously believe that they know the same amount of material as will be tested. Although students may be aware that only a portion of the course material will be on the exam, they do not know which material will be tested. To examine whether low-performing students, in particular, fail to consider this information, participants studied Swahili–English word pairs and were told that they would be tested on either 25% or 100% of the word pairs. Participants were asked to study until they believed that they could remember all of the items. The results showed that although test performance was equivalent across the two probability conditions, low performers (as defined by GPA) chose to study the word pairs for less time in the 25% test condition than in the 100% test condition, whereas high performers studied for similar amounts of time.

(4100)

Effects of Recollection Quality and Aging on Metamemory. JESSICA T. WONG & DAVID A. GALLO, *University of Chicago*—Aging impairs metamemory, or the relationship between memory accuracy and confidence judgments. One explanation is that aging increases reliance on general feelings of familiarity, providing an impoverished basis for confidence judgments, relative to specific recollections. Another explanation is that aging impairs the ability to recollect and/or monitor high-quality details, independently of familiarity effects. We tested the latter hypothesis using memory tests that relied exclusively on recollection, by holding familiarity constant across items. Subjects studied pictures and words and then took forced choice memory tests with confidence judgments. As was expected, the overall relationship between recollection accuracy and confidence judgments was affected by stimulus type (pictures > words) and by age (younger > older). Critically, these age-related impairments in metamemory were evident even when the groups were equated on overall recollection accuracy. These results suggest that age impairs metamemory by reducing the ability to recollect and/or monitor fine-grained details, independently of familiarity processes.

(4101)

Confidence Ratings of Performance Based on Learning With and Without Awareness. MARIANA V. C. COUTINHO, JOSEPH B. BOOMER, BARBARA A. CHURCH, & J. DAVID SMITH, *University at Buffalo* (sponsored by J. David Smith)—Participants can perform substantially above chance and yet have no awareness of learning in artificial grammar and Iowa gambling tasks (Persaud, McLeod, & Cowey, 2007). These findings have been interpreted as evidence for an implicit learning system (Ashby & Maddox, 2005). The present study explored the time course of awareness in other types of category-learning tasks, including rule-based tasks. We were interested in knowing whether awareness would track closely with accurate responding in these tasks or would show the same dissociation as that found using implicit learning tasks. Participants performed a categorization task and rated their confidence level for each trial. When a rule-based task was performed, confidence and performance level both increased sharply as participants reached the learning criterion and tracked closely together. The results showed

that accurate responding and awareness happen almost simultaneously when a rule-based task is performed. The results are discussed in terms of theories of implicit and explicit categorization.

• DIVIDED ATTENTION •

(4102)
Electrophysiological Correlates of Parallel Response Selection in Dual-Task Performance. SANDRA J. THOMSON, MATTHEW T. MAZUREK, JUDITH M. SHEDDEN, & SCOTT WATTER, *McMaster University*—One common interpretation of the processing limitation observed in dual-task performance is that the response selection stages of two concurrent tasks must be performed serially. Recently, several studies have challenged this serial-processing assumption by demonstrating the existence of backward response-level crosstalk between tasks. However, it is difficult to distinguish whether response information from Task 2 is, in fact, priming the response selection stage of Task 1 or, instead, a later motor execution stage, which would not violate the bottleneck theory. We evaluate this possibility in a dual-task procedure by examining lateralized readiness potentials (LRPs). Observing the influence of Task 2 response information on the latency or amplitude of Task 1 LRPs would suggest that this backward crosstalk occurs at a central response selection stage, rather than at a later motor execution stage. Our LRP data support a central Task 1 response selection locus for this backward response priming effect.

(4103)
The Importance of Continuous Scene Information for Multiple-Object Tracking and Target Updating. HAUKE S. MEYERHOFF, MARKUS HUFF, & FRANK PAPENMEIER, *Knowledge Media Research Center Tübingen*, GEORG JAHN, *University of Greifswald*, & STEPHAN SCHWAN, *Knowledge Media Research Center Tübingen* (sponsored by Stephan Schwan)—Human observers can keep track of multiple objects across continuous scene rotations. In comparison, abrupt rotations disrupt tracking performance. We report five experiments that examined this effect by introducing intervals of object invisibility during scene rotations. We were able to show that target updating relies on continuous scene information. In contrast, abrupt scene rotations during object invisibility impair performance (Experiments 1–3). This target-updating effect strongly resembles effects known from change recognition tasks. This spatial-updating process is expected to be an automatic process relying on proprioceptive cues. In Experiments 4 and 5, we tested whether target updating is an automatic or a voluntary process. We dissociated reference frame rotations from object rotations, thus introducing conditions in which it was useless or even harmful to process reference frame rotations. We found clear evidence for automatic target updating based on pure visual cues.

(4104)
Object Perception Under Divided Attention: Fixed-Capacity Categorization of Natural Objects. ALEC SCHARFF & JOHN PALMER, *University of Washington*, & CATHLEEN M. MOORE, *University of Iowa* (sponsored by John Palmer)—Can we identify multiple objects simultaneously? Or, alternatively, do we identify objects one at a time, as if reading words? These opposing ideas reflect two popular hypotheses about capacity limitation in object perception. Here, we used an extended simultaneous–sequential paradigm to measure the capacity of object perception under divided attention. Our findings reject the unlimited-capacity hypothesis and support a fixed capacity limit on categorizing natural objects. This extreme capacity limitation is consistent with a serial identification of objects but does not rule out the possibility of fixed-capacity parallel processing.

(4105)
Tracking the Attentional Boost Effect in High-Level Visual Areas. KHENA M. SWALLOW, TAL MAKOVSKI, & YUHONG V. JIANG, *University of Minnesota*—Memory for images presented at the same time as unrelated task targets is enhanced, relative to images presented at the same time as distractors (the attentional boost effect). A potential explanation of this effect is that perceptual processing of an image is greater when it is presented concurrently with a task target. To examine the neural correlate of the attentional boost effect, we used fMRI to measure brain activity when participants encoded images of faces and scenes for a later memory test. In addition, they pressed a button whenever the fixation square was white (target), rather than black (distractor). Brain activity in the fusiform face area and parahippocampal place area (and V1) was greater when target squares appeared than when distractor squares appeared. This enhancement was seen for background images of faces, scenes, and scrambled scenes. Thus, target detection in a fixation task results in increased brain activity in high-level visual areas.

(4106)
The Roles of Attention and Working Memory Capacity in Theory of Mind Tasks. MELISSA J. HAWTHORNE & BENTON H. PIERCE, *Texas A&M University, Commerce* (sponsored by Benton H. Pierce)—Extensive research has examined theory of mind (ToM), the ability to infer the emotional and mental states of others. However, few studies have examined the underlying abilities necessary to complete various types of ToM tasks, which may vary widely in complexity. In this study, we examined the roles of attention and working memory in four separate ToM tasks ("faces," "faux pas," a first-order task, and a second-order task). In Experiment 1, we found that a divided attention task disrupted performance on the first- and second-order tasks, as well as on the faux pas task, but had no effect on the faces task. In Experiment 2, we found that working memory capacity was unrelated to performance on any of the ToM tasks. These results suggest that attention may play a larger role than working memory in theory of mind.

(4107)
Dissociating Attentional and Preparatory Processes in Timing With Breaks. RÉMI GAUDREAULT, PAULE ELLEFSEN-GAUTHIER, & CLAUDETTE FORTIN, *Laval University*—Expecting a break during a time interval production diverts attention from the time estimation process, presumably disrupting an accumulation of temporal information. The net result is a lengthening of produced intervals proportional to the prebreak duration (Fortin & Massé, 2000). This break location effect is attributed to two factors: attention time sharing between timing and monitoring for the break signal and preparatory processes taking place before the break. The results from three studies examining the contribution of preparatory processes to this effect in time production are contrasted and discussed. Each study compares two conditions: (1) constant and variable prebreak duration (pure vs. mixed blocks of trials), (2) low and high uncertainty about location values, and (3) timing with and without the use of chronometric counting. The data converge to support the conclusion that the break location effect is due mainly to attention sharing, the specific role of preparation being negligible.

(4108)
Spontaneous But Not Effortless: The Ownership Effect in Recollective Recognition Is Affected by Divided Attention at Encoding. MIRJAM VAN DEN BOS, SHEILA J. CUNNINGHAM, & DAVID J. TURK, *University of Aberdeen* (sponsored by Martin A. Conway)—Previous work has shown that self-cues evoke arousal and capture attention in a relatively effortless fashion (Brédart, Delchambre, & Laureys, 2006; Williams, Diehl, & Mahoney, 2002). These processes have been assumed to be responsible for the greater elaboration of self-relevant information, as compared with, for example, other-relevant information (van den Bos, Cunningham, Conway, & Turk, 2010). The present experiments employed divided attention manipulations to investigate the nature of these processes. The data suggest that self-cues may capture visual attention and trigger arousal but that participants are not able to act upon these low-level responses when a secondary task is present. On the basis of these and previous findings, an exploratory model of self-memory biases is presented.

• SELECTIVE ATTENTION IV •

(4109)
Meaningful Strings Boost Partial Report But Not Whole Report Performance in RSVP. THOMAS G. GHIRARDELLI, SARAH EATON,

& KELLEN MATTHEWS, *Goucher College*—Nieuwenstein and Potter (2006) demonstrated superior recall of letters from an RSVP stream in a whole- than in a partial-report condition. They proposed that whole-report superiority occurs because the attentional blink results when observers are asked to select items from the RSVP stream as in partial report. The purpose of the present study was to examine whether meaningful stimuli might confer the whole-report advantage even in a partial-report task. Participants viewed an RSVP sequence of six items and performed either a whole-report or a partial-report task. Some of the sequences contained meaningful trigrams (e.g., LOL = laughing out loud). We hypothesized that meaningful strings might result in improved partial-report performance because they are selected as a unit instead of as separate items. We found that participants recalled significantly more items in partial report when the sequence contained a meaningful string than when it did not.

(4110)

Missing the Hard Cases: Effects of Relative Prevalence on Detection of Difficult Targets in Visual Search. MICHAEL ZEHETLEITNER, *Ludwig-Maximilians-Universität*, JEREMY M. WOLFE, *Harvard Medical School*, & HERMANN J. MÜLLER, *Ludwig-Maximilians-Universität* (sponsored by Mary C. Potter)—In visual search, miss error rates are higher when targets are rare than when the same targets are common in a set of trials. Suppose that overall target prevalence is high but the prevalence of more difficult targets varies. In three experiments, we found that rare difficult targets were missed more often. Target-absent RTs declined with the prevalence of difficult targets. False alarm rates were low and constant in these experiments. Difficulty is a relative term. In these orientation search experiments, a 6° target among vertical distractors was "difficult," with 25% misses that depended on set size, if the other targets were 45°, but not if the other targets were 3°, with 5% misses independent of set size. Previous prevalence data were modeled with separate decision criteria for identification and quitting. These data may require the addition of a modifiable criterion for selection decisions as well.

(4111)

The Time Course of Stimulus–Response Compatibility in Visual Search. WIESKE van ZOEST & JAN THEEUWES, *Vrije Universiteit Amsterdam* (sponsored by Jan Theeuwes)—In four experiments, target–distractor similarity was varied to investigate the dynamic influences of visual selection on stimulus–response (S–R) compatibility. Participants responded to the presence of a singleton arrow that was presented amid a series of nontargets. When the singleton arrow was present, observers pressed a button with their right index finger; when it was absent, observers used their left index finger. Observers were faster to respond "present" when the singleton arrow pointed to the right (corresponding) than when it pointed left (noncorresponding). However, this effect of S–R compatibility was found only when observers were relatively slow to respond. The moment in time in which S–R compatibility influenced performance depended on the relative salience of the singleton target, as well as on the identity of the irrelevant nontargets. Our results suggest that early responses were not influenced by the identity of the singleton arrow and that higher level effects of S–R compatibility in visual search take time to develop.

(4112)

Heart Rate Variability During Exogenous and Endogenous Cuing. JIM E. McAULIFFE, *Nipissing University*, MICHEL J. JOHNSON, *University of Moncton*, & GRAYDON RAYMER, MATT ADAMSON, KRISTI WEENING, MARK WACHOWIAK, & DEAN HAY, *Nipissing University*—The relationship between arousal (sympathetic/parasympathetic ratio) and cognition can be assessed using heart rate variability (HRV). In the present study, we examined HRV during two attentional-cuing tasks. Participants completed an exogenous cuing task (SOA = 800 msec) and an endogenous cuing task (SOA = 500 msec) while being monitored by electrocardiography. Inhibition of return was found with the exogenous cues, and the cue validity effect was found with the endogenous cues. HRV was assessed using both fast Fourier transform (FFT) and wavelet analysis. In general, there was greater arousal during the endogenous cuing task. The results are discussed in terms of the difference between reflexive (exogenous) and volitional (endogenous) orienting of attention and the relationship to the autonomic nervous system. In addition, the FFT is compared with wavelet techniques in assessing temporally resolved frequency variations in HRV.

(4113)

Visual Hemifield Asymmetry in Spatial Cuing and Inhibition of Return. BRYAN R. BURNHAM, NICOLE E. BIANCO, ALEX KASPER, ANTONY DELLITURRI, & NICK STILES, *University of Scranton*—Previous research has shown a visual hemifield asymmetry in the inhibition-of-return (IOR) effect. Specifically, IOR was larger for left–right cues than for right–left cues in native English speakers (Spalek & Hammad, 2005). Other research indicates a right-visual-hemifield bias for the orienting of attention (Pollman, 2000). In this study, we replicated the left–right bias for IOR and observed larger cuing effects following cues in the right visual hemifield, as compared with the left visual hemifield, in a manual detection version of the spatial-cuing task. We also observed this pattern in a localization task, but not an identification task. Our results also suggest that handedness is related to this asymmetry in the spatial orienting of attention.

(4114)

Potential Benefits of Dual Tasking When Fatigued. MARK CHAN, SABRINA GREGERSEN, & PAUL ATCHLEY, *University of Kansas*—Drivers engage in self-initiated behavioral countermeasures in an attempt to stay awake when fatigued, especially when driving under monotonous conditions. Many of these self-initiated behaviors do not improve alertness or performance. Recent research investigating the effects of cognitive load on performance indicates that the presence of an interactive cognitive task may reduce performance decrements when one is fatigued. We investigated the potential benefits of dual tasking when drivers were fatigued, using behavioral and neurophysiological (EEG) recordings. Drivers drove for 90 min under simulated monotonous highway conditions. The results suggest that continuous dual tasking does not mitigate fatigue: Performance was no better than that for drivers who were fatigued. Drivers who dual-tasked when fatigue was greatest exhibited marked improvements in driving performance and increased task engagement, as compared with other drivers. This indicates that the introduction of an appropriate cognitive load at specific periods may mitigate the effects of fatigue on performance.

(4115)

When Searching for Lesions, Radiologists Do Not Often Miss Rare Targets. RYOICHI NAKASHIMA & YUYA KOMORI, *University of Tokyo*, ERIKO MAEDA & TAKEHARU YOSHIKAWA, *University of Tokyo Hospital*, & KAZUHIKO YOKOSAWA, *University of Tokyo* (sponsored by Kazuhiko Yokosawa)—In screening tasks, rare targets are often missed (the prevalence effect; e.g., Wolfe et al., 2005). However, in our previous study (Nakashima et al., 2009), we compared experts (radiologists) with novices in medical screening tasks, and it was indicated that a strong understanding of the importance of tumors can be effective in preventing missed identifications of rare tumors. A concern with the previous study was ease of task. In this study, visual search for an important tumor on a computed tomography image whose difficulty was very high, involving two target prevalence conditions (50% vs. 2%), was conducted. Participants were novices and experts. The results indicated that novices missed targets more often in the low- than in the high-prevalence condition. However, contrary to the prevalence effect, experts did not often miss rare targets in the low-prevalence condition, despite task difficulty. This supports our previous suggestion.

(4116)

Breaking the Set: Surprise Capture in a Contingent Capture Paradigm. JAMES D. RETELL, ROGER W. REMINGTON, & STEFANIE I. BECKER, *University of Queensland* (sponsored by Stefanie I. Becker)—Understanding the role of top-down mechanisms in attentional capture has important consequences for understanding attentional control. Spatial-cuing experiments have shown that involuntary shifts of attention are contingent on top-down attentional control settings.

However, recent results suggest that task-irrelevant rare events can capture attention in the absence of active control settings for them. We explored this further by introducing a motion singleton into the cue frame of a spatial-cuing experiment as a surprise event, to see whether it would override existing attentional control settings. The motion singleton was presented in competition with a valid target color cue. The results ($n = 15$) showed that a motion singleton at a nontarget location led to elevated response times to validly cued targets. This suggests that surprising and rare motion singletons can capture attention even when they compete with a target color cue.

• SPATIAL COGNITION IV •

(4117)

What Does a Beacon Signal in Beacon-Based Route Learning? XIAO OU LI & LAURA A. CARLSON, *University of Notre Dame*—Imagine a hallway with two side-by-side doors and a women's room sign at the far left. How does one know which door is the one for women? The sign could serve as a beacon indicating that it is the closest door. The sign also could implicitly specify the destination of the men's room as the far door, acting like an anti-beacon for the women's room. If beacons operate by specifying particular doors (close or far), use of these two types of landmarks should not differ. To assess this, we asked participants to learn a route through a series of rooms, each with two doors distinguished by beacons, anti-beacons, and associative cues that indicated direction. Learning was best with beacons, followed by learning with associative cues; learning with anti-beacons was the most difficult. These data suggest that beacons function primarily by specifying closeness, rather than by specifying a particular object.

(4118)

Selecting a Reference Object. JARED E. MILLER & LAURA A. CARLSON, *University of Notre Dame*, & PATRICK L. HILL, *University of Illinois, Urbana-Champaign* (sponsored by Laura A. Carlson)—One way to describe the location of an object is to relate it to another object. Often, there are many objects that could serve as potential reference objects. A common theoretical assumption is that the features of an object that make it salient, relative to the candidate objects, are critical in determining which object is selected. The present research examined this assumption, assessing the importance of spatial, perceptual, conceptual, and functional features. Three experiments demonstrated that spatial features have the strongest influence on reference object selection, with perceptual features and conceptual features playing no role. Additionally, functional features were shown to be spatially dependent, such that they had an influence only when the spatial configuration allowed an interaction between the located object and the reference object. These findings challenge the viewpoint that salience in and of itself dictates reference object selection and argues for a strong dependence on spatial features.

(4119)

About Face: The Anchoring Effect of Chirality in Graphic Production. JYOTSNA VAID & SUMEYRA TOSUN, *Texas A&M University*, & REBECCA RHODES, *University of Michigan*—When asked to draw profiles of a face with their dominant hand, right-handed users of left-to-right (LR) scripts draw them facing leftward, whereas left-handers tend to orient them to the right. The present research examined profile orientation and gender specification of faces among right- and left-handed LR users asked to draw with each hand, with hand order varied. It was found that right-handers who used their dominant hand second to draw had a significantly lower incidence of leftward-facing and a higher incidence of gender-unspecified facial profiles with their dominant hand, as compared with their counterparts, who used their dominant hand first to draw. These findings lend support to a chiral anchoring hypothesis whereby the activation of canonical perceptual and social schemas depends on use of the dominant hand first.

(4120)

Distinct Sources of Action Compatibility in Early and Late Stages of Spatial Knowledge. QI WANG & HOLLY A. TAYLOR, *Tufts University*, TAD T. BRUNYE, *U.S. Army NSRDEC and Tufts University*, & GEORGE L. WOLFORD, *Dartmouth College*—The present study explored spatial knowledge development by comparing online response measures between navigators with different levels of environment experience. Online measures can reveal cognitive processing masked in overt measures. In the study, participants, grouped by campus familiarity, judged the accuracy of descriptions relating relative spatial locations by clicking *yes* and *no* buttons (standard response). At the same time, mouse-tracking software (Freeman & Ambady, 2010) recorded mouse trajectories (online). The correct mouse movement was congruent or incongruent with either the physical spatial relationship or the description's spatial term. The results demonstrated action compatibility effects (ACEs) differing as a function of spatial knowledge development. For well-developed spatial knowledge, responses requiring a movement incompatible with the physical spatial relationship (e.g., response button on right, but building to the left) showed mouse trajectories more consistent with the spatial relationship. For less developed spatial knowledge, the linguistic spatial term drove the ACE (e.g., response button on the right and description term on the left).

(4121)

Number-Induced Shifts in Spatial Attention: How Automatic Are They? KIKI ZANOLIE & DIANE PECHER, *Erasmus University Rotterdam* (sponsored by Diane Pecher)—The SNARC effect shows that left-hand responses are faster to low numbers and right-hand responses to high numbers, providing evidence for a mental number line with small numbers on the left and large numbers on the right. Fischer et al. (2003) showed that merely perceiving numbers can shift visual spatial attention to the right or left side, depending on number magnitude. In a series of experiments, we investigated under what circumstances numbers direct spatial attention. In all experiments, we presented participants with two lateral placeholders, one on each side of a fixation. A central digit (1, 2, 8, or 9) was presented for 300 msec. The participants were instructed to respond as quickly and accurately as possible when a target was detected. We manipulated instructions, target visibility, and whether the task required processing of the digits. The results show that numbers do not automatically direct spatial attention.

(4125–4132)

Grant Funding Agencies. Information about various grant funding agencies is available. Representatives will be available throughout the conference.

POSTER SESSION V
Saturday Evening
Exhibit Hall
Viewing 4:00–7:30, Author Present 6:00–7:30

• Action and Perception III •

(5001)

Feature Attraction Between Controlled Objects and Targets. JAMES D. MILES & ROBERT W. PROCTOR, *Purdue University* (sponsored by Robert W. Proctor)—We show that controlled objects are attracted to targets that share features with them. In a series of experiments, so-called feature attraction occurred when a colored cursor was moved to one of two colored targets. Movement times were faster and trajectories were more direct when the colors of the cursor and correct target corresponded. When the cursor and incorrect target (foil) colors corresponded, cursor trajectories deviated toward the foil as the movement progressed, suggesting that attraction occurs during response execution, rather than response selection. We provide evidence that such feature attraction occurs regardless of whether the color relation between the cursor and target is task relevant (Experiment 1) or not (Experiment 2) and further show that feature attraction occurs as long as the cursor and target both receive attention (Experiments 3 and 4). We discuss potential underlying mechanisms for feature attraction and how this phenomenon may influence day-to-day behavior.

(5002)

The Effect of Reference Valence on Affective Stimulus–Response Compatibility. YANMIN ZHANG & ROBERT W. PROCTOR, *Purdue University* (sponsored by Kim-Phuong L. Vu)—Several experiments investigated the effect of reference valence on affective stimulus–response (S–R) compatibility. Pictures of Albert Einstein and Adolf Hitler were used as reference objects, with positive and negative adjectives as target stimuli, and responses were made by moving a joystick in one of two directions along the sagittal plane. The results showed that reference valence interacted with affective S–R compatibility through a matching mechanism. When the stimulus and reference valences matched (positive words and Einstein; negative words and Hitler), moving the stimulus toward the reference was faster; when the stimulus and reference valences mismatched (positive words and Hitler; negative words and Einstein), moving the stimulus away from the reference was faster. Matching happened when the stimulus valence was task relevant but the reference was task irrelevant, when both were task relevant, and when neither was task relevant, suggesting that matching is a general rule for affective S–R compatibility when a valenced reference is provided.

(5003)

Hard and Fast Rules About the Body: Evidence of Dorsal Contributions to Judging Body Space. SYLVIA HACH, *Max Planck Institute for Human Cognitive and Brain Sciences*, MASAMI ISHIHARA, *Tokyo Metropolitan University*, & PETER E. KELLER & SIMONE SCHÜTZ-BOSBACH, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Peter E. Keller)—Analogously to the visual system, somatosensory processing may be segregated into dorsal and ventral streams, with the body constituting part of either the action system or a perceptual object. In our previous study, we found evidence of this: Handedness differences arose for body tasks requiring actions upon one's own body, but not for a task referring to an explicit representation of it. To further explore the dorsal contribution to the former, we added a manipulation of movement mode. Participants performed either immediate or delayed pointing movements toward predefined landmarks on their body outline. The results replicate previous findings and indicate that handedness differences are independent from movement mode. Kinematic analyses additionally show handedness differences in the online control of pointing movements. Altogether, these findings provide support for a dual-stream hypothesis of somatosensory processing and are the first to show similarities in the processing of body space and peripersonal space.

(5004)

Twin Compatibilities in Joint Action Tasks. PAMELA BAESS & WOLFGANG PRINZ, *Max Planck Institute of Human Cognitive and*

Brain Sciences (sponsored by Wolfgang Prinz)—Studies on joint action have shown that when a task is shared with a partner in such a way that each of them takes care of one of the responses, Simon effects are reported that are similar to those in the undivided task. A spatial compatibility effect (SCE) occurred only in the joint go/no-go condition. A recent study (Philipp & Prinz, in press) reported an identity-based compatibility effect (ICE)—that is, the compatibility between the responding agent and the irrelevant face on the screen. In the present studies, we present evidence from three go/no-go experiments using different faces (one's own face, a partner's face, or a neutral face), combining the ICE with an SCE. Hereby, we show that the ICE was found in the joint and single go/no-go conditions. Furthermore, an SCE occurred only in the joint, but not in the single, go/no-go condition. These results give further evidence for shared representations in the joint go/no-go condition.

(5005)

Stimulus Dynamics and Action Production Modulate Internal Action Simulation. PEGGY TAUSCHE, ANNE SPRINGER, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Cristina Massen)—Humans perceive temporally occluded actions in a fluent manner. It is suggested that they fill the perceptual gap with a mental simulation of the unseen action part. Our participants watched temporally occluded point-light actions and predicted the action course after occlusion. Prediction accuracy was measured. Data indicated that in addition to a real-time simulation process, a similarity-based matching process may be involved in action prediction. Moreover, these two processes appear to be modulated by the stimulus-inherent dynamics (fast vs. slow; Experiment 1) and the degree to which participants are engaged in a concurrent motor action (active vs. passive; Experiment 2). Overall, the results indicate that the relative involvement of dynamic simulation and static matching can be modulated by stimulus dynamics and concurrent action production. This supports our assumption that internal action simulation is influenced by conceptual knowledge and that it shares a common representational system with action production.

(5006)

Tempo Modulates Beat Perception and Involvement of Motor Areas in Timing. MOLLY J. HENRY, *Bowling Green State University*, JEAN TKACH, *Case Western Reserve University*, & J. DEVIN McAULEY, *Michigan State University* (sponsored by J. Devin McAuley)—Picking up on a beat when one listens to auditory rhythms has been proposed to depend on a striato-thalamo-cortical network involving the basal ganglia, supplementary motor area, and premotor cortices (Grahn & Brett, 2007). In the present study, 15 participants underwent fMRI while completing a tempo judgment task in which auditory stimuli implied a 600-msec beat or a 1,500-msec beat. Behavioral data revealed that listeners were significantly more likely to pick up on a beat in the 600-msec condition than in the 1,500-msec condition. Corresponding increases in brain activation were observed in the left thalamus, bilateral basal ganglia, bilateral SMA, and premotor areas. In contrast, no areas showed increased activation in the 1,500-msec condition, relative to the 600-msec condition. The results add support to the view that beat perception involves a network of motor areas of the brain.

(5007)

Diffusion Versus Linear Ballistic Accumulation: Different Models for Response Time, Same Conclusions About Psychological Mechanisms? CHRISTOPHER M. DONKIN & RICHARD M. SHIFFRIN, *Indiana University, Bloomington*, SCOTT D. BROWN & ANDREW HEATHCOTE, *University of Newcastle*, & ERIC-JAN WAGENMAKERS, *University of Amsterdam* (sponsored by Richard M. Shiffrin)—Quantitative models for response time and accuracy are increasingly used as tools to draw conclusions about psychological processes. Here, we investigate the extent to which these substantive conclusions depend on whether researchers use the Ratcliff diffusion model or the linear ballistic accumulator model. Simulations show that the models agree on the effects of changes in the rate of information accumulation and changes in nondecision time but that they disagree on the effects of changes in response caution. Fits to empirical data show, however, that the models

agree closely on the effects of experimental manipulations, both within and across groups, even when that manipulation affects response caution. We conclude that—in real data—researchers can analyze their data with either model, since the conclusions about psychological processes are unlikely to depend on the model that is used. As further confirmation of the interchangeability of the two models, we also find that they have equivalent complexity.

• MOTOR CONTROL •

(5008)

Fitts's Law Depends on Where You Look. SIMONA BUETTI, *University of Geneva*, JOS J. ADAM, *Maastricht University*, & DIRK KERZEL, *University of Geneva* (sponsored by Jos J. Adam)—Fitts's law says that movement time (MT) increases with longer distances. We investigated the impact of the initial gaze fixation on Fitts's law. In one condition, participants initially looked at the hand on the home position. When the target appeared, a large saccade toward the target preceded the hand movement by 45 msec. In another condition, participants initially looked at a position in the center of the range of possible target positions. Before the reach was initiated, a small saccade toward the target was executed 148 msec before the hand moved. We observed that the increase of MT with increases in distance was stronger when participants looked initially at the hand than when their gaze was already in the target region. We suggest that the longer preview times reduced uncertainty about the endpoint of the reach and allowed for more ballistic movements. Analyses of movement velocity and acceleration support this view.

(5009)

Comparing Movements Toward Targets and Effects: Similar Mechanisms? ANDREA WALTER & MARTINA RIEGER, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Martina Rieger)—The goal of an action can consist of either generating a change in the environment (i.e., to produce an effect) or changing one's own situation in the environment (i.e., to move to a physical target). In Experiment 1, we investigated movements toward given temporal targets and self-produced temporal effects. Participants performed continuous reversal movements under several goal combination conditions. They either synchronized the endpoints of their movements with tones presented in a regular rhythm (temporal targets) or produced tones at the reversal points of their movements in a regular rhythm (temporal effects). The results indicated that movement kinematics have typical temporal characteristics in movements both toward targets and toward effects. In Experiment 2, spatial kinematics according to Fitts's law were observed for movements toward given spatial targets and self-produced spatial effects. Thus, mechanisms of action control seem to be similar for movements toward effects and movements toward targets.

(5010)

Dual-Task Interference Between Saccades and Vocal Responses. LYNN HUESTEGGE & IRING KOCH, *RWTH Aachen University*—The simultaneous execution of two responses is known to cause interference. This was also demonstrated for saccades and manual responses. However, it remained an open question whether corresponding interference is based on shared physical characteristics of responses in both tasks (i.e., when both responses involve left/right movements) or on shared abstract concepts (i.e., when both tasks involve the cognitive concepts of left/right). In the present study, participants responded to an imperative auditory stimulus by saying "left" versus "right" (vocal task), by executing a left versus right saccade (saccade task), or both. The results indicated that both vocal responses and saccades exhibited dual-task costs. We propose that abstract conceptual response codes, rather than physical overlap of response dimensions, are an important source of dual-task interference.

(5011)

Let the Force Be With Us: Force Amplification in Dyadic Coordination. ROBRECHT P. R. D. VAN DER WEL, GÜNTHER KNOBLICH, & NATALIE SEBANZ, *Radboud University Nijmegen* (sponsored by Günther Knoblich)—People often perform actions that involve a direct physical coupling with another person, such as when moving furniture together. Here, we examined how people successfully coordinate such actions with others. We tested the hypothesis that dyads amplify their forces to create haptic information in order to coordinate. Participants moved a pole (resembling a pendulum) back and forth between two targets at different amplitudes and frequencies by pulling on cords attached to the base of the pole, one on each side. Participants performed this task either bimanually or together with another participant (each controlling one cord). We also included two transfer conditions. We measured the moment-to-moment pulling forces on each cord and the pole kinematics to determine how well individuals and dyads performed. Dyads produced more overlapping forces than did individuals, especially for tasks with higher coordination requirements. The results suggest that dyads amplify their forces to generate a haptic information channel to coordinate.

(5012)

Response Speed in Cued Reaction Tasks: An Analysis of Repetition and Alternation Effects. GEOFFREY O'SHEA, NATALIE DIAMANTE, MELANIE CHRISTMAN, & DAN PAGAN, *SUNY Oneonta*—In speeded choice reaction tasks, repetition effects are generally observed when the response-to-stimulus interval (RSI), or the time elapsing between the response to one stimulus and the appearance of the next stimulus, is less than 500 msec. However, for RSIs greater than 500 msec, an alternation effect is observed in which responses are faster to a stimulus that is different from the previous stimulus. When cues were used to signal the forthcoming response at RSIs of 375 and 750 msec, alternation effects were observed under the shorter RSI, but repetition and alternation responses were equivalent under the longer RSI. Experiment 2, featuring no-go stimuli, showed that no-go trials impaired repetition and alternation responses at long and short RSIs. These results suggest that conscious decision processes may mediate the alternation effect at the shorter RSI and that preparatory processes are affected by no-go trials despite the availability of advance information.

(5013)

Compensation Strategies in Older Golfers. TAE HOON KIM, RICHARD J. JAGACINSKI, & STEVEN A. LAVENDER, *Ohio State University* (sponsored by Richard J. Jagacinski)—Twenty younger and 20 older golfers attempted 40- and 80-yard eight-iron shots. No age-related differences were found in the tempo or speed of the swing; however, there were differences in the rhythmic relationship between the clubhead force and the weight shift. Whereas younger golfers primarily exhibited a 3 versus 2 polyrhythmic pattern between the peak forces of the clubhead and weight shift, older golfers primarily exhibited a simpler 3 versus 3 rhythmic force pattern by adding a forward weight shift at the beginning of the shot. Additionally, older golfers exhibited less independence between the timing of the clubhead force and weight shift, which indicated greater use of a single integrated coordinative unit for the upper and lower body, rather than two units. These findings are interpreted as compensations for age-related physiological slowing and increased temporal variability that help older golfers to preserve tempo at a speed comparable to that of younger golfers.

• DISCOURSE PROCESSING III •

(5014)

Does the Accessibility of Referents Impact Implicit Causality in Sentence Production? RYUTA ISEKI & TAKASHI KUSUMI, *Kyoto University*—In some sentences (such as "Ken blamed John because he . . .") the pronoun is likely to be interpreted as referring to the object (John), whereas in others (such as "Ken apologized to John because he . . .") it is interpreted as referring to the subject (Ken). This preference by the type of verbs is called *implicit causality bias*. Recently, Fukumura and van Gompel (2010) found that the bias did not change the selection of anaphoric expressions in a completion task and suggested that the bias is independent of the increased accessibility of referents. We investigated the opposite direction of the relationship between implicit causality and accessibility. In the completion experiment, the accessibility of referents was manipulated by antecedent sentences that referred to either subject in the subsequent sentence or none. The antecedent sentences did not

affect the type of responses in four types of implicit causality verbs (i.e., agent–patient, agent–evocator, stimulus–experiencer, and experiencer–stimulus verbs).

(5015)

Exploration of Cognitive Difference Between Agreeing and Understanding. YASUHIRO OZURU, TRINITY R. PARKER, & DAVID BOWIE, *University of Alaska, Anchorage*—Terms such as "agree" and "understand" or "disagree" and "do not understand" appear to be used almost interchangeably in everyday conversation. This leads to the question: Do these two types of verbal responses differ, and if so, how do they differ? This study focuses on understanding the differences and relations between agree/disagree and understand/do-not-understand responses. In the experiment, we presented 126 simple one-sentence statements, including some nonsense statements, to participants, using a computer. Participants were asked to indicate which of the four (agree, disagree, understand, or do not understand) responses would be most appropriate for each statement. Reaction time was monitored. The results indicated that participants have a general tendency to select an agree/disagree response even when a statement is somewhat nonsensical, such as "Space needs time." In addition, reaction time was significantly faster for agree/disagree responses than for understand/do-not-understand responses.

(5016)

Are You Serious? Context Versus Intonation in the Perception of Sarcasm. JENNIFER L. WOODLAND & DANIEL VOYER, *University of New Brunswick* (sponsored by Daniel Voyer)—This experiment investigated the relative contribution of context and tone of voice in the perception of sarcasm in short utterances. Eighty-three participants heard short stories read in a neutral tone of voice reflecting either a positive or a negative context, followed by a relevant statement in a sarcastic or sincere tone of voice. Context and tone of voice were either congruent (e.g., positive context with sincere tone) or incongruent (e.g., positive context with sarcastic tone). Participants were asked to rate from 1 to 7 whether they perceived the statement as *very sincere* (1) or *very sarcastic* (7). The results indicated a significant context $\times$ tone interaction on both ratings and response time. Specifically, midrange ratings and longer reaction times were obtained when context and tone were incongruent, as compared with when they were congruent. The discussion emphasizes the interplay of context and tone of voice in the perception of a sarcastic statement.

(5017)

Sarcastic Prosody: A Cue to Bad Intentions? DAWN G. BLASKO, VICTORIA A. KAZMERSKI, & STEPHANIE CATTRON, *Pennsylvania State University, Erie*—People must often make rapid decisions about a person's intentions when a situation is ambiguous. Sarcasm creates a communicative challenge because the listener must infer intent when the speaker's words are the opposite of what they mean, and they likely use a number of different cues, including facial expression and tone of voice. In a cross-modal priming experiment, participants heard words spoken in sarcastic or sincere prosody while a face displaying one of five emotions was presented. The task was to judge the intention of the person in the picture. After a filler task, an incidental word recognition task was given. The results showed that judgments were influenced by the incidental exposure to sarcastic prosody, with those hearing sarcastic prosody more likely to judge the person as having bad intentions. Emotion interacted with gender of the face. Additional variables included participant gender and relational aggression.

(5018)

The Role of Semantic Plausibility in Pronoun Comprehension. RACHEL H. MESSER & SHELIA M. KENNISON, *Oklahoma State University* (sponsored by Shelia M. Kennison)—The present research investigated how plausibility information would influence the resolution of the pronouns "he" and "she." Pronouns occurred in sentences containing two clauses. In Experiment 1, the second clause contained the pronoun. The first clause contained a proper name (e.g., John or Jane), followed by material that was congruent or incongruent with the gender of the proper name (e.g., wore a tie vs. skirt). In Experiment 2,

the second clause contained a proper name (e.g., John or Jane), and the first clause contained the pronoun, followed by material that was congruent or incongruent with the gender of the pronoun (e.g., wore a tie vs. skirt). The results indicated that plausibility influenced reading time to a greater extent when the proper name and pronoun were different genders than when they were the same gender.

• LETTER/WORD PROCESSING V •

(5019)

Eye Movements During the Reading of Degraded Text. TIMOTHY J. SLATTERY, KEITH RAYNER, & BERNHARD ANGELE, *University of California, San Diego*—A number of activation-type models of word processing predict that degrading the text that a word is presented in will slow the processing of low-frequency words more than it will high-frequency words. Such an interaction between text clarity and word frequency was recently reported in a study of eye movements during reading by Slattery and Rayner (2010). However, this interaction was apparent only in relatively late measures of processing, rather than in the early measures generally assumed to reflect lexical access. We argued that the relatively late effect was due to the subtle clarity manipulation employed. The present study used a far stronger manipulation of text clarity (random replacement of black text pixels with white background pixels). The results yield evidence for an interaction in early eye movement measures consistent with the predictions of such activation accounts of lexical access.

(5020)

Semantic Size Does Not Matter: Bigger Words Are Not Recognized More Quickly. SEAN H. K. KANG, *University of California, San Diego*, & MELVIN J. YAP, *National University of Singapore*—Sereno, O'Donnell, and Sereno (2009, *QJEP*) reported that words referring to large objects (e.g., *bookcase*) are recognized more quickly than words referring to small objects (e.g., *teaspoon*) in a lexical decision task. Using the same word stimuli as Sereno et al., we failed to replicate their results both in a behavioral experiment (despite having about double the number of subjects) and when we examined lexical decision data for those items from the English Lexicon Project (ELP; Balota et al., 2007). Also, megastudy lexical decision performance for a large set of monosyllabic nouns (with high size agreement among subjects) was submitted to a multiple regression analysis. Although variables like word frequency, imageability, and orthographic neighborhood accounted for significant variance in response latency, size was clearly not a significant predictor. We conclude that size (of the referent) does not influence lexical decision.

(5021)

Dominance and Subordination: Age-of-Acquisition Estimates for Ambiguous Word Senses. MAYA M. KHANNA, *Creighton University*, MICHAEL J. CORTESE, *University of Nebraska, Omaha*, & BRENDAN MURPHY & KRISTIN DANIELS, *Creighton University*—We collected age-of-acquisition (AoA) estimates for 3,460 distinct meanings of ambiguous words (e.g., *duck*). This yielded AoA estimates for dominant and subordinate meanings of 1,208 sets of ambiguous words. The AoA estimates for the dominant and subordinate meanings were outcome variables in multiple regression analyses in which lexical variables such as frequency, consistency, imageability, length, and neighborhood size served as predictor variables. Furthermore, we compared the present AoA estimates with the subset of items shared with the Cortese and Khanna (2008) AoA estimates for monosyllables, in which the distinct sense of the ambiguous words was not indicated during the rating procedure. The AoA estimates for both dominant and subordinate senses accounted for unique variance in the monosyllable AoA estimates, indicating that both dominant and subordinate senses contribute to these word representations. These findings also have implications for how traditional AoA ratings have been interpreted and how future ratings will be measured.

(5022)

Processing Whole Words and Morphemes: Evidence From Visual Word Recognition. ELISABETH BEYERSMANN, MAX

COLTHEART, & ANNE CASTLES, *Macquarie Centre for Cognitive Science* (sponsored by Anne Castles)—The recognition of a word (*free*) is facilitated by the prior masked presentation of a prime consisting of its derived form (*freely*; Rastle, New, & Davis, 2004). This has been taken as evidence that lexical access requires morphological parsing of the input letter string and that words are represented in the lexicon in morphologically decomposed form. If this is the case, morphologically complex primes with letter transpositions within the stem morpheme (*ferely*) should facilitate responses to their corresponding real words (*freely*), whereas primes with across-morpheme boundary transpositions (*freley*) should not. We found significant priming in both conditions using lexical decision, suggesting a direct pathway for the access of morphologically complex words. In a second experiment, we replicated Rastle et al.'s findings, using our materials. Taken together, our findings suggest that both whole-word access and morphological decomposition take place in the initial stages of visual word recognition.

(5023)

The French Lexicon Project. LUDOVIC FERRAND, *CNRS and Blaise Pascal University*, BORIS NEW, *CNRS and Paris Descartes University*, MARC BRYSBAERT & EMMANUEL KEULEERS, *Ghent University*, PATRICK BONIN, *CNRS and University of Burgundy*, ALAIN MÉOT & MARIA AUGUSTINOVA, *CNRS and Blaise Pascal University*, & CHRISTOPHE PALLIER, *INSERM, U562, Cognitive Neuroimaging Unit*—The French Lexicon Project (FLP) involved the collection of lexical decision data for 38,840 French words and the same number of pseudowords. It was directly inspired by the English Lexicon Project (Balota et al., 2007). Three variables were tested: word frequency, word length, and orthographic neighborhood. For word frequency, subtitle-based frequency estimates outperformed book-based frequency estimates; and for word length, we found a quadratic effect, with the shortest lexical decision times for words of six to eight letters when word frequency was taken into account. However, if orthographic similarity (operationalized as OLD20) was added, the word length effect on the RTs largely disappeared (although it remained robust for the accuracy data). The FLP data are freely available (http://sites.google.com/site/frenchlexiconproject/) for researchers who want to run other analyses, either to compare the French language with the English language or to address French-specific characteristics.

(5024)

The Role of Phonology in Visual Word Recognition: Evidence From Chinese. MAN-TAK LEUNG, DUSTIN K. Y. LAU, BRENDAN S. WEEKES, & JASMINE K. M. IP, *University of Hong Kong* (sponsored by Brendan S. Weekes)—The hypothesis of bidirectional coupling of orthography and phonology predicts that phonology plays a role in visual word recognition, as observed in the effects of feedforward and feedback spelling to sound consistency on lexical decision. However, because orthography and phonology are closely related in alphabetic languages (homophones in alphabetic languages are usually orthographically similar), it is difficult to exclude an influence of orthography on phonological effects in visual word recognition. Chinese languages contain many written homophones that are orthographically dissimilar, allowing a test of the claim that phonological effects can be independent of orthographic similarity. We report a study of visual word recognition in Chinese based on a mega-analysis of lexical decision performance with 500 characters. The results from multiple regression analyses, after controlling for orthographic frequency, stroke number, and radical frequency, showed main effects of feedforward and feedback consistency, as well as interactions between these variables and phonological frequency and number of homophones. Implications of these results for resonance models of visual word recognition are discussed.

(5025)

Does Position Matter? Differences in the Visual Identification of Stems and Affixes. DAVIDE CREPALDI, *University of Milano-Bicocca*, & KATHLEEN RASTLE & COLIN J. DAVIS, *Royal Holloway, University of London* (sponsored by Kathleen Rastle)—Crepaldi, Rastle, and Davis (2010) have demonstrated that morpheme interference effects do not emerge in morphologically structured pseudowords where a suffix precedes a stem (e.g., *mentshoot* is as difficult to reject as *mantshoot*), showing that suffix identification is sensitive to positional constraints. In this study, we investigate the same issue in the other types of English morphemes—that is, stems and prefixes. In two lexical decision experiments, we show that (1) the rejection time of reversed compounds (e.g., *moonhoney*) is longer than that of matched control nonwords (e.g., *moonbasin*) and (2) the rejection time of pseudo-prefixed nonwords (e.g., *predrink*) is longer than that of matched control nonwords (e.g., *pledrink*) but that the effect disappears when the prefix follows the stem (e.g., *drinkpre* took as long as *drinkple* to be rejected). These data extend Crepaldi et al.'s findings and show that stem identification is position independent, whereas affix identification is position specific.

• PSYCHOLINGUISTICS V •

(5026)

When Proficient Statistical Learning Goes Against Efficient Language Processing. JENNIFER B. MISYAK & MORTEN H. CHRISTIANSEN, *Cornell University* (sponsored by Morten H. Christiansen)—Statistical learning is widely assumed to play a key role in language, although few empirical studies aim to directly link variation in statistical learning with differences in language. In our study, we examined how individuals' statistical learning of adjacent dependencies relates to their online processing of natural language. The first experiment documented the group trajectory of adjacency learning for 30 adult participants and established a corresponding individual-differences index for statistical learning. Using this index, the second experiment probed for within-subjects associations between statistical adjacency learning and online sentence processing in two comparative contexts (involving embedded relative clauses and subject–verb agreement). Findings suggest that more proficient adjacency learners appear to focus too much on computing local statistics, at the cost of less efficiently processing nonlocal dependencies in language. Thus, counter to standard assumptions in the statistical-learning literature, greater sensitivity to statistical structure does not necessarily lead to better language performance.

(5027)

Elliptical Expressions in Chinese: Fuzzy Syntax in Discourse Processing. LIANG TAO, *Ohio University*—This study extends the linguistic theory of fuzzy grammar by testing the role of syntax in Mandarin Chinese discourse that allows abundant elliptical sentences containing missing nominal referents. Three experiments tested 40 native Chinese speakers on their processes of elliptical expressions. Experiments 1 and 2 tested recoverability of missing referents in isolated expressions and in discourse texts, respectively. Experiment 3 tested recoverability of the syntactic structures of elliptical expressions. The findings indicated that participants could recover missing referents only where discourse context offered clues. But they were unable to determine the exact syntactic structures of the elliptical expressions. A context-dependent principle of emergent reference is proposed to account for discourse processes with abundant elliptical sentences in Chinese. Without overt presentation of full sentences, syntax becomes fuzzy, yet conceptual information is not compromised; therefore, elliptical expressions with multiple occurrences of missing referents are processed without the constraint of specific syntactic structures.

(5028)

Investigating the Effects of Relative Semantic Richness on Eye Fixations During Reading. IAN S. HARGREAVES, CHRISTOPHER R. SEARS, & PENNY M. PEXMAN, *University of Calgary* (sponsored by Penny M. Pexman)—A number of different models of lexical-semantic representation have been proposed, and these models have often been based on disparate assumptions. Pexman, Hargreaves, Siakaluk, Bodner, and Pope (2008) found that descriptions of relative semantic richness (number of features, number of semantic neighbors, and contextual dispersion) did not account for the same variance in responses across lexical decision and semantic categorization tasks. This

suggests that semantic richness has many dimensions, the contributions of which vary depending on the demands of the task. We predicted that these same descriptions may also contribute differentially across the time course of word recognition during reading. Following Juhasz and Rayner (2003), we investigated the effects of intercorrelated lexical (e.g., word length) and semantic (e.g., semantic richness) variables on eye fixation durations during the naturalistic reading of sentences. Our results help to delineate the relative availability of semantic information across time.

(5029)

The Auditory Picture Superiority Effect and Dual-Coding Theory. ROBERT J. CRUTCHER & FITORE MUSMURATI, *University of Dayton*—Previous research has shown that environmental sounds are recalled better than spoken verbal labels for sounds (e.g., the sound of coughing vs. the word "coughing"). This auditory picture superiority effect (Crutcher & Beer, 2006), like the picture superiority effect (Paivio & Csapo, 1973), can be explained by dual-coding theory (Paivio, 2007): Pictures (or sounds) are recalled better than their corresponding verbal labels because, at encoding, they are more likely to activate multiple representational codes that can aid retrieval. A follow-up experiment strengthened this interpretation by showing that imagining the corresponding sounds for the words produces equivalent recall of sounds and words (Crutcher & Beer, 2006). In the experiment reported here, the dual-coding account was further strengthened by showing that instructing participants to verbally label the stimuli increased the recall advantage of sounds over words, as compared with a free strategy control group instructed to do whatever they could to remember the items.

(5030)

Does Japanese Draw a Grammatical Count/Mass Distinction? An ERP Study. JUNKO KANERO & MUTSUMI IMAI, *Keio University*, & HIROYUKI OKADA, *Tamagawa University* (sponsored by Mutsumi Imai)—In Japanese, nouns are grammatically classified by classifiers, which are organized around semantic features such as animacy, shape, size, and functionality. Languages with classifiers are generally thought to lack the count/mass distinction. However, some linguists have proposed that speakers of those languages syntactically differentiate count/mass nouns by classifiers (Chen & Sybesma, 1999; Mizuguchi, 2004). By means of ERP recording, the present study investigates whether the count/mass classifiers are processed syntactically or semantically. ERPs were recorded during a noun–classifier matching task, and the stimuli included violations within count/mass categories (e.g., count noun with a mismatched count classifier) and across count/mass categories (e.g., count noun with a mismatched mass classifier). All mismatched stimuli evoked a broadly distributed N400, and across-category violation did not show any distinctive signature indicating syntactic processing. The results suggest that classifiers are primarily processed on semantic bases and that classifiers do not draw the count/mass distinction.

• LANGUAGE PRODUCTION/WRITING II •

(5031)

Shared Mappings Between Concepts and Functional Assignment Across Languages Facilitates L2 Production. SUNFA KIM, GAIL MAUNER, & JEAN-PIERRE KOENIG, *University at Buffalo* (sponsored by Gail Mauner)—We hypothesized that bilinguals use second language (L2) syntactic alternations most easily when their first languages (L1s) and L2s share mappings between conceptual representations and grammatical function assignment, despite differences in basic word order. We tested this by examining L2 English structural priming for transitive and dative alternations in three bilingual groups, on the assumption that L2 structural priming would occur for syntactic alternations that share such mappings. Whereas Japanese, Korean, and Mandarin have transitive alternations, only Mandarin has a dative alternation. Japanese and Korean do not have a double-object construction. As predicted by our hypothesis, we observed priming for the transitive alternation in Japanese and Korean L2 English speakers but no priming

for the dative alternation. In contrast, we observed priming for the dative alternation for Mandarin L2 English speakers. These results highlight the importance of shared mappings between conceptual representations and function assignment in models of L2 sentence production.

(5032)

Implicit Learning of Tip-of-the-Tongue States: Assessing a Hebbian Learning Account. MARIA C. D'ANGELO, PETER A. JANSEN, & KARIN R. HUMPHREYS, *McMaster University*—According to a two-stage model of language production, tip-of-the-tongue (TOT) states occur when a word's lemma has been successfully activated by conceptual representations but the word's phonological features are only partially activated. Recent work has demonstrated that the longer an individual stays in a TOT state for a given word, the more likely he or she is to reexperience a TOT for that word 48 h later. This finding occurs despite the fact that participants are shown the target word during the initial test phase. We present empirical results indicating that implicit learning of TOT states can occur rapidly and can persist even 1 week later. This learning effect has been argued to occur through a Hebbian learning-like mechanism, and we develop a computational neural network model to test this hypothesis. The empirical results converge with simulations from the computational model, providing support for a Hebbian learning account of repeated TOT experiences.

(5033)

Ease of Processing Constrains the Activation Flow in the Conceptual–Lexical System During Speech Planning. ANDREAS MÄDEBACH, JÖRG D. JESCHENIAK, & FRANK OPPERMANN, *University of Leipzig*, & HERBERT SCHRIEFERS, *Radboud University Nijmegen* (sponsored by Jörg D. Jescheniak)—In a series of picture–word interference experiments, speakers named a target object in the presence of an unrelated, not-to-be-named context object. Phonological processing of context objects was assessed by contrasting the effects of distractor words phonologically related and unrelated to the context object's name. All objects had high-frequency names. Ease of processing of these objects was manipulated by visual degradation. Our results show that context objects were substantially phonologically coactivated when the target and context object were easy to process (i.e., when presented nondegraded), but not if the processing demands of both objects, only the context object, or only the target object were enhanced (i.e., when presented degraded). These data demonstrate that the amount of available processing resources constrains the forward cascading of activation in the conceptual–lexical system. Context objects are likely to become phonologically coactivated if they are easily retrieved and if prioritized target processing leaves sufficient resources.

(5034)

Phonological Activation of Object Names in a Visual Search Task. FRAUKE GÖRGES, FRANK OPPERMANN, & JÖRG D. JESCHENIAK, *University of Leipzig*, HERBERT SCHRIEFERS, *Radboud University Nijmegen*, & MATTHIAS M. MÜLLER, *University of Leipzig* (sponsored by Herbert Schriefers)—Meyer et al. (2007) showed that the presence of an object semantically related to a target object, as well as a conceptually unrelated object with the same name as the target object, leads to interference in a visual search task, indicating conceptual and lexical influences on the search process. The present study aimed at further exploring the nature of the lexical influence, using a partial phonological overlap between target and competitor name, rather than homophones, whose special properties could have contributed to the effect. Both semantic and phonological relations led to interference, demonstrating that the lexical effect found by Meyer et al. was not simply due to their use of homophones. Interestingly, the phonological effect was observed only when participants were familiarized with the names of the objects prior to the experiment, implying that lexical activation in a visual search task may depend on particular features of the experimental procedure.

(5035)

The Time Course of Learning Phonotactic Constraints From Production Experience. JILL A. WARKER, *University of California, San*

Diego (sponsored by Victor S. Ferreira)—Adults are able to learn phonotactic constraints, or constraints that determine which sounds may be combined together in a particular language, from recent experience in speaking or hearing those constraints. In production, this learning is reflected in speech errors. However, constraints in which consonant placement depends on the identity of an adjacent vowel (e.g., /s/ is a syllable onset if the vowel is /æ/ but a syllable coda if the vowel is /ɪ/) take until the second day of testing to appear in speech errors. Three experiments used speech errors as a measure of learning to investigate the time course of learning these artificial phonotactic constraints from production experiences, specifically asking whether more practice or a consolidation period is needed for learning. Taken together, the results suggest that consolidation in the form of both sleep and time away from the task provides a benefit to learning.

(5036)

Argument Order in Pantomime: Consistency Fails When It Is Needed Most. MATTHEW L. HALL, RACHEL I. MAYBERRY, & VICTOR S. FERREIRA, *University of California, San Diego*—When asked to produce pantomimed descriptions of transitive events (e.g., a girl pushing a box), people of diverse linguistic and cultural backgrounds will consistently produce GIRL BOX PUSH (Goldin-Meadow et al., 2008). Does this actor–patient–action (ArPA) order extend to potentially reversible events, such as a girl pushing a boy? In three experiments, we show that although native English speakers prefer ArPA for nonreversible events, they reliably avoid ArPA for reversible events. Experiment 1 demonstrates that people abruptly and consistently switch order for reversible events even after pantomiming dozens of nonreversible events. Experiment 2 shows that this cannot be due to participants' concerns that their gestures denoting humans were overly similar. Experiment 3 demonstrates that when reversible and nonreversible events are intermixed, participants still avoid ArPA for reversibles but begin to abandon ArPA for nonreversibles. Thus, the natural order of some events is different from that of others.

• BILINGUALISM III •

(5037)

Acquiring Foreign Vocabulary Through Linguistic Context: Where Is the Limit to Vocabulary Learning? RICHARD JACKSON HARRIS, *Kansas State University*, & BERNARDO DE LA GARZA, *University of Texas, Brownsville* (sponsored by Richard Jackson Harris)—Studies examined the effects of varying numbers of unfamiliar words within written discourse on the ability to use linguistic context information in comprehension. Krashen's input hypothesis was tested to examine the point at which the amount of noncomprehensible input begins to break down the ability to use linguistic context for translation and comprehension. A brief story varied the number of foreign (actually, pseudo-Finnish) content words in each sentence. The results indicated that, as the number of foreign words increased, the ability to accurately translate foreign words and create situational models for comprehension began to deteriorate when noncomprehensible input reached 18% of the total content words. This result suggests that there is an optimal level of effectiveness in the use of a linguistic context strategy for learning novel vocabulary from prose and that the strategy's effectiveness begins to decline when the noncomprehensible input exceeds 18% of the content words.

(5038)

The Roles of Priming and Translation Dominance in Resolving Translation Ambiguity. CHELSEA M. EDDINGTON & NATASHA TOKOWICZ, *University of Pittsburgh* (sponsored by Natasha Tokowicz)— Many words have more than one translation across languages. Such "translation-ambiguous" words are generally translated more slowly and less accurately than their unambiguous counterparts. The present study examines the extent to which word context and translation dominance reduce the difficulties associated with translation ambiguity, using a primed translation recognition task. Participants were presented with English–German word pairs that were preceded by a related or unrelated prime and decided whether the word pairs were translation equivalents. The speed and accuracy with which pairs were recognized as translations

were examined with respect to prime relatedness and the dominance of the translation. The results suggest that both factors influence translation recognition and, furthermore, that translation-unambiguous pairs are recognized more quickly and accurately than translation-ambiguous pairs.

(5039)

Semantic Priming in Different-Script Bilinguals: Do Different Scripts Modulate Activation of the Nontarget Language? NORIKO HOSHINO, *Bangor University*, CLARA D. MARTIN, *Universitat Pompeu Fabra*, & GUILLAUME THIERRY, *Bangor University*—Past research suggests that both languages are active regardless of a bilingual's intention to use one language only. A recent ERP study demonstrated that same-script bilinguals showed semantic priming in an unattended language, as well as in an attended language (Martin et al., 2009). In the present study, we examined the extent to which different scripts could modulate semantic activation in the unattended nontarget language. A series of intermixed English and Japanese words was presented, and half of the words taken in pairs were semantically related, whereas the other half were unrelated. Japanese–English bilinguals decided whether the number of letters of each English word was more than five or not, while ignoring Japanese words. A preliminary result indicated that unlike the same-script bilinguals in the previous study, Japanese–English bilinguals showed semantic priming only in the attended language, English, suggesting that different scripts can serve as a language cue.

(5040)

Effects of Early-Stage L2 Learning on Nonverbal Executive Control. MARGOT SULLIVAN, SYLVAIN MORENO, & ELLEN BIALYSTOK, *York University* (sponsored by Ellen Bialystok)—In previous research, brief periods of instruction in a second language (L2) led to brain functional modifications in ERP. Changes in N400, indicating discrimination between L2 words and pseudowords, were evident after only 14 h of L2 instruction (McLaughlin et al., 2004), and changes in P600, indicating detection of syntactic violations, were found after 18 months (Osterhout et al., 2008). Bilingualism also leads to changes in nonverbal processing, particularly for tasks requiring inhibition of conflict. Our question was whether these changes could be detected in early stages of L2 learning. We measured ERPs for a go/no-go task in 25 university students before and after 6 months of Spanish training. The results showed reduced amplitudes for N2 and P3 components on no-go trials and better behavioral performance after L2 instruction, showing better conflict resolution. These results demonstrate transfer of skills in a nonverbal control system after brief training in an L2.

(5041)

Age-Related Decline in Episodic Long-Term Memory Is Attenuated by Bilingualism. SCOTT R. SCHROEDER & VIORICA MARIAN, *Northwestern University* (sponsored by Viorica Marian)—Older adults perform more poorly than young and middle-age adults on episodic long-term memory tasks when they are not provided with environmental support (i.e., cues). In the present study, we considered whether bilingualism has an effect on this normal age-related decline in episodic long-term recall. Monolingual and bilingual older adults (who were free of dementia and were matched on IQ and education) performed a surprise, delayed, free-recall task for memory of pictures of previously viewed scenes. Bilinguals performed better than their monolingual peers, recalling significantly more items. Moreover, within the bilingual group, earlier acquisition of a second language (and thus, a greater proportion of one's life speaking two languages) was associated with better recall. These results suggest that extensive practice controlling two language systems can mitigate normal age-related decline in episodic long-term recall.

(5042)

Bilinguals With Better Executive Control Think in a More Language-Specific Way. SHIRI LEV-ARI & BOAZ KEYSAR, *University of Chicago* (sponsored by Boaz Keysar)—Whenever bilinguals use one language, they have to suppress their other languages (Bialystok & Craik, 2009), but the suppression is never full (Marian & Spivey, 2003). We propose that bilinguals' executive control influences their ability to

think in a language-specific manner. Subjects judged the similarity of unlabeled pictures of objects that potentially shared a label in either Hebrew or English, but not both (*house key*, *keyboard key*). They performed the task twice: in a Hebrew and in an English session. Bilinguals judged the pictures as more similar when the unstated label matched the session language, and the difference between their ratings in the two sessions was larger the higher their working memory (WM) was. We conclude that with higher WM, bilinguals' perception of the world becomes more language specific. This has implications for the role of WM in language interference, language representation, and the relation between language and thought among bilinguals.

• CONCEPTS AND CATEGORIES III •

(5043)

Schematic Representations in the Dorsal Stream. KEVIN J. HOLMES & PHILLIP WOLFF, *Emory University* (sponsored by Phillip Wolff)—Schematic language (e.g., verbs, prepositions) and depictions (e.g., line drawings) reduce the rich detail of the visual world to a coarser level of description. Recent neural evidence suggests that representations associated with these schematic forms may be computed in the dorsal pathway of the visual system, the same pathway as that used in the processing of real and implied motion. In a series of experiments, we found that implied motion was perceived more often in response to scenes that were highly schematic (e.g., line drawings) than to scenes that were highly realistic (e.g., photographs) and to realistic scenes that were described or drawn schematically, rather than realistically. Problem-solving strategies were also found to be affected by the realism of the scenes. The results point to a mode of representation in the dorsal stream that captures information at a relatively abstract level, with language acting as a potential vehicle for its formation.

(5044)

The Effect of Verbal Description on Competition Between Categorization Systems. SARAH J. MILES & JOHN PAUL MINDA, *University of Western Ontario* (sponsored by John Paul Minda)—Categorization research has focused on the cognitive processes used during categorization, providing evidence for verbal and nonverbal learning systems. One theory of category learning (Ashby et al., 1998; Minda & Miles, 2010) states that the verbal and nonverbal systems compete with each other to provide a categorization response. Early in learning, the verbal system is strongest, but the nonverbal system can outperform the verbal system and gain control as learning progresses. We investigated the interaction between the systems by having participants describe stimuli before learning to categorize them using either the verbal or the nonverbal system. Describing the stimuli improved performance by the nonverbal system early in learning, because it sped the transition between systems. In a second study, participants described their categorization strategy throughout category learning. This decreased the nonverbal system's performance, because frequent verbalization of the categorization strategy prevented the attenuation of the nonverbal system, despite its suboptimal performance.

(5045)

Progressive Alignment Does Not Aid Learning Probabilistic Relational Categories. WOOKYOUNG JUNG & JOHN E. HUMMEL, *University of Illinois, Urbana-Champaign* (sponsored by John E. Hummel)—Kotovsky and Gentner (1996) showed that presenting progressively aligned examples helped children discover relational similarities: Comparisons based on initially concrete and highly similar but progressively more abstract exemplars helped the discovery of relational structures. We examined whether progressive alignment can aid learning of relational categories with either a deterministic structure (in which one relation reliably predicts category membership) or a probabilistic structure (in which each relation predicts category membership with 75% reliability). Under the deterministic structure, progressive alignment helped subjects learn relational categories. However, progressive alignment did not help subjects learn the probabilistic relational categories. The results show that learning relational categories with a deterministic structure can be improved by progressive alignment, consistent

with Gentner's findings, but support our previous finding that relational categories are represented as schemas, which are learned by a process of intersection discovery that fails catastrophically with probabilistic category structures (Jung & Hummel, 2009).

(5046)

Category-Based Induction in Action and Thought. STEPHANIE Y. CHEN, *New York University*, BRIAN H. ROSS, *University of Illinois, Urbana-Champaign*, & GREGORY L. MURPHY, *New York University* (sponsored by Gregory L. Murphy)—In category-based induction, people predict an object's properties on the basis of its category membership. When an object can be in multiple categories, normative Bayesian principles suggest that information about all those categories should be used. Research shows that many people focus on only a single category. The present research transformed the induction task into a formally identical action task. Exemplars consisted of shapes that moved in different directions. Subjects learned to categorize the shapes into four categories and then made inductions by predicting the direction of exemplars' movement. In one condition, this was done through a game-like catching task. We found that people did use information about multiple categories, especially under time pressure. A control condition used the same learning procedure but an explicit, verbal induction. This research begins an investigation into how category information is used when formally equivalent tasks are responded to by explicit reasoning versus speeded action.

(5047)

Classification and Inference Are Inherently Different. ERIN L. JONES & BRIAN H. ROSS, *University of Illinois, Urbana-Champaign* (sponsored by Brian H. Ross)—Prior research has contrasted classification and inference, using a variety of stimuli and tests; however, the observed differences in performance on these tasks can be attributed to either methodological differences or an inherent difference between the tasks. The inherent-difference explanation argues that the goals of the task lead classification and inference learners to use different strategies during learning. Inference learners tend to focus on what each category is like, whereas classification learners focus on what best predicts category membership. These differences during learning lead to performance differences on later category-related tests. In two experiments, using real-world categories and controlling for methodological differences, inference learners were better able to classify new category members than were classification learners. These results suggest that there is an inherent difference between classifying an item and inferring a feature that cannot be explained by methodological differences between the tasks.

(5048)

Exemplar Similarity and Rules in Categorization and Induction With Textual Stimuli. CHRISTOPHER PAPADOPOULOS & BRETT K. HAYES, *University of New South Wales* (sponsored by Brett K. Hayes)—Two studies examined the use of rules and exemplar similarity in categorization and feature prediction with textual stimuli. Categories composed of text vignettes describing applicants for membership in a fictitious club were presented. Participants learned to discriminate between successful and unsuccessful applicants. Some were given the category rule, whereas others were told to pay attention to exemplar features. At test, novel instances that varied in the degree to which they followed the rule and in their resemblance to old instances on rule-irrelevant dimensions were presented for either categorization (successful vs. unsuccessful applicant) or induction (predict a missing rule-relevant feature). An effect of exemplar similarity was found for categorization, but only when participants had to abstract the rule and when rule-irrelevant features were highly salient. Some evidence suggesting that induction was also affected by exemplar similarity was found. The implications for models of categorization and induction are discussed.

(5049)

Discontinuous Information Integration Category Structures Lead to Better Retention and Generalization. DARRELL A. WORTHY & W. TODD MADDOX, *University of Texas, Austin*, & J. VINCENT FILOTEO, *University of California, San Diego* (sponsored by W. Todd

Maddox)—Neurobiological theories of information integration category learning propose that striatal units are responsible for associating areas of the visual field with motor output processes. We hypothesize that discontinuous category structures (categories composed of distinct subclusters) lead to more striatal units being recruited to represent each category. This should lead to attenuating initial learning but should accentuate long-term retention and generalization, as compared with continuous categories. Participants trained with either discontinuous or continuous information integration category structures and then completed a transfer block either 1 day or 1 week later. Initial learning was better for participants learning continuous categories. Following a 1-day interval, transfer accuracy was still higher for continuous categories. However, following a 1-week interval, transfer accuracy dropped substantially for continuous categories but remained remarkably stable for discontinuous categories. These results suggest that training with discontinuous categories leads to better long-term retention and generalization.

• Reasoning and Problem Solving II •

(5050)

Capturing and Analyzing "Understanding" in Problem Solving With the Expert Performance Approach. JONG SUNG YOON & K. ANDERS ERICSSON, *Florida State University*—Research on problem solving is typically based on the average performance of groups, where each participant solves only a couple of problems, making it difficult to capture individual differences in understanding and the structure of detailed learning processes. To address this problem, the expert performance approach was applied to measure the learners' progress of understanding in the 8-puzzle by administering a collection of representative tasks—involving the selection of the best moves for several different configurations in the 8-puzzle. Sixty participants solved a series of 8-puzzles, followed by another series of 8-puzzles, with half of them getting strategy instruction at the midpoint. Improvements in 8-puzzle performance were related to initial performance on the 8-puzzle, general cognitive abilities, such as intelligence (Raven), strategy instruction, representative task performance, and several other measures of understanding. The cognitive mechanisms mediating the progress of understanding are discussed, along with the benefits of the use of representative tasks

(5051)

Constructing Representations: The Effects of Diagrams on Algebraic Solution Accuracy. KEVIN D. DIETZ & SUSAN R. GOLDMAN, *University of Illinois, Chicago* (sponsored by Susan R. Goldman)—This study examined the effects of constructing different types of diagrammatic representations on the solution accuracy of algebraic word problems. It was hypothesized that participants given task instructions to create graphical or tabular representations would show higher solution accuracy than would participants given either no task instructions or task instructions to create nonspecific representations. Participants solved rate and ratio problems. Effects of diagrammatic representation varied with problem type, but in ways contrary to the hypothesis, in that participants in the graph condition performed less accurately than the other groups on rate problems. Additionally, there were no effects of table construction. Analyses of the constructed representations showed that symbolic representations were more frequently constructed than diagrammatic ones, despite the task instructions. We speculate that participants approached the problems with procedural solution strategies that did not require the conceptual unpacking that is required to construct diagrammatic representations.

(5052)

Eye Movements Reveal Solution Knowledge Prior to Insight. JESSICA J. ELLIS, MACKENZIE G. GLAHOLT, & EYAL M. REINGOLD, *University of Toronto, Mississauga*—Participants solved anagram problems while their eye movements were monitored. Each problem was composed of a circular array of five letters: a scrambled four-letter solution word containing three consonants and one vowel and an additional randomly placed distractor consonant. We reasoned that viewing times on the distractor consonant, as compared with the solution consonants, would provide an online measure of knowledge of the solution. We

found that viewing times on the distractor consonant and the solution consonants were indistinguishable early in the trial. In contrast, several seconds prior to the response, viewing times on the distractor consonant decreased in a gradual manner, as compared with viewing times on the solution consonants. These findings provide evidence of partial knowledge of the solution to anagram problems prior to response. Implications for the study of insight problem solving are discussed.

(5053)

Evaluating the Probability of Indicative Conditionals As They Are Read. ANDREW J. STEWART, MATTHEW HAIGH, & LOUISE CONNELL, *University of Manchester*—Conditionals of the form *if p then q* (e.g., "if student tuition fees rise, then applications for university places will fall") describe uncertain scenarios, about which people have differing degrees of belief. The results from offline reasoning tasks show that some participants equate this belief with the subjective probability of the conjunction $P(pq)$, whereas others base it on the subjective conditional probability $P(q|p)$. We present three reading time experiments examining how and when probabilistic information informs the online processing of conditionals. Specifically, we manipulated each of $P(p)$, $P(q)$, and $P(q|p)$ to be either high or low and took a number of reading time measures. The results showed that readers are simultaneously sensitive to $P(p)$ and $P(q|p)$ when reading the consequent analysis region. Our data suggest that online processing is initially guided by a conjunctive representation of p and q.

(5054)

Negative Transfer in Matchstick Arithmetic Insight Problems. TRINA C. KERSHAW, *University of Massachusetts, Dartmouth*, JASON L. G. BRAASCH, *University of Poitiers*, & CHRISTOPHER K. FLYNN, *University of Massachusetts, Dartmouth*—The present experiment examined whether a successful solution on one type of problem, indicating the relaxation of a constraint, would have a negative impact on subsequent problems that did not involve the same constraints. One hundred forty-five participants solved a series of matchstick arithmetic problems. In one group, participants were given three relatively simple "chunk decomposition" (CD) problems. A second group solved one "operator decomposition" (OD) problem, involving more constraints, between the baseline CD problem and two later problems. The third group solved three OD problems, similarly placed. The results indicated that successful solution of an OD problem produced negative transfer to subsequent CD problems in the form of longer solution times. Participants who did not successfully solve OD problems did not slow down on subsequent problems; they displayed evidence of positive transfer. The findings were interpreted with reference to theories of constraint relaxation and its relationship to problem-solving performance.

(5055)

Structured and Unstructured Knowledge Underlie Category-Based Inductive Reasoning. AIMEE K. BRIGHT, *Durham University*, & AIDAN FEENEY, *Queen's University Belfast*—Accounts of category-based induction can be distinguished by whether they assume structured or unstructured knowledge. Unstructured knowledge is associative, whereas good examples of structured knowledge are knowledge about taxonomic and causal relations. In two experiments, using speeded task (Experiment 1) and secondary task (Experiment 2) paradigms, we asked participants to rate the strength of inductive arguments in which the categories were taxonomically or causally related. For arguments whose categories had a causal relationship, we manipulated causal order. A measure of strength of association was highly predictive of inductive strength ratings. However, more additional variance was accounted for by taxonomic and causal beliefs—and we observed effects of causal order—only when people were not under time pressure or were under low load. No existing theory of induction can capture these findings, which suggest that both structured and unstructured knowledge are important in inductive reasoning.

(5056)

Number Comparison Performance in Elementary School Students. ALEX M. MOORE & MARK H. ASHCRAFT, *University of Nevada,*

Las Vegas (sponsored by Mark H. Ashcraft)—We report additional results from the initial phase of a longitudinal study on children's mathematical development. We administered a battery of math tasks and questionnaires to 122 children in Grades 1–5 and to 20 college adults. In this presentation, we focus on children's performance on a number comparison task ("which is larger, 7 or 9?"). The symbolic distance effect (faster RTs as the numbers become more different) interacted with grade, as did the congruency effect (faster judgments of "which is larger" for larger digits). As we've found with performance on number line estimates, children's performance on number comparisons correlated significantly with their performance on standardized math tests. Number comparison RTs also correlated significantly ($-.39$) with working memory capacity. Even classic information-processing tasks, like number comparison, show important developmental trends that relate to important educational achievements.

• HUMAN LEARNING V •

(5057)

Go Big or Go Home: Effects of Animation on Recall and Recognition. KIM A. PURDY & SUSAN E. RUPPEL, *University of South Carolina Upstate*—Studies examining the effects of animation in Web site advertisements have reported conflicting results. Some have concluded that fast animation improves recall (Sundar & Kalyanaraman, 2004; Yee-Lin, Kuan, Lai-Lung, & Nu, 2009), whereas others have documented an impairment (Chung, 2006; Hong, Thong, & Tam, 2004). The present study examined this issue by varying the degree and amount of exposure to the animation. Fifteen word lists were presented. The first three and last three lists contained no animation (control). The remaining lists presented three levels of animation (basic, moderate, exciting). Recall and recognition tasks were performed. Analysis of the recall data showed that animation initially had a negative effect, with basic animation producing the poorest recall. However, by the third exposure, there was no significant difference between the conditions. Such results were not paralleled in the recognition data. Implications of the findings are discussed.

(5058)

Testing Levels the Playing Field for Students With Lower Working Memory Capacity. POOJA K. AGARWAL, *Washington University*, NATHAN S. ROSE, *Rotman Research Institute*, & HENRY L. ROEDIGER III, *Washington University* (sponsored by David G. Elmes)—Subjects learned educationally relevant material in a typical cued-recall paradigm. Subjects studied the material, which was followed by study or test (with feedback) trials at various lags. Subjects completed a final cued-recall test after 10 min or after 2 days. Final recall was better for study–test items than for study–study items at both retention intervals (RIs). This testing effect was not significant for lag 0 but was significant for longer lags at both RIs. There were large individual differences during initial learning (predicted by working memory span), and initial learning was a strong predictor of performance on the final recall test. For final recall, high spans recalled more of the study–study items, but testing during learning eliminated this difference between low and high spans. These results suggest that testing at spaced lags provides optimal learning conditions and, doing so, levels the playing field for students with lower working memory capacity.

(5059)

The Effects of Loss Aversion on Learning. NICOLE J. BIESHERNANDEZ & DAVID E. COPELAND, *University of Nevada, Las Vegas*—Three experiments examined whether the concept of loss aversion can be extended to learning and preferences about learning in the context of education. In Experiment 1, participants rated syllabi to investigate preferences for a loss versus gain grading system. The results showed a clear effect of loss aversion; participants had more negative impressions of the loss grading system. Experiments 2 and 3 investigated whether the preference for a gain grading system would affect learning in the laboratory and classroom, respectively. The results indicated that framing the grading system in terms of losses negatively influenced learning, but only in a natural learning setting (i.e., the classroom). This study has potential implications for decision-making theories in cognitive psychology, as well as for educational practices.

(5060)

Extending the Spacing Effect Beyond Fact Learning in a Mock Classroom Setting. IRINA V. KAPLER, TINA WESTON, & NICHOLAS J. CEPEDA, *York University*—Despite the popularity of cramming for exams, laboratory research suggests that students actually perform better if they distribute their study episodes across time. This is known as the *spacing effect*. Currently, there are few studies addressing the spacing effect in a real classroom or showing spacing benefits beyond the learning of factual information. The present study explored whether spacing can be successfully implemented in a mock classroom and whether distribution of study episodes can help learning of applied material. We taught undergraduate students about a topic unrelated to their studies in two conditions: spaced by 1 day or spaced by 1 week. Retention was tested 5 weeks later. Students answered applied and factual questions. The results suggest that a longer gap between study episodes improved student performance. The implications of the spacing manipulation and the importance of closing the gap between research and practice are discussed.

(5061)

What Is the Influence of Providing Feedback During Retrieval Practice on Retrieval-Induced Forgetting? MATTHEW ERDMAN & JASON C. K. CHAN, *Iowa State University*—Prior research has shown that testing can impair subsequent recall of nontested materials—an effect termed *retrieval-induced forgetting* (RIF). In the present experiments, we examined the effects of providing feedback during retrieval practice on later memory for nontested materials. In two experiments, we varied the type of feedback administered during retrieval practice (no feedback, immediate feedback, delayed feedback). Experiment 1 used cued recall as the final test, and Experiment 2 used recognition as the final test. Significant RIF was found in all feedback conditions. The present research provides support for the inhibitory account of RIF.

(5062)

Testing for Transfer: Limits of the Testing Effect. CYNTHIA L. WOOLDRIDGE, JULIE M. BUGG, & MARK A. McDANIEL, *Washington University* (sponsored by Mark A. McDaniel)—Repeated testing improves memory, a phenomenon known as the *testing effect*. Laboratory studies of the testing effect typically use factual material and repeat questions on initial quizzes and the final criterial test. However, educators are interested in the application of material and use related but not repeated questions when testing students. To address this discrepancy, we quizzed individuals on factual or applied material, using questions that were either repeated or related to the final test questions. Repeated questions showed the typical robust testing effect found in the laboratory but no transfer. Related questions showed a markedly reduced testing effect that was isolated to factual questions but, nonetheless, represented transfer. The differences between repeated and related questions raises the question of whether the underlying causes of the testing effect in the laboratory and classroom may differ.

• ASSOCIATIVE LEARNING II •

(5063)

Modeling Intralist and Interlist Effects in Free Recall. LYNN J. LOHNAS, *University of Pennsylvania*, SEAN M. POLYN, *Vanderbilt University*, & MICHAEL J. KAHANA, *University of Pennsylvania* (sponsored by Michael J. Kahana)—In modeling human memory, theorists often make the simplifying assumption that memory is cleared at the start of each experimental trial. As a result, the explanatory scope of most memory models has been limited to intralist phenomena, such as the effects of primacy, recency, contiguity, and similarity on memory search. To account for interlist effects, such as prior-list intrusions and proactive and retroactive interference, models must allow for the continuity of memory across lists. Building on the context, maintenance, and retrieval model (CMR; Polyn, Norman, & Kahana, 2009), we propose a theory of both intralist and interlist effects in free recall (CMR2). We show that CMR2 can account for the patterns of prior-list and extra-list intrusions in free recall, as well as proactive and retroactive interference effects and the ability of participants to selectively target retrieval of items on prior lists in the list-before-last paradigm (Jang & Huber, 2008; Shiffrin, 1970).

(5064)

Spatial Contiguity Between Response and Reinforcement Affects Behavioral Variability in Rats. KENNETH J. LEISING, *Texas Christian University*, & W. DAVID STAHLMAN & AARON P. BLAISDELL, *UCLA* (sponsored by Aaron P. Blaisdell)—Recent experiments have indicated that variability in behavior is negatively related to the probability of positive reinforcement (e.g., Stahlman & Blaisdell, in preparation; Stahlman, Young, & Blaisdell, 2010). Furthermore, Stahlman and Blaisdell manipulated the temporal relationship between an operant response and reinforcement and found a positive relationship between temporal delay and behavioral variability. In this experiment, we investigated whether spatially separating the site of an operant response from the site of reinforcement would similarly affect behavioral variability. We trained rats to barpress on two levers during discriminative stimuli. One of the levers was immediately adjacent to the food source (i.e., *near*), whereas the other was on the opposite side of the chamber (i.e., *far*). The discriminative stimuli indicated the likelihood of reinforcement at the trial's termination (i.e., *hi* vs. *lo*, 100% vs. 25%). Consistent with previous results, we found that decreased spatial contiguity increased temporal variability in barpressing behavior.

(5065)

Aging and Attention in Associative Learning. JARED HOLDER, SHARON A. MUTTER, MELANIE ASRIEL, & CANDICE GROVES, *Western Kentucky University* (sponsored by Sharon A. Mutter)—This study investigated age differences in learned attention in associative blocking and highlighting (Kruschke, 2003). The blocking experiment revealed that older adults learn to ignore irrelevant cues. Participants learned single cue–outcome associations (A→X, F→Y) and then learned associations for single cues paired with a new cue and the same outcome (A.B→X), as well as associations for new cue–outcome pairs (C.D→Y). Older adults' test predictions subsequently revealed a blocking effect (A.C→X; B.D→Y). The highlighting experiment showed that older adults learn to shift attention from irrelevant to predictive cues. Participants learned compound cue–outcome associations (I.PE→E) and then learned associations for both original and novel compounds. Novel compounds contained one cue from the original compound paired with a new cue and outcome (I.PL→L). Like young adults, older adults developed a stronger association between PL→L than between PE→E (PE.PL→L). To avoid prediction errors, they learned to shift attention away from the irrelevant cue I toward the predictive cue PL.

(5066)

A Funny Thing Happened on the Way to the Maze: Incidental Learning in Humans. ROSE H. DANEK, *Illinois Wesleyan University*, & J. TOBY MORDKOFF, *University of Iowa* (sponsored by J. Toby Mordkoff)—Contemporary learning theories derive much of their explanatory power from the assumption that all stimuli presented vie for associative strength, the assumption of shared weight space (SWS). Theories based on this assumption have proven successful in explaining many of the observed conditioning phenomena in animals. However, work with humans has proven more complex, due to outside knowledge, biases, and heuristics (see, e.g., Chapman, 1991; Perales, Catena, & Maldonado, 2004; Tversky & Kahneman, 1974; Viken, Treat, Bloom, & McFall, 2005; Waldmann, 2000, 2001). The present series of experiments sought to test the assumption of SWS in a task that was less susceptible to the influence of "top-down" factors. Support for the assumption of SWS was obtained in humans, as it had been previously in animals. The present research strengthens the assumption that the same mechanisms underlying animal conditioning underlie human learning and provides an exciting new technique for studying learning in humans.

(5067)

Age-Related Memory Deficit: Role of Study Time and Encoding Strategies. CHARLOTTE FROGER, BADIÂA BOUAZZAOUI, & LAURENCE TACONNAT, *University of Tours UMR CNRS 6234 CeRCA* (sponsored by Laurence Taconnat)—This study explored the age-related metamemory impairment (Souchay & Isingrini, 2004) and the associative deficit in episodic memory (Naveh-Benjamin, 2000). The aim was to examine whether older adults were able to adapt their study time to task difficulty (i.e., by varying the strength of association) and whether they used this study time effectively by implementing encoding strategies (i.e., imagery, sentence, repetition). The results confirmed an age-related associative deficit in memory. Although both age groups adapted their study time to task difficulty equally well and used the same encoding strategies, older adults were impaired in memory performance. The effect of aging in episodic memory may be partly explained by an inability to use study time effectively and by the encoding strategies implemented. These results are interpreted according to the environmental support framework (Craik, 1990), stating that older adults are impaired in self-initiated processes.

• COGNITIVE CONTROL V •

(5068)

Effects of Media Multitasking Use on Cognitive Performance. MEREDITH E. MINEAR, FAITH BRASHER, JACK LEWIS, MARK McCURDY, & ANDREA YOUNGGREN, *College of Idaho*—Ophir, Nass, and Wagner (2009) reported that individuals who routinely engage in multiple forms of media use are actually worse at multitasking, due possibly to an inability to ignore irrelevant stimuli, from both external sources and internal representations in memory. Using the Media Multitasking Index developed by Ophir et al. (2009), we identified heavy media multitaskers (HMMs) and light media multitaskers (LMMs) and tested them on measures of task switching, working memory, and fluid intelligence. We found that HHMs actually performed better on task switching, as measured by mixing cost, and that there were no differences between groups for switch cost. In addition, we found that LMMs performed better on Raven's progressive matrices. These results may suggest that HHMs have learned to switch more efficiently between simple tasks but have a more difficult time with complex cognitive tasks.

(5069)

Sequential Difficulty Effects During Strategy Execution. KIM UITTENHOVE, PATRICK LEMAIRE, & MIREILLE LECACHEUR, *University of Provence and CNRS*—We hypothesized that in strategy switching, performance would be impaired after a difficult strategy. In a first experiment, subjects had to give estimates for two-digit multiplications (e.g., 43 × 86). The strategy they had to use was imposed on each trial, either easy (rounding both operands down; 40 × 80) or difficult (rounding both operands up; 50 × 90). The most important results were (1) a replication of strategy switch costs for the easy strategy and reversed switch costs for the difficult strategy, (2) a repetition RT benefit for the easy strategy and a repetition RT cost for the difficult strategy, and (3) a general RT slowdown after the difficult strategy. Experiment 2 disentangled strategy sequential difficulty effects from strategy switch costs. Implications for models of strategy selection are discussed.

(5070)

Lateral Asymmetries in Cerebral Bloodflow Velocity Predict Cognitive Performance. NATASHA B. SCHULTZ, HOLLY A. PHILLIPS, & DAVID A. WASHBURN, *Georgia State University*—Transcranial Doppler sonography provides noninvasive measures of cerebral bloodflow velocity (CBFv) and mental activity. CBFv declines as cognitive effort decreases (e.g., during a vigilance task) and increases with tasks that require focused attention (e.g., mental arithmetic). In this poster, we summarize unexpected findings in which hemispheric asymmetries in CBFv predict performance on tasks that require sustained attention, visual searching, and speeded shoot/don't-shoot judgments. For example, students participated in a watchkeeping task that required shooting at computer-generated targets, using a laser-modified handgun. The best predictor of individual differences in decision speed and marksmanship was the difference in CBFv between the cerebral hemispheres, with the top quartile of participants characterized by relatively suppressed (slower than baseline) activity in the right cerebral hemisphere, as compared with the left. These task-specific lateralized patterns are stable over time and seem to be related to cognitive control or readiness, rather than functional cerebral asymmetries in component operations.

(5071)

Response Set, Repetitions, and Runs Moderate Working Memory Capacity's Effect on Stroop Interference. MATTHEW E. MEIER &

MICHAEL J. KANE, *University of North Carolina, Greensboro*—In a color–word Stroop task, Kane and Engle (2003) showed that individual differences in working memory capacity (WMC) systematically predicted response time and error rate interference. In two experiments, the present study explored further the influence of Stroop task characteristics on the relations among WMC, interference, and congruency sequence effects (i.e., the reduction in interference observed following conflict trials vs. congruent trials). In Experiment 1, high- and low-congruency Stroop tasks were constrained to prohibit color and word repetitions between trials and to limit the lengths of runs of consecutive congruent or incongruent stimuli. In Experiment 2, these constraints were lifted. WMC-related variation in Stroop interference and in congruency sequence effects was absent in Experiment 1's constrained task. However, in Experiment 2's unconstrained task, WMC predicted interference and changes in congruency sequence effects over time. Together, these experiments suggest boundary conditions to WMC's association to cognitive control abilities.

(5072)

Tracking the Multitasking Mind. STARLA M. WEAVER & CATHERINE M. ARRINGTON, *Lehigh University* (sponsored by Catherine M. Arrington)—Voluntary task switching allows for an assessment of the executive processes that enable multitasking behavior. Across a series of experiments, we used mouse movement trajectories to examine the online control processes that occur during voluntary task switching. We obtained continuous computer mouse trajectory data from participants responding to onscreen category labels representing binary choices in two simple tasks. Temporal manipulations of response and stimulus onset were used to assess the influence of endogenous and exogenous factors on multitasking performance. When responses were initiated prior to stimulus onset, both trajectories and choice outcomes demonstrated increased endogenous control that was maintained even after stimulus information became available. However, when stimulus onset preceded response initiation, stimulus-based influences on the processes that lead to task choice were seen. Using this novel application of mouse trajectory tracking, we were able to differentiate between factors influencing task choice and task performance.

(5073)

Reappraisal Versus Distraction: The Neural Correlates of Emotion Regulation. BRANDY N. JOHNSON & ROBERT L. WEST, *Iowa State University* (sponsored by Robert L. West)—Response-focused strategies of emotion regulation involve modifying thoughts after an emotional stimulus is encountered. Cognitive reappraisal and distraction represent two forms of response-focused emotion regulation. In the present study, event-related brain potentials were used to examine the neural correlates of these two forms of emotion regulation. In the task, individuals first viewed an emotional picture; then, on the basis of a cue, they continued to think about the picture, reappraised the picture, or tried to distract themselves. Individuals viewed the picture a second time. During the cue interval, there were differences in slow wave activity between the three conditions, indicating that the two forms of regulation involve different neurocognitive processes. During the second viewing of the picture, the LPP was reduced in amplitude for reappraisal trials, relative to attend trials. In contrast, there was little difference in the amplitude of the LPP between distract and attend trials.

(5074)

Effect of Suppressing Target Memories With Multiple Episodic Cues. JENNY WONG, BRENDAN D. MURRAY, & ELIZABETH A. KENSINGER, *Boston College* (sponsored by Elizabeth A. Kensinger)—Many empirical studies using the think/no-think (TNT) paradigm (Anderson & Green, 2001) have shown that people can intentionally forget memories of learned word pairs, but no studies have yet used multiple episodic cues to see whether this effect is the result of the actual impairment of the target memory representations. The present study used a modified TNT paradigm to address this question. Words that were suppressed with just one cue were later remembered significantly less often than words suppressed with two cues for the same total number of repetitions [$t(31) = 5.89$, $p < .001$], whereas there was no effect of cue number

of words that were repeatedly recalled. This suggests that memory suppression is cue dependent, whereas memory recall is cue independent. This dissociation has implications for further research on the resilience of memory representations in the brain.

• **WORKING MEMORY V** •

(5075)

The Effects of Combining Physical Activity and Cognitive Training in Healthy Older Adults: Independent, Additive, or Overadditive? JANINE M. JENNINGS, DALE DAGENBACH, JEFFREY A. KATULA, MARK A. ESPELAND, ROBIN W. DOVE, & KAYCEE M. SINK, *Wake Forest University*—Both repetition-lag memory training (Jennings & Jacoby, 2003) and aerobic exercise training (Colcombe & Kramer, 2003) have shown promise as interventions for cognitive aging, producing benefits on a range of cognitive measures of attention, working memory, and executive function. In this study, the Seniors Health and Activity Research Program Pilot trial (SHARP–P), these approaches were combined in a 2×2 design (repetition-lag training, exercise training, both, and a healthy-aging educational control group) in a population of community-dwelling older adults. Benefits of repetition-lag training were found for the flanker, one-back, and self-ordered pointing tasks. Benefits of aerobic exercise training were found for task switching and recall. The results from the combined exercise and repetition-lag group suggested independent benefits of training, with little evidence of additive or overadditive effects.

(5076)

Working Memory and Long-Term Memory Retrieval Requirements During Event Imagination. KRISTOFFER ROMERO & MORRIS MOSCOVITCH, *University of Toronto*—The processes underlying event construction (i.e., imagination) are not known. Specifically, it is unclear whether, during imagination, items are held online in working memory (WM), long-term memory (LTM), or both. To determine whether imagining a complex event requires holding information in WM and/or LTM, younger and older adults were briefly shown three to six words and were asked to imagine an event with those words. Critically, subjects could press a key to redisplay the words again briefly. The number of keypresses was taken as a measurement of retrieval demands. Older adults had higher rates of keypresses, particularly when more words were presented. Keypressing rates correlated highly with measures of LTM and moderately with measures of WM, suggesting that both are necessary for imagination. This suggests that LTM is implicated in imagination both through supplying items from episodic memory and in the actual construction process itself.

(5077)

Working Memory for Serial Order: A Spatial/Verbal Dissociation. LEON GMEINDL, MEGAN WALSH, & SUSAN M. COURTNEY, *Johns Hopkins University*—Usually, verbal information is encountered in a temporally ordered manner and is rehearsed serially in working memory (WM). In contrast, spatial locations might naturally be coded in WM as configurations and not rehearsed serially. We used memory span tasks to test whether serial order is therefore more readily bound to verbal than to spatial representations. Removing the requirement to reproduce serial order improved performance more for locations than for digits. Furthermore, serial order was freely reproduced twice as frequently for digits as for locations. Participants also failed to detect changes in serial order more frequently for locations than for digits. These results provide converging evidence for a dissociation in the binding of serial order to spatial versus verbal representations. Separable domain-specific control processes may be responsible for this binding. Alternatively, these results may reflect fundamental differences in how effectively temporal information can be bound to different types of stimulus features in WM.

(5078)

Age-Related Differences in Inhibiting Irrelevant Information in a List-Learning Paradigm Using Perceptual Cues. LISA A. VANWORMER, *University of West Florida*, & TAMRA J. BIRETA, *College of New Jersey* (sponsored by Ian Neath)—The inhibitory deficit

hypothesis suggests that older adults are more susceptible to interference from irrelevant information than are younger adults, because of age-related declines in inhibitory ability (Hasher & Zacks, 1988), but that this deficit can be overcome with the aid of salient perceptual cues used to accentuate relevant information (Hasher, Zacks, & May, 1999). The purpose of the present experiment was to determine whether a salient perceptual cue (i.e., color) would affect age-related differences in inhibitory ability for lists that varied by relevance cue and distractor type. Younger and older adults viewed lists including both relevant and irrelevant stimuli for immediate recognition. Pretrial perceptual cues eliminated age-related declines in performance when the irrelevant stimuli were pseudowords, but not when they were words from the same word pool as the relevant stimuli. The results indicate that perceptual cues may differentially impact the automatic semantic processing of younger and older adults.

(5079)

Action-Video-Game-Related Improvements in Object Representations. HANDE SUNGUR & AYSECAN BODUROĞLU, *Boğaziçi University*—Previous research has clearly demonstrated action video game improvements in visual and spatial attention. The present study investigated action-video-game-related changes in visual short-term memory capacity and object representation by comparing video game players (VGPs) and nonvideo game players (NVGPs). In a color wheel task (adapted from Zhang & Luck, 2008) where viewers were asked to freely recall the color of briefly presented objects, we found that VGPs were more accurate than were NVGPs. Furthermore, in the multiple identity tracking task (Horowitz et al., 2007), we found that VGPs not only were able to track more objects, but also were able to maintain identity of tracked objects better than NVGPs. Finally, we demonstrated that VGPs had greater attentional breadth and higher spatial representation resolution. These results suggested that VGPs have improved object representation abilities, which are likely to be due to enhancements in visual short-term memory processes.

(5080)

Individual-Differences Capacity and Resolution of Representations in Visual and Spatial Short-Term Memory. AYSECAN BODUROĞLU, *Boğaziçi University*, & PRITI SHAH & ANNALYN NG, *University of Michigan*—Even though visual short-term memory (VSTM) capacity is severely limited, large individual differences in capacity have also been reported. These differences may be partly driven by differences in representations resolution. Taking an individual-differences approach, we investigated the relationship between capacity and resolution of representation in visual and spatial domains, using the color wheel task (Zhang & Luck, 2008) and its spatial analogue. These tasks require participants to freely recall either the studied colors or locations, enabling us to determine the degree to which they had been accurately represented. Even though previous research in the visual domain had argued that representation resolution remained the same despite memory load increases, results from our spatial task suggested that there may be an inverse relationship between load and representation resolution. We report findings on how differences in VSTM capacity and representation resolution relate to individual differences in change detection, imagery ability, and personality variables.

(5081)

Strategy Training and the Automated Operation Span Task. TESSA M. ANDERSON & KANDI J. TURLEY-AMES, *Idaho State University*—The present study examined whether strategy use enhanced working memory (WM) span scores and the correlation between WM span scores and higher cognitive functioning (HCF) tasks, using the Aospan (Unsworth, Heitz, Schrock, & Engle, 2005). The relationship between processing speed and processing accuracy errors with the Aospan were examined, as well as how they were affected by strategy use. The Nelson–Denny and the Raven's progressive matrices were administered to assess HCF. Participants completed the Aospan in a pre–post design with half of participants trained to use a rehearsal strategy. As with the OSPAN, strategy use enhanced WM span scores, but the relationship between WM and HCF was not strengthened. Each type of error decreased

as WM increased. Furthermore, strategy instruction was related to an increase in processing speed errors. The impacts of strategy use on OSPAN and Aospan performance are discussed.

(5082)

Examining Age-Related Effects in Inhibitory Functioning: Evidence From Filtering and Switching Between Filter Settings. KERSTIN JOST & IRING KOCH, *RWTH Aachen University*, & ULRICH MAYR, *University of Oregon* (sponsored by Ulrich Mayr)—A decline in inhibitory functioning has been suggested as one major factor behind cognitive aging (e.g., Hasher & Zacks, 1988). In a series of short-term memory experiments (behavioral and EEG), we addressed the question of whether the ability to prevent irrelevant information from being stored declines with age. Old and young participants were presented with an array of colored rectangles and had to remember only the red items, while ignoring blue ones. Event-related potentials measured during the retention interval indicate that filtering starts later for older than for younger adults. In a second experiment, we explored whether the flexible application of filter settings differed for older and younger participants. To this end, we introduced a switching situation in which the relevant color changed across trials. Performance on switch trials indicated that older adults were less efficient in ignoring items of the no-longer-relevant color, suggesting a decreased flexibility in filtering.

• EXPLICIT MEMORY V •

(5083)

The Earlier They Come, The Harder They Fall: Testing the Competition Dependence Assumption of Retrieval-Induced Forgetting. CHRISTOPHER J. SCHILLING & BENJAMIN C. STORM, *University of Illinois, Chicago*—Work on retrieval-induced forgetting has shown that the retrieval of a specific item or subset of items from memory can cause the forgetting of other items in memory. According to the inhibitory account of retrieval-induced forgetting, inhibition is elicited to suppress nontarget items that compete with the retrieval of target items. Thus, the extent to which an item suffers from retrieval-induced forgetting should be determined, at least in part, by the extent to which that item competes during retrieval. Specifically, an item that competes strongly should suffer from more forgetting than should an item that competes less strongly. We tested this prediction by manipulating the order in which participants studied exemplars from a given category. Consistent with the inhibitory account, we found that items studied first and last suffered from significantly more retrieval-induced forgetting than did items studied in between.

(5084)

Age Differences in Neuropsychological Correlates of False Memory for Contextual Details. KETHERA A. FOGLER & DONNA J. LaVOIE, *Saint Louis University*—False memory for critical lures has been attributed to their semantic association with presented items; however, critical lures are often "remembered" with vivid contextual details. These details are not random but are borrowed from the context in which similar items were learned. The role of context and the neuropsychological correlates that may be implicated in the formation of false memories were examined in young and older adults. Studied items were presented in one of two colors, with one color being proportionally more frequent than the other. Critical lures and studied items produced similar levels of recognition and were most often recalled as being studied in the dominant contextual color. This effect was more pronounced in older adults. Neuropsychological assessment of cognitive function indicated a negative correlation of medial temporal lobe function with false recognition, but only in older adults. These tasks were not correlated with memory for studied items.

(5085)

The Relation Between Familiarity and Positive Affect: A Sometime Thing. TERESA GARCIA-MARQUES, *ISPA University Institute of Lisbon*, & LEONEL GARCIA-MARQUES, *University of Lisbon* (sponsored by Larry L. Jacoby)—We investigated the close relationship between familiarity and positive affect, often documented by the mutual impact of their corresponding judgments. We had our participants

perform both an evaluative and a recognition task in an implicit association paradigm. We expected that old/like versus new/dislike mappings would be facilitated and that old/dislike versus new/like would be inhibited, which is what we found. However, our data suggested that this interference is asymmetric. PDP-based estimates of controlled and automatic components were equivalent for the automatic components but were higher for the controlled component of recognition. We hypothesized that the association between familiarity and affect is anchored only in the automatic component. Using a mere exposure paradigm, we expected that load would increase the association between familiarity and affect, which is what we found. Further results suggested that liking and recognition tend to be positively but weakly correlated and that the association is disrupted when fluency is an unreliable source of memory.

(5086)

Mind Racing: Exercise and Long-Term Memory. M. WINDY McNERNEY & GABRIEL A. RADVANSKY, *University of Notre Dame* (sponsored by Gabriel A. Radvansky)—Over time, regular physical exercise can lower the risk for age-related declines in cognition. However, the immediate effects of such exercise on memory consolidation in younger adults have not been fully investigated. In the present study, the effects of aerobic exercise, anaerobic exercise, and no exercise were assessed on three different memory tasks: paired-associate learning, procedural learning, and text memory. Our results indicate that performance on the procedural learning and text memory tasks was improved with anaerobic exercise, both immediately and 1 week later, but that there was no benefit for aerobic exercise. Finally, no benefit of exercise was found for paired-associate learning. These findings suggest that intense exercise may benefit certain types of memory consolidation.

(5087)

The Testing Effect and Retrieval Effort: An EEG and EMG Study. LEONORA C. COPPENS, PETER P. J. L. VERKOEIJEN, REMY M. RIKERS, & HENK G. SCHMIDT, *Erasmus University Rotterdam* (sponsored by Henk G. Schmidt)—Retrieval effort is often considered to be a factor in the emergence of the testing effect (i.e., tested information is retained better than restudied information in the long term). Usually, the measure of effort in testing effect paradigms is response latency. In the present study, we used EEG and EMG to more directly measure retrieval and effort during learning. Participants studied and were tested on word pairs. EEG was used to distinguish between retrieval and recognition. Muscular activity in the corrugator supercilii area was used as a measure of effort. Preliminary results show that testing evoked a larger 500- to 800-msec parietal old/new effect (suggesting retrieval) and higher corrugator supercilii activity than did restudying. Moreover, tested items were more often recalled correctly on the retention test after 3 days than were restudied items. Thus, items that were retrieved with more effort during learning were recalled better. These results support the retrieval effort hypothesis.

(5088)

Making Memories More Resistant to Retroactive Interference: Another Test Effect. VERED HALAMISH & ROBERT A. BJORK, *UCLA*—Tests, as learning events, often lead to better long-term retention than do additional study opportunities. We examined whether testing can also, in the shorter term, help to insulate memories from retroactive interference. Participants learned a list of related word pairs, then restudied a given pair or received a cued-recall test (without feedback) on that pair, and then learned a second list of word pairs that was designed to contain pairs that either interfered with or did not interfere with given pairs in the first list. A subsequent cued-recall test for the List 1 pairings revealed better memory for tested than for restudied information, but only for pairs subjected to retroactive interference from List 2 pairings. The results are consistent with a broader model that assumes that the distribution of item strengths in memory is shifted in specific and differing ways for restudied versus tested items.

(5089)

Recognition Processes in a Change Detection Task. BOGDAN KOSTIC & ANNE M. CLEARY, *Colorado State University* (sponsored by Anne M. Cleary)—Prior work has shown that observers can recognize undetected objects in a change detection task. However, no studies have examined the processes (i.e., recollection and familiarity) that feed into those recognition decisions. The present study used a change detection task in which participants indicated the locations of missing objects in real-life scenes. Experiment 1 validated the change detection task and showed that participants' familiarity ratings are higher for undetected objects than for unstudied objects. Experiment 2 examined the role of guessing on the change detection task by providing a don't-know option during change detection and showed that when participants used the don't-know option, familiarity ratings were not significantly different from those for unstudied objects. Experiment 3 used a remember–know task at test and showed that recollection contributes to the later recognition of detected objects, whereas familiarity contributes to the later recognition of undetected objects.

(5090)

Does the Hypercorrection Effect Occur When Feedback is Delayed? DANIELLE M. SITZMAN & MATTHEW G. RHODES, *Colorado State University*—Previous research has demonstrated that, when given feedback, participants are more likely to correct confidently held errors, as compared with errors held with lower levels of confidence, a finding termed the *hypercorrection effect* (Butterfield & Metcalfe, 2001). We explored whether this effect would still be present when feedback was delayed. In the first experiment, participants studied a list of word pairs and received immediate, delayed, or no feedback on an initial retention test; a final retention test was given 2 days later. In the second experiment, participants were allowed to control the amount of time they spent studying feedback. In both the immediate and delayed feedback conditions, a person's confidence impacted the correction of errors and the amount of time spent processing feedback. This suggests that, even after a delay, information about one's initial confidence is accessible and influences the effectiveness of feedback.

(5091)

Investigating the Role of Emotion in Delayed Free Recall. AISHA P. SIDDIQUI & NASH UNSWORTH, *University of Georgia* (sponsored by Nash Unsworth)—Typically, studies investigating emotion in delayed free recall show that emotional words are recalled more often than neutral words; however, most studies report this only as their dependent measure. Using a search model framework, the present study looked at other dependent measures to determine how emotion influences the contents of memory and the probability of sampling items. The results showed that emotional words were more likely to be output earlier in the recall sequence, suggesting that emotionality boosts relative strength. When emotionality was made salient (Experiment 2), participants were able to utilize emotional associations, in addition to temporal associations, to cue retrieval of additional emotional words but relied mainly on temporal context when the emotional information was not made salient (Experiment 1). Overall, the results suggest that emotion contributes to enhanced memory by influencing the probability of sampling an item during the search process—specifically, by boosting relative strength and strengthening interitem associations.

(5092)

Prospective Memory: The Effects of Dividing Attention on Spontaneous Retrieval. TYLER L. HARRISON, *Georgia Institute of Technology*, & GILLES O. EINSTEIN, *Furman University* (sponsored by Gilles O. Einstein)—Dividing attention has been shown to decrease prospective memory performance (Marsh & Hicks, 1998). Although a reasonable explanation of this finding is that dividing attention limits the resources needed to monitor for a prospective memory target, the purpose of our research was to test whether dividing attention interferes with spontaneous retrieval processes. We created task demands that discouraged monitoring and encouraged reliance on spontaneous retrieval processes for prospective memory retrieval, and we presented prospective memory targets under both divided attention and nondivided attention conditions. Analysis of ongoing task performance indicated no evidence of costs and, thus, revealed that we were successful in discouraging monitoring. Because prospective memory performance was very similar in the

divided attention and nondivided attention conditions, our results suggest that spontaneous retrieval is not affected by at least moderate disruptions in attention.

(5093)

Recognition Criterion Rigidity: The Striking Similarities Between Standard, Distractor-Free, and Target-Free Recognition. JUSTIN C. COX & IAN G. DOBBINS, *Washington University* (sponsored by Ian G. Dobbins)—It is often assumed that observers seek to maximize correct responding during recognition testing by actively adjusting decision criteria. However, early research (Wallace, 1978) suggested that recognition rates remained consistent despite complete removal of distractor items from the test. We extended these findings across three experiments, addressing whether response rates or judgment confidence would change when participants were presented with standard test lists versus "pure" test lists consisting entirely of targets or of distractors. Even when observers were made aware of the composition of the pure test lists, the overall "old" and "new" endorsement rates and the confidence of these reports remained remarkably similar to what is observed during standard testing. These data suggest that observers do not actively strive to maximize likelihood of success across a test. Instead, learning opportunities prior to testing appear to play the dominant role in recognition criterion placement and confidence judgment.

(5094)

A Testing Effect Without Overt Retrieval: The Difficulty of Selective Retrieval in Free Recall. MEGAN A. SMITH & HENRY L. ROEDIGER III, *Washington University* (sponsored by James S. Nairne)—When given instructions to forget or exclude part of a set of material after it has been encoded and to retrieve another part, students seem unable to comply; students inadvertently retrieve the excluded items (Roediger & Tulving, 1979). Using this paradigm, we asked whether subjects would show a testing effect for excluded words, those that seem to be retrieved but not reported. Students studied categorized lists of words and subsequently recalled the whole list, recalled part of the list, or completed a filler task. Taking an initial test improved performance on a final test, the standard testing effect. More interestingly, words that were not retrieved in the exclude condition were better recalled than words in the no-test condition. Thus, a robust testing effect occurred for words that were covertly retrieved but not explicitly recalled. The results provide further evidence for difficulty in retrieving parts of a list following exclusion instructions.

(5095)

Wait, There Is Something Special About You: Discrepancy-Plus-Search Processes in Prospective Memory Retrieval. MARK A. McDANIEL & JI HAE LEE, *Washington University*—The present study contrasted the influence of familiarity processes with those of discrepancy processes (both theoretically involved in spontaneous noticing of a prospective memory [PM] cue) in PM. The former predicts high PM performance for PM targets with high fluency, whereas the latter predicts high performance for targets with high discrepancy, elicited by the mismatch between the actual versus the expected fluency of the PM targets. Within a new paradigm, discrepancy was manipulated by mismatching the anagram solution difficulty (fluency) of PM targets with the anagram solution difficulty of nontarget items. Supporting the discrepancy view, participants were more likely to perform the PM task if their PM targets were anagrams with mismatching difficulty from nontargets, relative to when PM targets were anagrams with matching difficulty to nontargets. The results were inconsistent with the familiarity view's prediction of higher PM performance with easy anagrams as PM targets.

(5096)

Repeated Retrieval Slows Changes in Phenomenology When Remembering Events. HEATHER J. RICE, *Washington University*, & ANDREW C. BUTLER, *Duke University*—Recent studies of repeated retrieval have focused on how it affects accuracy. Few studies have examined the influence that repeated retrieval has on the phenomenology associated with remembering events. We examined how repeated retrieval affects both word-cued event memories and lab-based minievents. Participants nominated 12 recent events, using a Galton–Crovitz paradigm, and experienced 12 minievents; they then rated their recollective experience, using the Autobiographical Memory Questionnaire (AMQ). Once a week for the next 3 weeks, they retrieved half of these events: 6 cue-word events and 6 minievents. During a final session, participants rerated every event on the AMQ. Ratings of several properties (e.g., reliving the event, experiencing a first-person perspective) decreased more for nonretrieved events than for retrieved events. This pattern was observed primarily for minievents. The results suggest that retrieval can slow changes in phenomenology that occur over delays.

(5097)

When and How Does Testing During Study Insulate Against the Buildup of Proactive Interference? YANA WEINSTEIN & KATHLEEN B. McDERMOTT, *Washington University*, & KARL K. SZPUNAR, *Harvard University*—When learning a series of word lists, people who take a free recall test after each list learn subsequent lists more effectively than do those who do not take initial tests (Szpunar et al., 2008). That is, testing protects the learner from the buildup of proactive interference. Here, we show that this phenomenon replicates with pictures and face–name pairs as stimuli and when the test is cued recall. Furthermore, we test possible explanations of the effect. Does testing simply serve as a mental context change or a refreshed mental set? (No.) Can the effect be attributed to subjects in the nontested condition not paying attention, believing no test will occur? (Not entirely.) The insulating effect of retrieval against proactive interference is robust and appears to be retrieval specific.

(5098)

Prospective Memory and Aging: Failing to Remember or Failing to Forget? MICHAEL K. SCULLIN, JULIE M. BUGG, & MARK A. McDANIEL, *Washington University* (sponsored by Julie M. Bugg)—Prospective memory (PM) refers to the ability to retrieve and execute intentions in the appropriate context. To investigate whether younger and older adults deactivate or otherwise forget completed PM intentions, participants performed a typical event-based PM task. Next, participants were told that the PM task was done and would not need to be performed again. Critically, we still (re)presented the PM target cue during a subsequent task ("commission error" phase). Although there were no age-related declines in PM performance, older adults executed the (contextually inappropriate) PM response during the commission error phase more frequently than did younger adults. In three experiments, we demonstrated that encoding strategy, PM cue salience, and degree of contextual overlap between the PM and commission error phases modulated this age-related difference. Our results suggest that older adults' PM difficulties may sometimes reflect a failure to forget (or otherwise deactivate) completed intentions, not a failure to remember.

(5099)

A Model-Based Characterization of Individual Differences in Prospective Memory Monitoring. ADAM C. SAVINE, JILL T. SHELTON, MICHAEL K. SCULLIN, & MARK A. McDANIEL, *Washington University*—Although there is consensus that monitoring often supports prospective memory, the mechanisms by which individuals monitor for future intentions need to be elucidated. We proposed three models to help characterize monitoring: the attentional focus model, the secondary memory retrieval model, and the information thresholding model. The validity of these models was assessed using a novel paradigm, the complex ongoing serial task (COST), which involved multiple decisions per stimulus. Prospective memory responding and the dynamics of ongoing task costs were evaluated to adjudicate between the models. The data revealed individual differences in the adoption of a particular monitoring strategy. Furthermore, participants acting in accordance with the attentional focus and information thresholding models performed the prospective memory task better with fewer ongoing task costs than did individuals acting in accordance with the secondary memory retrieval model. The COST paradigm and our model-based approach provide a foundation for future empirical work regarding prospective memory monitoring.

• Event Cognition •

(5100)

Seeking Explanations for Witnessed Events: Intentional Causes and Susceptibility to Suggestion. AMANDA MORRISON & MARIA S. ZARAGOZA, *Kent State University*—Suggestive forensic interviews have the potential for distorting eyewitness memory. Recent studies have shown that participants/witnesses are more likely to develop false memories for suggested fictitious events when the misleading suggestions provide a causal explanation for the events participants witnessed than when they do not serve this explanatory role (Chrobak & Zaragoza, 2010). Building on these earlier findings, the present study varied whether the suggested event described a voluntary cause of a negative witnessed outcome (e.g., an accident), relative to an unintentional cause of the same witnessed outcome. The results showed that susceptibility to suggestion was influenced by the extent to which the suggested cause was perceived as voluntary.

(5101)

The Effect of Object State-Changes on Event Processing: Do Objects Compete With Themselves? NICHOLAS C. HINDY, *University of Pennsylvania*, GERRY T. M. ALTMANN, *University of York*, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by Gerry T. M. Altmann)—Events often entail changes in state of individual objects. How do we maintain distinct representations corresponding to the "before" and "after" of a described event? On reading "the squirrel will crack the acorn," we must keep track of multiple representational instantiations of the acorn—before it was cracked and after. Conversely, on reading "the squirrel will sniff the acorn," there is only a single (unchanged) instantiation of the acorn to keep in mind. The left inferior frontal gyrus (IFG) has previously been demonstrated to be central in resolving competition among semantic alternatives. We used fMRI to test the hypothesis that multiple object instantiations compete when an object is changed from its original state. Increased activity in the left IFG associated with a change of state appeared at the intersection of activity associated with color naming in a Stroop task, and activity increased during a separately performed sentence comprehension task.

(5102)

Dynamic Effects of Emotion on Perceived Durations: A Temporal Bisection Study. JULIE ANNE SÉGUIN, DAVID N. HARPER, & GINA M. GRIMSHAW, *Victoria University of Wellington*—A stimulus's emotional content can affect its perceived duration. The present experiment used emotional images to examine the independent effects of arousal and valence on time perception in three duration ranges: 400–1,600 msec, 1,000–4,000 msec, and 2,000–8,000 msec. Participants saw emotional and neutral images of varying durations and were asked whether these durations were closest to the short or the long anchor. In contrast to previously reported overestimation of the duration of emotional faces (Droit-Volet, Brunot, & Niedenthal, 2004), in the shortest range, we found that all emotional images were underestimated, as compared with neutral images. These findings are consistent with attentional effects of emotion on time perception. Furthermore, results in the longer ranges suggest that the effect of emotional factors on time perception can change as stimulus duration increases.

(5103)

Effects of Attending to Manner and Path on Memory for Actors. ALAN W. KERSTEN, JOHANNA D. BERGER, & JULIE L. EARLES, *Florida Atlantic University*—This research reveals that attending to an actor's manner of motion yields greater memory for the identity of that actor than does attending to the actor's path. Participants viewed video clips, each involving an actor moving in a particular manner (e.g., crawling) along a particular path (e.g., out the door). Participants were instructed to attend to either manner or path. Recognition foils in a subsequent memory test included not only new manners and paths, but also familiar manners and paths performed by the wrong actors. Attending to path made participants less likely to falsely recognize new paths, but more likely to falsely recognize familiar paths performed by

the wrong actors. Attending to manner made participants less likely to falsely recognize not only new manners, but also familiar manners performed by the wrong actors, suggesting that manner-of-motion representations carry information about the identities of the actors of those motions.

(5104)

Walking Through Doorways Improves Memory. ANDREA K. TAMPLIN, SABINE A. KRAWIETZ, & GABRIEL A. RADVANSKY, *University of Notre Dame*—This study explored the influence of event shifts on memory for a list of words when an event shift either did or did not come between two halves of the list. In one experiment, people moved from one location to another. At a first location, people heard half of a list of words. Then the person moved either across a large room (no event shift) or through a doorway to another room (event shift). They then heard the second half of the list. After a 2-min distraction task, people recalled the entire list. The results revealed that people remembered more words when there was a shift in location than when there was not. This pattern of results suggests that the event boundary served to help chunk the list items, thereby emphasizing relational information and improving memory for the list overall.

(5105)

Rapidly Varying Ideomotor Effect Anticipations. ROLAND PFISTER & ANDREA KIESEL, *University of Würzburg*, & TOBIAS MELCHER, *University of Göttingen* (sponsored by Marco Steinhauser)—According to ideomotor theory, voluntary actions are selected and initiated by means of anticipated action effects. Prior experiments demonstrated these effect anticipations with response–effect (R–E) compatibility phenomena, using blocked R–E relations, whereas daily actions typically produce context-dependent effects. In the present study, we accounted for this natural variability and investigated R–E compatibility, varying R–E compatibility trial by trial. In line with recent findings on ideomotor learning, R–E compatibility influenced responding only when participants responded in free choice trials, assuming that participants then adopted an intention-based action control mode. In contrast, R–E compatibility had no impact when participants responded according to imperative stimuli throughout the experiment—thus, when participants adopted a stimulus-based action control mode. Interestingly, once an intention-based mode was established because of free choice trials within an experimental block, we observed R–E compatibility effects in free, as well as forced, choice trials.

(5106)

Motor Simulation and Language Processing: Exploring Potential Interference Effects. MARK A. CASTEEL, *Pennsylvania State University, York*—Researchers studying embodied cognition have shown that readers often produce a mental simulation of described actions. Interestingly, some researchers have found that motor activation facilitates language processing, whereas others have found interference. One potential resolution is that responses requiring integration of the linguistic input with the preceding information may produce interference. Indeed, data I presented at last year's Psychonomic Society Annual Meeting showed that readers slowed when they read an action similar to one they were planning to repeat. The present research sought to extend last year's finding by using a different response also requiring semantic integration. Participants pantomimed a behavior (swing a bat), then read a passage describing a similar (bang a gong) or a different behavior. To see whether interference would occur, a go/no-go task was used; participants responded only if the action was sensible given the preceding information. The results help to delineate the ongoing influence of motor simulation on language comprehension.

• Selective Attention V •

(5107)

Is the Emotional Modulation of the Attentional Blink Driven by Response Bias? HELEN TIBBOEL, BRAM VAN BOCKSTAELE, & JAN DE HOUWER, *Ghent University*—Several studies have shown that the attentional blink (AB; Raymond, Shapiro, & Arnell, 1992)

is diminished for highly arousing T2 stimuli (e.g., Anderson, 2005). Whereas this effect is most often interpreted as evidence for a more efficient processing of arousing information, it could also be due to a bias to report more arousing stimuli than neutral stimuli. We introduce a paradigm that allows one to control for such a response bias. Using this paradigm, we obtained evidence for a reduced AB for taboo words in the absence of a response bias. This supports the idea that the emotional modulation of the AB is caused by genuine attentional processes.

(5108)

The Effect of Varying Cue–Target Onset Asynchronies on Reach Trajectories. HEATHER F. NEYEDLI & TIMOTHY N. WELSH, *University of Toronto*—According to action-centered attention, there is a coupling between attentional and response-planning processes. Consistent with these theories, research has shown that goal-directed reach trajectories deviate toward an irrelevant cue at short (<100 msec) cue–target onset asynchronies (CTOAs) and away from the cue at CTOAs greater than 750 msec. The deviations resemble the pattern of facilitatory and inhibitory reaction time (RT) effects seen in paradigms using keypress responses (e.g., Posner & Cohen, 1984). In the present study, we used CTOAs ranging from 100 to 1,100 msec to determine the relationship between trajectory and RT effects. We found consistent inhibition in RT at CTOAs > 350 msec, whereas deviations away from the cue were observed only at longer CTOAs. Also, the magnitudes of the deviations were reduced at long CTOAs, whereas the inhibitory effects in RT were more persistent. The results indicate that the inhibition of action may be slower to develop and more transient than in attention.

(5109)

Object-Based Attention in Occluded Objects. YONGNA LI & W. TRAMMELL NEILL, *University at Albany* (sponsored by W. Trammell Neill)—In many studies, subjects process two attributes of one object more easily than two attributes of two different objects (within-object superiority). However, some experiments have shown exactly the opposite result—that is, between-object superiority (e.g., Davis & Holmes, 2005; Neill, Li, & Seror, 2009). This effect occurs most often when subjects make same/different judgments of the target features, and it appears to be due to comparison of the whole objects when the target features are on different objects (e.g., Li & Neill, 2009). In contrast, Behrmann, Zemel, and Mozer (1998) reported within-object superiority in same/different judgments, when one object partially occluded the other. In the Behrmann et al. experiments, targets appeared on the same object on two thirds of the trials and on different objects on one third of the trials. We report here that this probability bias is crucial to within-object superiority; when this confound is removed, the effect is eliminated or reverses to between-object superiority.

(5110)

Contingent Attentional Capture by the Matching Color at Uncued Locations. YOUNG EUN PARK & YANG SEOK CHO, *Korea University* (sponsored by Yang Seok Cho)—On the basis of a recent work (Belopolsky et al., 2010), the present study examined the suppression of nonmatching cues obtained when a top-down set for a specific target was enhanced through inclusion of no-go trials for nonmatching targets. Participants made a response to color targets while withholding their response to onset targets, or in the opposite way. Onset cues produced no evidence of capture when participants were set for color targets, whereas color cues led to slower responses to the onset target at the cued location than at uncued locations. Whether this effect is due to disengagement of attention after capture by nonmatching cues was examined by manipulating SOA. Color cues inhibited onset target responses at short SOAs and facilitated them at long SOAs, suggesting an attentional capture by "white" nonsingleton cues that matched the target-defining feature. These findings support the view that exogenous attentional orienting is contingent on top-down control settings.

(5111)

God: Do I Have Your Attention? LORENZA S. COLZATO, *Leiden University*, WERY P. M. van den WILDENBERG, *University of Amsterdam*, NACHSHON MEIRAN, *Ben-Gurion University of the Negev*, ANNA M. BORGHI, *Bologna University*, & BERNHARD HOMMEL, *Leiden University*—Religion is commonly defined as a set of rules, developed as part of a culture. Here, we provide evidence that practice in following these rules systematically changes the way people attend to visual stimuli, as indicated by the individual sizes of the global precedence effect (better performance to global than to local features). We show that this effect is significantly reduced in Calvinism, a religion emphasizing individual responsibility, and is increased in Catholicism and Judaism, religions emphasizing social solidarity. We also show that this effect is long-lasting (still affecting baptized atheists) and that its size systematically varies as a function of the amount and strictness of religious practices. These findings suggest that religious practice induces particular cognitive control styles that induce chronic, directional biases in the control of visual attention.

(5112)

Split Attention Is Limited by Inhibition Among Multiple Spotlights. BRIAN R. LEVINTHAL & STEVEN L. FRANCONERI, *Northwestern University* (sponsored by Steven L. Franconeri)—To accomplish simple visual tasks such as comparing two objects, we must access information from more than one location in the visual field. Some research suggests that selection can occur over two noncontiguous locations, but the limitations on this ability are not well understood. We argue that selection of multiple locations is limited by the interference created by the inhibitory surrounds of two or more selection regions. When observers were allowed to select two RSVP streams within a visual quadrant with a single region of selection, performance was near ceiling. But when intervening distractors were added, requiring two noncontiguous selection regions within close proximity, performance dropped drastically. When these two locations were translated so that they straddled the hemifield boundary, performance again rose to near ceiling, because of the buffer that this boundary appears to provide against interference.

(5113)

Visual Short-Term Memory Capacity: Disconfirming the Hypothesis of an Early, High-Capacity Store. MICHI MATSUKURA & ANDREW HOLLINGWORTH, *University of Iowa*—Interactions between attention and visual short-term memory (VSTM) play a central role in cognitive processing. Attention can select an object already stored in VSTM, improving memory performance for the cued item (e.g., Griffin & Nobre, 2003). Recently, Sligte et al. (2008) found that cuing an object in VSTM led to relatively accurate, high-capacity memory, even after the iconic image of the array had faded. They proposed two VSTM subsystems: a fragile, high-capacity subsystem and a durable, limited-capacity subsystem. We examined whether this division is warranted by testing for the presence of a high-capacity form of VSTM. We replicated the Sligte et al. method with controls over perceptual grouping, in experiments probing multiple forms of feature memory, and with an improved cuing method that included neutral trials. Although cuing effects were observed consistently, in none of the experiments was there evidence of a high-capacity VSTM representation, consistent with traditional, single-store models.

(5114)

Object-Based Attention: Reducing Uncertainty With Reward. JEONGMI LEE & SARAH SHOMSTEIN, *George Washington University*—Much of the evidence accumulated over the past decade suggests that visual attention is often object based. Recent investigations of the object-based phenomena differ as to what mechanism gives rise to the effect. Here, we provide support for the uncertainty reduction hypothesis (i.e., greater target uncertainty yields object-based effects). Using event-related fMRI, while presenting exactly the same visual stimuli to the observer, in a set of three experiments, we reduced target uncertainty by manipulating what was being rewarded (same-object targets, different-object targets, or both). It was observed, as measured behaviorally and with fMRI, that reward alone guides attentional selection—in some cases, completely reversing object-based effects. These results suggest that internal factors alone (i.e., reward based) can serve to reduce uncertainty, thereby eliminating object-based effects.

• SPATIAL COGNITION V •

(5115)

Path Integration and Visual Landmarks: Optimal Combination or Multiple Systems? MINTAO ZHAO & WILLIAM H. WARREN, JR., *Brown University*—We tested two hypotheses about how path integration and visual landmarks are combined during human navigation. (1) The Bayesian integration hypothesis predicts that navigation will be determined by a weighted combination of information sources, with weights based on their individual reliability (Cheng et al., 2007); (2) the multiple-system hypothesis predicts that different information will dominate under different environmental conditions (Shettleworth & Sutton, 2005). Participants performed a triangle completion task in an ambulatory virtual environment. The visual landmarks were covertly shifted prior to the home-bound leg (by 15º to 135º). With local landmarks, participants followed the landmarks completely up to a 90º shift and then switched to rely on path integration at 135º. With distal landmarks, they primarily relied on path integration and ignored the landmarks. These findings indicate that path integration may function as a backup or reference system for navigation, rather than being optimally integrated with visual landmarks.

(5116)

Estimating Encoding and Execution Errors in Path Integration. ELIZABETH CHRASTIL & WILLIAM H. WARREN, JR., *Brown University*—Previous research on path integration has identified three primary sources of error: encoding, integration, and execution. Models of path integration often assume that encoding errors are the primary contributor to overall error (e.g., Fujita et al., 1993). However, the use of distance reproduction and distance estimation tasks to measure encoding error may actually confound these sources of error. We experimentally separate and quantify encoding and execution errors in distance tasks. To isolate encoding error, participants (1) walk a given distance and then throw a beanbag an equivalent distance, while (2) throwing error is estimated by throwing to a visible target. To identify execution error, (3) participants blind walk to a visually specified target. In a distance reproduction task, (4) participants walk a given distance and are then instructed to walk an equivalent distance. We use these estimates of encoding and execution error to interpret errors in distance reproduction.

(5117)

Reference Frames As Dynamic Knowledge Structures: From Egocentric to Intrinsic. NATHAN GREENAUER, CATHERINE MELLO, & MARIOS N. AVRAAMIDES, *University of Cyprus*, & DAVID WALLER, *Miami University* (sponsored by David Waller)—To date, egocentric and intrinsic reference frames in memory have been treated as conceptually distinct. Yet experiments that provide support for either type of reference frame have varied widely in the length of the testing procedures employed, ranging from 48 trials (Greenauer & Waller, 2008) to 480 trials (Mou, Liu, & McNamara, 2009). We evaluated whether different findings about the use of reference frames in spatial memory may be attributable to variations in test length by evaluating retrieval performance across multiple testing blocks. The results show that an egocentric reference frame was prominent on early test blocks, whereas an intrinsic reference frame was manifest later in testing. The results suggest that previously disparate findings in the literature may be at least partially attributable to differences in methodology. More important, they indicate that spatial reference frames may be dynamic and may develop with repeated retrieval.

(5118)

Enhanced Prototypes in Scene Recognition Are Not Necessarily Extreme Category Members. TYLER THRASH & DAVID WALLER, *Miami University*, & ALINDA FRIEDMAN, *University of Alberta* (sponsored by Alinda Friedman)— Novel views of scenes can be recognized as well as or better than learned views if the novel views are sufficiently similar to multiple learned views (Friedman & Waller, 2008). Moreover, these better-recognized, novel views of scenes (sometimes called *enhanced prototypes*) do not necessarily need to be views of realistic scenes. For example, in a classic study, Posner and Keele (1968) found that novel instances for groups of randomized dot patterns could be classified nearly as easily as learned instances, if the novel instances represented the groups' prototypes. More recently, Palmeri and Nosofsky (2001) used multidimensional scaling techniques to argue that enhanced prototypes of randomized dot patterns lie in the extremes of psychological space. In three experiments, we provide evidence that enhanced prototypes for scenelike stimuli do not always lie in the extremes of psychological space and consider possible reasons for the disparate findings.

(5119)

Effect of Attentional Manipulation on Spatial Memory Encoding and Effect of Individual Encoding Strategies on Navigation Efficiency. XUE HAN & SUE BECKER, *McMaster University* (sponsored by Sue Becker)—We conducted two experiments using a virtual driving task to investigate attention, object location, and individual encoding strategy effects on spatial memory encoding. With different attentional manipulations, we found that when attention was directed toward objects' appearance, people's spatial memories for decision-point and non-decision-point objects were the same. When attention was directed toward objects' locations, spatial memory for the decision-point objects was superior. This suggested that by studying objects' appearance, the objects might be treated as independent objects and might be processed predominantly within the ventral visual stream; in contrast, by studying objects' location, objects might be treated as landmarks and might be processed predominantly within the dorsal visual stream. We also found evidence that individuals used different strategies, such as allocentric, egocentric, and landmark. We found that individuals who indicated that they used an egocentric encoding strategy were significantly less efficient in delivering passengers to their destinations than were other strategy users.

(5125–5132)

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